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FOREWORD

I am pleased to put into the hands of readers Volume-7; Issue-12: 2020 (Dec, 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 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 Jan, 2021

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Abstract—The development of suppliers has emerged in the literature as a potential management strategy aimed at the search for competitive advantage by contemporary organizations. The adoption of evaluation measures as support instruments, in addition to providing opportunities for improving performance, also offers subsidies to buyers, managers, entrepreneurs and decision makers in activities that involve planning, operationalization, and supply chain integration. In the face of an increasingly technological context, forms of commercialization and relationships give rise to versatile methods, whose solutions are applicable to different situations and scenarios. In this sense, this work presents a proposal for a holistic approach based on attributes and practices of daily marketing, providing from this, supplier performance evaluation. To obtain it, the methodological framework consisted of a case study in a Brazilian television station, with emphasis on the suppliers that make up its supply chain. Results indicated that the adoption of the proposed evaluation method may represent a fundamental tool for buyers and those responsible for making decisions regarding contracting and strengthening strategic relationships. In addition, the findings suggested that the use of action plans with suppliers that presented unsatisfactory results has the ability to promote a positive relationship in building the partnership and improving performance.

Keywords—Business globalization, Supply chain resilience, Supplier management, Operations management, Relationship.

I. INTRODUCTION

In the global business competition environment, supply chain management has become essentially important for business relationships, and also for organizations to create and sustain competitive advantages in products and services (Shishodia, Verma,& Dixit, 2019). According to Koberg and Longoni (2019), this management must integrate corporate functions internal and external to the company, covering, for example, the management of the total flow of the distribution channel, adding value from the supplier to the end user.

Expanding this view, Pettit, Croxton and Fiksel (2019) point out that to remain competitive, companies realized that it is not enough to just prioritize the improvement of internal processes, and it is necessary to prepare to compete in the supply chain. According to Kannan and Tan (2002), this means adopting a strategy aimed at integrating and coordinating the main business processes, in order to create a supply chain that seeks to increase the performance and performance of everyone involved.

For these reasons, there is a high importance in the evaluation of suppliers and, from that, the elaboration of policies that contribute to increase the performance potential of the supply chain is essential in the current commercial relations (Vörösmarty&Dobos, 2020). Thus, trends described in the literature point to a new business posture, in which organizations direct their efforts focused on the customer (Govindan, Shaw, & Majumdar, 2020, Sunil & Sunitha, 2020). According to Schniederjans, Curado and Khalajhedayati (2020), this new attitude

directs the supply chain to an integration through information that represents an opportunity for companies to reduce costs, whether through leaner processes, elimination of waste, or even higher service levels. offered to customers, for example.

In this context, Moyano-Fuentes, Bruque-Cámara and Maqueira-Marín (2019) describe that the majority of suppliers are being placed at a strategic level in organizations and this is due to companies being focused on their essential skills and operations, mainly concentrating their efforts in your core business. For these authors, these efforts fall on a large number of suppliers, something that has led organizations to work together with their supply chain partners.

Therefore, the objective of this work was to propose a holistic approach based on attributes and practices of daily marketing to evaluate performance and supplier development. To achieve this objective, a case study was carried out on a television station with coverage in Brazil and other countries in the world. In this way, the contribution involves not only managers, industry professionals and researchers on the topic, but also, in the collaboration of the discussion on the prospecting of empirical evidence covering the supplier, in order to allow what extent understanding to the performance measurements are beneficial. for supply chain and stakeholder development.

II. THEORETICAL REFERENCE

The economic development of nations has influenced trade relations and, therefore, increased competitiveness among organizations. Within this context, companies are becoming more and more involved and also dependent on know-how about logistics, in issues that aim to seek and meet market demands in the most efficient way possible (Shishodia, Verma, & Dixit, 2019).

Thus, the plurality of commercial relationships directly influences regulatory policies, suppliers and cultural and human behavior, which are also varied in supply chain networks (Kannan & Tan, 2002, Vörösmarty&Dobos, 2020). Considering these reasons, the literature has pointed out that unresolved difficulties with suppliers, added to management models that do not adequately measure the needs of supply chains have generated inefficient transactions (Koberg&Longoni, 2019, Pettit, Croxton, &Fiksel, 2019).

This opinion was also cited by Harland (1996), more than two decades ago, when pointing out that the performance of the supply chain must not only consider customer satisfaction, but also be related to the reliability of delivery, the cost / price ratio and specific aspects of performance in the sector or segment. Durach, Kembro and Wieland (2017) expand this context by describing a trend in the literature to point out variability by sector, which need specific approaches that evaluate and contribute to the development of suppliers.

Indeed, the literature has long recognized the fact that suppliers play a key role in the performance of companies. Ford and McDowell (1999) point out that one of the possible reasons is the expressive costs of purchasing goods and services, which normally represent about 70% of the total cost. Therefore, due to the companies' dependence on their suppliers to be competitive in the market, the need for an effective management of the entire supply chain is highlighted (Kannan & Tan, 2002).

Zhu *et al.* (2018) argue that Supply Chain Management (SCM) has been perceived as a strategic tool to gain competitive advantage through collaboration with business partners, and provides a way to plan, organize, manage, measure and deliver optimally, products and services.

For Rajeev, Pati, Padhi and Govindan (2017) the scenario of growing demand for products gradually puts pressure on industrial production, generating impacts throughout the supply chain. The authors also emphasize that negative consequences of this phenomenon fall on the environment and society, whose effects have been perceived by the increase in pollution rates and environmental calamities. With this, researchers and industry experts are inclined to work on issues of sustainable production and consumption in the context of supply chain management.

In recent years, attention to consumers, companies and entities has acquired greater consistency in relation to environmental issues and the impact of human activities on natural resources (Toro, Franco, Echeverri, &Guimarães, 2017). Hänninen and Karjaluoto (2017) reinforce that due to the increase in public awareness of environmental and social issues, and the greater rigidity in government regulation, companies cannot ignore these factors in their business processes, throughout the chain, because otherwise, may face serious problems in the market.

With this, in addition to criteria such as quality, delivery performance and technical capacity, which have traditionally been considered in the process of evaluating and selecting suppliers, companies are learning and attaching due importance in the acquisition of products and services from partners who can deliver them. them with environmental responsibility (Aissaoui*et al.*, 2007, Lee *et al.*, 2009, Balcik& Ak, 2014, Sinha & Anand, 2017).

Given the above, the evaluation of the performance of the supply chain has become essential with the visualization of the importance of suppliers for the success of companies. However, due to the complexity of relationships and connections, managing the performance of your suppliers is still a challenge (Maestrini*et al.*, 2017).

According to arguments in the literature, the supplier has a fundamental role in supply chain management, as an appropriate partner that can provide buyers with products and services in the quality and quantity demanded, at the right time and at a fair price, has positive and lasting effects on the results and competitiveness of the entire supply chain (Chen, Lin, & Huang, 2006, Araz&Ozkarahan, 2007, Cengiza*et al.* 2017).

Therefore, supplier performance appraisal becomes one of the most essential and important processes for successful supply chain management. However, Karsak,&Dursun (2015) consider that the evaluation process becomes a complicated process, due to the fact that it involves different suppliers based on a scope of different criteria, quantitative and subjective (Resat&Unsal, 2019).

Ho, Xu and Dey (2010) argue that in order to assess the performance of suppliers, several criteria must be considered and evaluated in relation to each partner. For this reason, the supplier evaluation problem can be considered as a multi-criteria decision-making problem.

For Suraraksa and Shin (2019), in supplier management, performance evaluation appears in at least two distinct stages of this process, the selection phase and the monitoring and development phase. However, for this last phase mentioned, few proposals are found for decision-making models for continuous consideration in monitoring and development (Silva, Ramos, Alexander, &Jabbour, 2020).

Maestrini*et al.* (2018) highlights that supplier evaluation does not offer benefits to the supply chain and the level of service provided, without practices that seek the development and improvement of members of the chain. Evaluating without assisting and directing actions that can promote development, according to Govindan, Shaw and Majumdar (2020), is the same as doing nothing, however, with an associated cost.

III. METHODOLOGICAL APPROACH

The holistic approach proposed in this work was used in a Brazilian open commercial television network of multinational scope (research unit). To make this approach feasible, attributes and practices of this daily marketing were used to compose a supplier performance assessment through a case study (Kant & Dalvi, 2017, Sousa-Zomer, Magalhães, Zancul, Campos, &Cauchick-Miguel, 2018, Bai, Kusi-Sarpong, Badri Ahmadi,& Sarkis, 2019, Shishodia, Verma, & Dixit, 2019).

Due to the multiplicity of suppliers involved in the context of a television network and, also, for the sake of convenience in carrying out this work, the selection was strategically prepared based on five requirements (Li, Fun, & Hung, 1997, Glas, Gaus, & Essig, 2018, Santos, Murmura, &Bravi, 2019, Silva, Ramos, Alexander, &Jabbour, 2020), which are related to the financial, temporal, managerial and operational dimensions of supply contracts: (1) contract over 12 months; (2) Supply contract with values greater than 179,022.18 USD; (3) Continuous supply service; (4) Have a manager responsible for the contract; (5) High daily volume of requisitions and purchase orders in the case of material supply.

Thus, considering the adopted case study method, requirements 1 and 3 became necessary due to the proposed approach having 4 cycles of annual evaluations to validate the award of the best performers. On the other hand, requirement 4 was fundamental for the realization of the approach, due to the evaluation having been carried out by supply contract managers, who, in addition to being responsible for the elaboration and monitoring of an action plan for development. The other requirements were established because they are of a strategic nature and, due to their relevant financial and operational impacts on the company's business.

Thus, a case study was carried out to assess and contribute to the development of suppliers (Sousa-Zomer*et al.*, 2018), through three complementary phases (Fig. 1). Therefore, in the formulation of the operationalization, the works of Kant and Dalvi (2017), Bai *et al.* (2019) and Shishodia*et al.* (2019).



Fig. 1: Synthesis of the methodological approach.

In this approach, the evaluation phase considered in its conceptual-theoretical structuring the use of a Supplier

Performance Index (Li *et al.*, 1997, Santos *et al.*, 2019), which allowed measuring performance, and creating a direction for the development of strategic points and situations inherent to the daily life of the company and suppliers. Thus, according to Moyano-Fuentes, Bruque-Cámara and Maqueira-Marín (2019), an operational planning was prepared based on the evaluation, contemplating planning, performance and operation guidelines. Concluding this phase, according to Sunil and Sunitha (2020), tests were carried out to check the adherence and suitability of the approach in order to allow the proposals to be possible to be executed and, from that, guidelines were defined for the conduction of these proposals.

In order to corroborate the guidelines of this approach, a data treatment was performed through inferential analysis (Silva *et al.*, 2020), using an electronic spreadsheet and using the Statistical Package for the Social Science (SPSS) software, trial version. With a confidence level (Z) of 90%, and a sampling error of 5% (Gonçalves, 2016).

Additionally, a mining was done to check for the presence of missing values. Thus, considering the subsidies and evidence generated, an inferential analysis was made (Govindan, Shaw, & Majumdar, 2020). Also, to verify the reliability of the data collected, Cronbach's alpha (C_{α}) was used, a value from 0.7 is considered acceptable (Acuña-Opazo, Gonzáles, &Cortéz, 2017).

As a result, a performance report was generated, which was made available to supply contract managers and supply managers for management and monitoring purposes. In addition, a Vendor List was made available to buyers, prepared using the Microsoft® Power BI platform, containing: supplier identification, information on service provision and / or material delivery contracts and supplier evaluation.

Finally, an action plan containing the current and desired positioning of the supplier was delivered to the suppliers and also made available to the contract managers for guidance and monitoring of the activities defined in the plan (Glas*et al.*, 2018).

IV. RESULTS

This section presents the application of the supplier assessment and development approach. Thus, in order to promote a better understanding and verification of this approach, a case study of the daily life of a television broadcaster in Brazil and other countries around the world is presented.

In this way, the selection of participating suppliers was carried out strategically based on the five requirements listed above. With this, 34 suppliers were chosen (Space and Environmental Management \rightarrow 4; Maintenance and Operation \rightarrow 7; Business Security \rightarrow 6; Services and Logistics \rightarrow 15 and Production and Office Materials \rightarrow 2), of these 94% act exclusively as service providers. services, while 6% are related to materials, and have strategic supplier status due to the high daily volume of requisitions and purchase orders demanded.

It is worth mentioning that all those involved collaborated responding to the assessment instrument and, after the data were processed through inferential analysis, missing values were not identified to be considered or discarded. Cronbach's alpha found in the analysis of responses was in the order of 0.876, establishing an adequate correlation between the items evaluated.

Then, to define the attributes (criteria and subcriteria) of the evaluation, a survey was conducted using a Supplier Performance Index. Concomitantly, a discussion involving the team of buyers from the areas involved and the managers of the supply contracts of the selected companies was conducted in order to consider the know-how and experience in the supply chain they have.

The compilation of the survey allowed the visualization of attributes of service providers (Table 1), among which ten metrics are related to the technical dimension of performance, three represent performance from an environmental point of view, two refer to documentation and finally, an index focused on health and safety in the provision of the service.

Criteria	Subcriteria	Description
Technique	1. Customer satisfaction	Technical quality of the service provided.
	2. Quality hired staff	Quality of the service provider staff.
	3. Hired team flexibility	Ability to manage requested changes.
	4. Operational excellence	Effectiveness and compliance with processes and procedures.

Table. 1: Definition of evaluation parameters of service providers

	5. Operational Availability	Planning and management of the contracted team.
	6. Compliance	Compliance with the contractor's rules and requirements.
	7. Compliance with the contractual SLA.	Compliance with deadlines established in the contract.
	8. Accomplishment of the Planning.	Compliance with monthly service planning.
	9. Payment / Receipt flow	Awareness and compliance with contracting and payment rules.
	10.Garment andPPE	Existence, condition and use of garment and PPE.
Documentation	1. Delivery of priority documents	Delivery of documents required by contract.
	2. Delivery of full documents	
Health and Safety	1. Occurrence of work accidents	Death, removal, temporary or permanent limitation resulting from negligence.
Environment	1. Legal requirements	Service situation.
	2. Environmental incidents	Occurrence of violations.
	3. Operational control checklist	Management, preparedness and response to emergency and environmental liabilities.

Legend: SLA (Service Level Agreement). PPE (Personal Protective Equipment).

After defining the attributes, considering the scope, each defined criterion can be considered applicable or not to certain suppliers or niches of activity, something that influences the data collection instrument (questionnaire) to be applied to each supplier company to evaluate performance. Thus, the managers responsible for the supply contract of the 32 participating service providers, carried out the analysis and definition of the criteria and sub-criteria to be used for evaluation, according to each area of activity, in addition to determining the importance weights (Tables 2, 3, 4 and 5).

Table. 2: Space and Environmental Management

Criteria Subcriteria		Weight	
Technique	ue Customer satisfaction		
	Qualityhired staff		
	Hiredteamflexibility	65%	
	Accomplishment of the Planning.	0570	
	Payment / Receiptflow		
Documentation	Delivery of priority documents	10%	
	Delivery of full documents		
Health andSafety	Occurrence of work accidents	20%	
Environment	Legal requirements		
	Environmental incidents	5%	
	Operational control checklist		

Table. 3: MaintenanceandOperation

Criteria	Subcriteria	Weight
Technique	OperationalAvailability	
	Compliance with the contractual SLA.	70%
	Payment / Receiptflow	
Documentation	Delivery of priority documents	150/
	Delivery of full documents	13%
Health andSafety	Occurrence of work accidents	15%

Table. 4: Business Security

Criteria	Subcriteria	Weight
Technique	Customersatisfaction	
	Qualityhired staff	
	Operationalexcellence	
	OperationalAvailability	70%
	Compliance	
	Payment / Receiptflow	
	Garmentand PPE	
Documentation	Delivery of priority documents	10%
	Delivery of full documents	
Health and Safety	Occurrence of work accidents	20%

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Criteria	Subcriteria	Weight
Technique	Customersatisfaction	
	Qualityhired staff	65%
	Compliance with the contractual SLA	0070
Documentation	Delivery ofprioritydocuments	20%
	Delivery of full documents	
Health andSafety	Occurrenceofworkaccidents	10%
Environment	Operational control checklist	5%

Regarding the performance evaluation of material suppliers, a technical criterion was used due to the existence of technical specifications for the items. This metric assessed whether the contractor has met the delivery deadlines set out in the contract.

After defining the evaluation parameters, there was an appreciation by the managers responsible for supply contracts. For this, a five-point Likert type scale was used to measure the degree of satisfaction of the suppliers' performance (χ), in addition to binary questions when this scale was not applicable (A - Very Satisfactory $\chi > 90\%$; B – Satisfactory $75\% < \chi \le 90\%$; C – Regular $60\% < \chi \le 75\%$; D – Unsatisfactory $50\% < \chi \le 60\%$; E – Very Unsatisfactory for $\chi \le 50\%$).

For this work, 32 questionnaires regarding service providers were considered, which were submitted to six managers responsible for contracts, obtaining a response rate of 100%. The interviewees were focal points of contact with suppliers, therefore, they were familiar with the operation object of the evaluation. To evaluate the performance criteria of the two participating material suppliers, the issuer authorized and carried out on the Oracle ERP, a survey of the fulfillment of delivery deadlines for all purchase orders (OC's) issued to these suppliers in the last three months, during April, May and June 2018. It is important to note that for both supplying companies, the delivery time for the materials demanded through the OC's is three business days.

The Service Level Agreement was obtained considering the ratio between the number of purchase orders served in the term established in the contract and the total number of purchase orders issued in percentage. Within this proposal, suppliers were evaluated annually in four quarterly cycles and classified according to the score calculated through the evaluations carried out each quarter according to the defined range (Fig. 2).



Fig. 2: Range available for evaluation.

From the use of the premises established in this work, considering the evaluation range (Fig. 2), through the treatment of the data obtained and the information gathered from the Oracle ERP, it is possible to obtain the evaluation of each of the 34 suppliers (Table 6).

Table. 6: Evaluation result

Area	Supplier	Performance (%)
Space and	A1	83.80
Environmental Monogement	A2	93.50
Management	A3	93.50
	A4	87
Maintenance and	A5	100
Operation	A6	100
	A7	100
	A8	100
	A9	94.40
	A10	93
	A11	86.70
Business Security	A12	58
	A13	59./74
	A14	79.37
	A15	95.44
	A16	90.87
	A17	96.50
Services and	A18	100
Logistics	A19	92.25
	A20	94
	A21	100

	A22	88
	A23	100
	A24	100
	A25	94
	A26	98.25
	A27	100
	A28	100
	A29	92.25
	A30	84.25
	A31	100
	A32	100
Production and Office Materials	A33	19
Production and Office Materials	A34	83

In this way, it was possible to carry out the classification according to the level of performance (Table 6), allowing buyers and managers to view the level of service provided by the station's suppliers (Fig. 3). The results clarify that 91% of the suppliers obtained satisfactory results, with 71% of them with a service level classified as very satisfactory, integrating the project's award group, which expects to recognize suppliers who perform above 90% in the annual evaluation.



Fig. 3: Performance Status.

However, there were suppliers with performance below the desired level (A11, A12, and A33), which represents 9% of the sample of suppliers participating in the evaluation. It is worth mentioning that, of the three suppliers with insufficient performance, two of them are from the Corporate Security area. For this reason, when verifying the performance of this, we verified the lowest average score among the areas (Corporate security 79.9%; Space and environmental management 89.4%; Services and logistics 96.2% and Maintenance and operation 96.3%), which can represent a point of attention for decision making and improvement.

Another important point to be emphasized is that the suppliers A33 and A34 are the only companies that supply materials, having as evaluation criteria the fulfillment of the delivery SLA. This means that supplier A33 made only 19% of deliveries demanded in May 2018 within three business days, as agreed in the contract, which indicates an alarming situation, given the importance of supplying items for the operation of the broadcaster. Supplier A34, on the other hand, demonstrated an 83% rate of order fulfillment within the delivery period.

Concluding a phase of evaluation and dissemination of the results, the performance results of the suppliers were made available to the managers responsible for the supply contracts and to the buyers of each area involved. And, based on these results, it becomes possible, in the long run, to build a database to manage all its suppliers and their performance. Immediately, a list of suppliers was created using Microsoft Power BI, containing information on the contracts for the provision of services or delivery of materials and also, according to information regarding the evaluations. The performance report was also sent by email to suppliers with good performance, to motivate them to continue to seek excellent levels of service.

Finally, aiming to work on continuous improvement in the supply chain through the definition of short and medium-term actions, which enable the development and adaptation of suppliers' performance to the quality levels desired by the broadcaster, action plans were prepared for those who performed with classification C, D or E in the quarterly evaluation (Fig. 4).



Fig. 4: Action planning and sanctions.

To collaborate with the development of the supplier, in addition to the development of an action plan, the possibility of applying sanctions was also envisaged for those who perform below the defined ideal or, continue in the same classification, even after planning and carrying out the plan of action. Thus, suppliers classified as regular (C) continued with the preparation of the plan as a corrective measure to adjust criteria with lower than expected evaluation. Those classified as unsatisfactory (D), continued with the preparation and execution of the action plan, however, if the classification remains unchanged for the second consecutive evaluation cycle, these will be blocked for new hires. And, in the case of the "Very unsatisfactory" classification (E), they must follow the action plan, however, new contracts were blocked. In the latter case, the release for new hires will only occur after two consecutive cycles being classified as A, B, or C. Continuing, suppliers A11 and A12, service providers in the corporate security area were classified as unsatisfactory and supplier A33 who operates in the supply of materials, classified as very unsatisfactory (Table 6), were directed to the action plan phase.

That said, the A11 supplier's action plan was designed with a view to working on actions to improve the critical criteria raised (Table 7). Within this context, operational

availability was the criterion that performed the worst. It is important to highlight that, during the leadership discussions, this attribute was considered unanimously, extremely important for a service provider in the business security area, as it involves people directly (artists and public figures) in production and recording studios, inside and outside the station.

Action	Justification	Responsible	Schedule	Method
Training of employees with certificate issuance	Need to train and specialize the team working in the workplace.	A11	July andAugust 2018	Training Program
Study on staff dimensioning provided	Lowoperationalavailability	A11 and Broadcaster	July and August 2018	Survey of the number of employees, areas served, shifts, reserve staff, etc.
Increase in the number of employees available	In case of undersized personnel	A11	September2018	Hiringorallocation.
Training and awareness of correct use of Garmentand PPE.	Little and misuse of the necessary equipment in the workplace	A11	July and August 2018	Training and availability of booklets and standards.

Another important critical point indicated was the deficient technical and operational qualification of the team. Professionals with little preparation or shallow training and competence to act in situations inside and outside the recording studios, this, in several cases, ended up influencing the operational excellence of the service. Thus, these points have a direct influence on the visualization of value and customer satisfaction of the broadcaster.

In addition to the right problems of direct relationship order with the issuer, several occurrences were also identified in which the supplier A33 accepted the purchase orders, however, it did not have items in stock or, as verified several times, the product in question was discontinued without market. Similarly, an action plan (Table 8) for these management issues was designed so that the broadcaster could have a more active and less reactive status for the orders to be delivered by the supplier. Thus, a diary should then be sent by supplier A33 to the supply sector for open orders, containing: order identification, description, quantity report, delivery date, order status, reasons for non-delivery, and update of the order delivery date.

As a result, the supplier A33 now has another management parameter, something that resulted in increased service and control of the purchase orders demanded, in addition to the delivery times delivered. In addition, this plan allowed that in cases of discontinuity of products in the catalogs or lack of items in stock, quickly reported to the broadcaster, and then, a decision regarding the replacement of the item could be carried out effectively.

On the other hand, the supplier A33 presented a "Very unsatisfactory" result in the performance evaluation, being the lowest among all participants (Table 6). As it is a material supplier and its sole evaluation criterion is compliance with the contractual SLA, this suggests that during the month of May of the year 2018, only 19% of the orders placed within the established delivery period were met.

This low performance brought several impacts to the broadcaster's operation, which often requires agility and speed in the acquisition of materials for use in scenarios and content production. In addition, the delay in delivery overloads the work activities of buyers, who, in some cases, due to the need to identify the causes of orders not being delivered, need to audit, check and update receipt dates, in addition to answering and resolving complaints of users demanding the materials. Unlike the action plan prepared for service providers, in which the results can only be observed in the next evaluation cycle carried out each quarter, the results for the material suppliers, as in the case of company A33, are already observed right after the execution of the actions, due to the data referring to the SLA used for evaluation being automatically fed into the ERP system used by the broadcaster. Thus, after preparation, transfer, and monitoring of this supplier, the performance presented below was reversed in the following two months after the aid for the development of the same (Fig. 5).

Table. 8: Management action plan prepared for supplier A33.

Action	Justification	Responsible	Schedule	Method
Daily status report of open orders	Need for greater control and compliance with delivery deadlines.	A33	From June 2018	Report
Weekly follow-up meeting	kly follow-up meeting Greater proximity and understanding of the status of orders and problems encountered.		From June 2018	VideoCall



Fig. 5: Performance of the supplier A33.

A supplier evaluation and development approach allows integrating interests and conducting commercial relations effectively, monitoring them in a more timely manner, giving the possibility to evaluate them based on the company's strategy and objectives. In fact, thanks to the possibility of assigning notes to previously prepared and informed attributes, it is possible to manage groups of suppliers with different relevance to the company's business, as well as to contribute to the development of these stakeholders.

This narrative is supported by the results obtained, in which the supplier A33 obtained a significant increase in the rate of compliance with the deadline for delivery of materials in the first month of execution of the action plan. Of the 379 purchase orders issued to this supplier in June 2018, 81% were fulfilled on time, in the following month, by the time this work was conducted, 99 purchase orders had been issued to the supplier in question, and 91 % of them were delivered within the SLA defined in the contract, which suggests a positive impact of the plan in relation to the development and performance of suppliers in the supply chain.

V. FINAL CONSIDERATIONS

The main contribution of this work is that it provides insights on what and how to conduct the assessment and development of suppliers, taking this as a strategy for building mechanisms that increase performance, exposing different ways of establishing trust.

It is important to note that the supplier evaluation process differs from the supplier selection evaluation, in which some works include the qualification phase, where the partners do not yet have a relationship with the company and is only a possible candidate for supply.

In this sense, the empirical contribution contributes to a greater understanding of company-buyer-supplier relationships, the responsibilities involved and performance. Thus, managers can use the results achieved to identify gaps and possible developments in local supply chains. This will allow the proposition of actions that are relevant, while those responsible deal with specific issues of suppliers.

In addition, companies looking to expand their management and operations have in the proposed approach a tool that can assist in the understanding of existing organizational practices, enabling the development of future strategies to deal with various local issues in the supply chains.

Another important contribution of this work is the possibility for managers to explore links between the social and the economic through the assessment of performance and development, aligning goals based on that. For students and researchers, these findings support the expansion of the scope of their research by linking issues related to social sustainability and the relationships between company, buyer and supplier.

Nevertheless, future research should seek to extend the contextual orientation of this work, researching intraorganizational and inter-organizational attributes (criteria and sub-criteria) inherent to supply chains. The inductive research project that gave rise to this work can be expanded through deductive projects for supply chains, based, for example, on a specific sector, as this work did.

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Analysis of Levels of Motor Coordination in Boys from 12 to 13 Years of age Handball Players in Nanuque / MG: A Case Study

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Abstract— Currently, in the field of Physical Education, it is essential to insert a physical assessment or test, because through them it is possible to diagnose different aspects, assess variables related to motor, social, affective, cognitive and other issues. One of the means found to identify the level of Motor Coordination was the German KTK test (Körperkoordination Test fürKinder) proposed by Kiphard and Schilling. Objective: To assess Global Motor Coordination through the KTK test, in adolescents aged 12 to 13 years old, of both sexes, from a sports initiation team to handball in the city of Nanuque-MG. Methodology: From a population of 101 athletes enrolled in the handball sports school, 51 students were selected who will fit in the age group of the study. It is worth mentioning that the 51 students chosen correspond to 100% of the population with this age group. The KTK test was used to assess global motor coordination, where the diagnosis is made through the results of the Very Weak, Weak, Regular, Good and Very Good coefficient. For data analysis, descriptive statistics and graphs were used bar. Results: The results obtained through the KTK test, showed that the majority presented the MUIO BOM result, with a total of 42 (82%) athletes, being 25 (60%) boys and 17 (40%) girls totaling 82% of those evaluated. Conclusion: It was concluded that with the elaboration of this research, the level of Global Motor Coordination of adolescents from 12 to 13 years old, of this handball team in the city of Nanuque / MG, the Very Good coefficient, showing that they have a sufficient state for sports and daily practice without impairing motor development in this age group of early adolescence.

Keywords—KTK, Global Motor Coordination, Adolescents from 12 to 13 years old.

I. INTRODUCTION

Currently, in the field of Physical Education, it is essential to introduce physical or motor tests, because through them it is possible to obtain parameters in relation to different aspects, namely: the motor, social, affective, cognitive, among others. Fitness focused on health and performance changes rapidly during adolescence, both boys and girls are able to obtain significant gains for fitness measures (GALLAHUE and OZMUN, 2013). In view of the experience lived with many students who practice various sports, there was always an observation in relation to some difficulties at the motor level presented by certain students, to develop some practical activities. In view of these characteristics, it is necessary to diagnose the level that they are in their motor development,

Santos et al (2004), states that motor development is characterized by the experience of several dynamic and static motor situations, such as moving around in different environments and manipulating different objects and instruments in conditions of daily routines at home, school and in sports experiences, generally of playful way.

According to Luz et al (2015), there is a concern in the literature in the development of motor coordination that implies the health of children and adolescents, I understand that motor coordination has a harmonious and economic interaction of the musculoskeletal system, the nervous system and the sensory system producing precise and balanced motor actions

Motor Learning, in this way, is the foundation of sports initiation studies. Galatti (2006) approaches that the sport initiation is the first moment of contact with the specific practice of the sport, distinguishing itself by the educational objective, of total formation of the human being in order to collaborate for its physical, cognitive, affective and social development. "

One of the ways to identify the level of motor coordination is to apply the German test KTK (Körperkoordination Test für Kinder) proposed by Kiphard and Schilling (1974), for the KTK test there are age norms in the form of values of the QMG (general motor quotient) test in which it attends children from five to fourteen years old with the objective of diagnosing and assessing motor coordination, the KTK method consists of four tasks: balance in rear gear, side jumps, single-legged jumps and lateral transposition

According to Gorla et al. (2000), the test was built primarily to determine the developmental situation of the body domain of children with disabilities. However, it is currently observed that it has been used with several groups, including children with and without disabilities, since it both assesses global motor coordination and identifies children with coordinative / motor disorders, being an important tool to assess the level of motor coordination. in sport as a way of seeking global motor maturation in sports practitioners

In a study on the data obtained from the KTK Lopes et al tests, it addresses that children and adolescents with less developed coordination, are at increased risk of being overweight or obese adults, mainly because they practice less physical activities when compared to those with more developed coordination.

The present study is specifically interested in studies that used KTK as an instrument to assess motor coordination in adolescents aged 12 to 13 years, mainly due to the following aspects: 1) it is an appropriate test for adolescents with typical standard motor development; 2) the test covers an age group of 5 to 14 years of age, that is, it can be applied to adolescents; 3) KTK is easy to set up and takes little time to administer; 4) KTK is one of the tests with the lowest cost of execution; 5) the test is completely standardized and considered highly reliable. Given the above, the objective of this work is to analyze motor coordination through the KTK test in adolescents aged 12 to 13 years old who practice handball in the city of Nnuauqe-MG.

II. MATERIALS AND METHODS

The research was carried out with a sample of 51 students from 12 to 13 years old of both sexes, 28 (55%) boys and 23 (45%) girls of the handball team in the city of Nanuque / MG, as shown in table 1. Participating athletes were chosen without distinction of gender. Data collection was carried out at the training site with a scheduled date at the Poliesportivo Murilo Badaró gymnasium, by a group of trained evaluators from academics in the Physical Education course together with the researcher professor. The athletes were submitted to a battery of body coordination tests - KTK Test (balance beam, lateral jumps and transfer on platform) as recommended by Kiphard & Schilling (1974). For the realization oftesting batteries, students were informed of the procedures and were conducted 3 in 3 to perform the test, so on and on to perform the demonstration with respect to the execution of the KTK test. The KTK test consists of four tasks with an increasing level of difficulty, which aims to make the child reach his high performance. The difficulty of the work is measured by achieving or not achieving, proposed to differentiate the maximum performance in each task, acquired by its frequent repetition. In this way, the test is scored by making or counting the reproductions per unit of time. The test takes between 10 and 15 minutes to apply, and covers all aspects of motor coordination, which has balance, rhythm, laterality, the speed and agility that spread across four tasks. The first task, called Balance Beam, consists of walking to the rear on three wooden beams with different thicknesses, in order to observe the stability of the reverse gear, with three valid attempts. The second task, Salto Monopedal, consists of jumping one or more blocks of foam, according to age, placed on top of each other, with a lower limb, having three attempts valid for each height, with the objective of observing coordination and dynamic energy / strength. The third task, Lateral Jump, consists of jumping from side to side, with both feet at the same time, as quickly as possible, for fifteen seconds, with two valid passages, the number of jumps is recorded by the evaluator and added to the end the task, aims to evaluate the speed in alternating jumps. The fourth task, called Transfer on Platform, consists of moving on the platforms that are placed on the ground, in parallel, next to each other, for 20 seconds, with two valid passages, the evaluator adds the two passages at the end of the task with the objective of evaluating laterality and spatio-temporal structuring

III. RESULTS AND DISCUSSION

During the application of the tests, a total of 51 handball athletes aged 12 and 13 years were evaluated in a universe of 101 practitioners within the sports school of

the municipality having a group of 28 boys and 29 girls within the group evaluated (Graph 1). The overall average age of the athletes was 12.5 ± 1.29 years, with males 12.60 ± 1.79 years and females 12.56 ± 0.50 years

Graph1 - Classification of athletes by gender



Result obtained after collecting data from the KTK test, it is observed that most adolescents have a level of motor coordination classified as very good, as shown in Graph 2, where we did not have athletes classified as very weak, 1 (2%) classified as weak, 4 (8%) teenagers classified as weak, another 4 (8%) classified as good and mostly 42 (82%) athletes classified as very good

The "Normal Coordination" and "Good Coordination" of the students evaluated can be associated with the fact that Physical Education classes are made up of a greater variety of activities, which according to Hirtz and Holtz (1987) and Hirtz and Schielke (1986) is an essential assumption for the training of coordinating skills.

According to Gorla and Araújo (2009), good motor performance improves the school and sports results of children and adolescents, providing an improvement in their social acceptance, where with good motor coordination, children and adolescents have better performance in their daily activities. , making it more confident and with the highest self-esteem for sports performance.

Graph 2 - General classification of the KTK test





Graph 3- Classification of the KTK Test separated by Gender

Graph 3 shows the classification of the KTK test separated by gender, where we can see a highlight in the very good classification, with a significant amount between the differences between boys and girls, being 25 (60%) boys and 17 (40%) girls.

A study by Souza et al (2014) on performance in motor skills of boys and girls found a higher performance in boys' motorcycles due to the fact that different activities are sometimes offered than girls.

IV. CONCLUSION

With the preparation of this study, he analyzed that with the application of the KTK test it was possible to establish the level of Global Motor Coordination of students aged 12 to 13 years of the handball sports team in the city of Nanuque-MG, where most of the participants are with the Good and Very Good level, showing that they are in a sufficient state for sports and daily practice without impairing motor development in this age group of early adolescence.

The present study contributes so that the education professionals who work with this tool can, through a valid diagnosis, observe the level of motor coordination of their students or athletes once they can make some interventions so that those same evaluated cannot reach a stage. more adult with the level of coordination required below that required both in sport and in his professional life.

Future investigations could use broader samples either focusing on more age groups to be investigated, covering

practitioners of other sports or even different demographic regions.

Given the importance of the topic, it is considered that much remains to be done in the field of research in this area and is therefore a fertile field of work for other researchers.

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Riboflavin ameliorates the L-NAME induced brain injury

A Riboflavina na melhora da lesão cerebral induzida por L-NAME

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Abstract— Introduction: Oxidative stress has been associated with the pathogenesis of vascular disorders as hypertension and stroke. Studies have been carried out to identify preventive alternative therapies, including vitamins with antioxidant power. Methods: Twenty-four adult male rats (SHR-sp) were subdivided into four groups with six rats (n=6) each: control (not treated), riboflavin (B2 treated), B2 plus L-NAME, and L-NAME. Individual neurologic outcome status was appraised through maze, balance and motor tests. Oxidative stress serum markers (Homocysteine and Malonic Dialdehyde) were determined for each group. The hypotensive effect (p < 0.05) observed with L-NAME: 196.5 ± 1.97mmHg (L-NAME plus B2), 195 ± 3.3mmHg (B2); 235.3 ± 2.16mmHg (control), 233.7 ± 4.50 mmHg (L-NAME). There was neuroprotective effect of riboflavin in the response to those neurological tests. Regarding oxidative stress markers, animals treated with riboflavin showed lower values (p < 0.05), suggesting better protection. Conclusions: Even under NO synthase inhibition, riboflavin enhanced neurological outcome status and reduced systolic pressure levels. Discoveries suggest riboflavin might become a preventive and regenerative strategy of stroke management.

Keywords— Oxidative Stress, riboflavin, L-NAME, neurological tests.

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I. INTRODUCTION

Cerebrovascular accidents (CVA) have a peak incidence between 6th and 7th decades of life when added to cardiovascular and metabolic alterations related to age 10,18 . However, a stroke may occur earlier and be related to other risk factors such as diabetes, hypertension, obesity, immune and inflammatory diseases 20 . Recent global studies revealed an increased incidence of strokes worldwide, surrounding 10 million cases in incidence ⁵.

Regarding this, there is a strong evidence implicating oxidative stress in the pathogenesis of vascular disorders in general. The reaction of free radicals with macromolecules starts an oxidation process triggering an inflammatory reaction which leads to both endothelial injury and decreases the elasticity of large and small vessels causing hypertension and stroke ¹⁵. Thus, a number of studies have been carried out to identify alternative therapies which include the possible action of vascular endothelial protective nutrients, including vitamins with antioxidant properties ^{3,16}. In addition, some authors have reported a physiological downregulation of riboflavin kinase in SHRSP rats ²³, a known experimental model for the study of severe hypertension and stroke as well.

Those findings putting together bring up the riboflavin (vitamin B2) due to its role on the mechanism of oxidation-reduction and the metabolism of homocysteine ⁶. Besides that, the possibility that riboflavin might be involved in nitric oxide synthesis increases the interest in the investigation of riboflavin's effects in brain injury models involving oxidative stressors such as L-Nitroarginine Methyl Ester (L-NAME).

In fact, nitric oxide has been recognized as both: an endothelium-derived relaxing factor (EDRF) substance and neurotransmissor¹⁷. The inhibition of nitric oxide synthase (NOS) has been related to brain injury as well ¹¹. Therefore the aim of this study was to investigate the possible effects of riboflavin (B2) chronic supplementation on neurologic performance of spontaneously hypertensive stroke-prone rats (SHR-sp) previously submitted to L-NAME.

II. MATERIALS AND METHODS

Animals and supplementation

Twenty-four adults (18 weeks) male spontaneously hypertensive stroke-prone rats (SHR-*sp*), obtained from the colony of the bioterium of the Federal University of the State

of Rio de Janeiro, were kept in individual metabolic cages in controlled conditions: temperature $(21 \pm 2 \circ C)$, humidity (60 \pm 10%), air exhaustion cycle (15 min / h) and 12 h-dark/light cycle (artificial lights, 7 am-7 pm) and fed a standard diet Nuvilab (Nuvital ®) plus water *ad libitum*.

After a baseline period of 10 days, the rats were randomly subdivided into four groups of six animals each: Group 1 - Control (receiving vehicle: water), Group 2 -Riboflavin(B2) Treated (10mg/Kg of body weight) (Sigma ®-R4500), Group 3- Riboflavin(B2) plus L-Name (50mg/kg) (N5751, Sigma ®) and Group 4- L-Name isolated. The duration of Treatment was 28 days and riboflavin was administered by oral gavage and L-NAME in drinking water. All the procedures were carried out in accordance with the conventional guidelines for experimentation with animals (NIH Publication No. 85-23, revised 1996). The experimental protocols used in this study were approved by the Ethics Committee for Use Animal Experimentation (CEUA) at the Federal University of Rio de Janeiro State, Protocol N.2016-2.

Physiological parameters

The animals maintained in metabolic cages were submitted to the daily evaluation of water and food intake, body weight, diuresis and physical aspects: distribution and coloring of hair, bleeding, stains, cracks, opacification, and coloring of mucous. The behavioral aspects and motor-sensory parameters investigated were also following Kolb & Whishaw methodology ²². Systolic blood pressure was determined through the non-invasive method of plethysmography ⁷.

Neurological tests

The sensory-motor skills of the animals were assessed daily from the basal period:

• Memory test and spatial orientation (Maze test). The animals were initially trained for a week in a maze for the development of memory and spatial orientation. After this step, the treated rats and control groups received their treatment for 4 weeks and the rats were retested. The animals were placed in a one-way point of a maze with dimensions 30 X 55 X 55 cm and should find the exit. When the animal ran all the way, the task runtime was recorded. If the animal took more than 120 sec to travel the path, the test was stopped and the trademark of 120 sec was recorded.

- Balance test- Inclined plane: the balance bar is a wooden structure 5mm larger, whose function was to assess the time at each animal could support its own weight through the power of the forelimb placing holding it at the bar. The time the rats took the bar holding was timed.
- Motor Tasks: This test was performed by measuring the sensitivity of the animal to pain in response to application of heat (water at 70 ° C) at the tail end of the animal where the response time to the stimulus is timed using a sport timer of the brand "Miky" (adaptation of the method SDI Tail Flick Analgesia Meter, the San Diego Instruments - USA)
- Behavioral alterations and TIA and stroke signals: The animals were handled daily and any evidence of neurological sensory, motor or behavior alterations was recorded.

Blood Collection

At the end of treatment, the animals under anesthesia with sodium pentobarbital (60 mg/Kg of body weight) had the blood collected by punction of the caudal vein, for biochemical analysis.

For the sacrifice, the same drug was used, at high dose (100mg/Kg of body weight) until the absence of vital signs and then the liver was removed for macroscopic evaluation following Sherle method ¹⁹.

Blood homocysteine (Hcy)

The material used for the determination of homocysteine frozen was plasma obtained from centrifugation of the blood contained in a disposable tube with EDTA anticoagulant. The blood was centrifuged in a centrifuge model CELM Kombat (measurement and calibration Control-Lab), the 3500rpm for 15 minutes. The plasma separated from cells by centrifugation was removed from the primary tube by pipetting with disposable tips and placed in a secondary tube, identified and sterile. The method was used to measure HPLC (High-Performance Liquid Chromatography) using the Shimadzu C18 column with Novapac, reading fluorescence at wavelengths 385 and 515nm.

Malonic Dialdehyde (MDA)

The material used for the determination of malonic dialdehyde serum levels was obtained from the centrifugation of blood collected in a disposable tube without anticoagulant. The blood was centrifuged in a centrifuge model CELM Kombat (measurement and calibration Control-Lab), the 3500rpm for 15 minutes. The serum separated from cellular components by centrifugation was removed from the primary tube by pipetting with disposable tips and placed in a secondary tube, identified and sterile.

Colorimetric method was used for MDA, using equipment Micronal B442 and thiobarbituric acid as the reagent.

Statistical analysis

Two-way ANOVA model was used to compare the variables among the groups, with a Confidence Interval of 95% threshold being considered statistically significant.

III. RESULTS

Supplementation of B_2 did not alter the biological parameters and general health status of animals. The physical examination together with the macroscopic evaluation of the liver (Table 1) confirmed the absence of toxicity of riboflavin under supraphysiological doses.

In addition, there was a significant role of riboflavin in systolic blood pressure reduction ⁶. Besides that, the significantly (p< 0.05) hypotensive effect was observed even in presence of L-NAME: 196.5 \pm 1.97mmHg (L-NAME plus B₂), 195 \pm 3.3mmHg (B₂); 235.3 \pm 2.16mmHg (control), 233.7 \pm 4.50 mmHg (L-NAME); (Table1).

Our results indicated a neuroprotective effect of riboflavin. By the end of the experiment (4 weeks), vitamin supplementation has reversed blocking L-Name effect. There was a significant reduction of approximately 22 seconds in memory test, 13 seconds in the balance test and 4 seconds in the motor task.

observations the Neurological demonstrated presence of an ataxia and hemiparesis in one rat from the B₂ plus L-NAME group, but this animal recovered quickly, revealing a picture of a transient ischemic attack. With respect to the L-Name group, all animals were apathetic, irritable to the touch, with bristling hair and two rats showed irreversible ataxia and hemiparesis. In the Control group, the animals were apathetic and irritable to the touch. None of the B₂ group subjects presented visible neurological impairments.

Regarding oxidative stress markers, the animals treated with riboflavin showed significantly (p<0.05) lower values, suggesting a better protection (Table 2).

Physiological general parameters and liver weight injury induced: of SHR-sp rats Riboflavin treated, Control and L-NAME-

Table 1. Values represent the mean \pm SD of physiological parameters of 6 animals per group.

Phy Par (siological rameters Froups	Body Weight (g)	Diuresis (mL)	Food Intake (g)	Water Intake (mL)	Liver Weight (g/100g bw)	Systolic Blood Pressure (mmHg)
	Control	4.67±2.23	16.94±2.14	16.94±2.14	26.62±3.63	3.48 ± 0.21	235.3 ± 2.16
Rats	B ₂	3.28±1.27	21.70 ± 3.53	21.70 ± 3.53	30.51 ± 2.12	3.72 ± 0.24	195 ± 3.30
	L- NAME	6.68±5.41	19.09 ± 3.04	19.09 ± 3.04	29.97 ± 6.45	3.31 ± 0.38	233.7 ± 4.50
	L-NAME + B ₂	5.43±3.22	15.34 ± 4.12	15.34 ± 4.12	24.86 ± 4.68	3.75 ± 0.57	196.5 ± 1.97

Table 2: Profile of biomarkers associated to an oxidative stress

Markers Group	Hcy (mmol/l)	MDA (nmol/mg)
Control	16.21 ± 0.63	5.87 ± 0.38
B ₂	12.45 ± 0.35 *	4.05 ± 0.68 *
L-NAME	19.46 ± 0.56	$7.\ 78\pm0.87$
L- NAME + B ₂	14.67 ± 0.22 *	5. 34 ± 0.73 *

Table 2. Values represent mean \pm SD of homocysteine and malonic dialdehyde levels of six animals per group. * P <0.05 was considered significant.

Tests Groups	Memory	Balance test	Motor Task
Control	$38"81 \pm 09"36$	$23"97 \pm 04"27$	$3'26''31 \pm 0'00''05$
B ₂	$16"25 \pm 04"51*$	19"84 ± 01"48 *	1'18"'29 ± 0'00"'08 *
L-Name	$40"41 \pm 04"12$	33"77±02"11	$5'33''42 \pm 0'00''05$
L-Name + B ₂	$18"25 \pm 06"47*$	20"44 ± 02"41*	1'37"19 ± 0'00"04 *

Table 3: Response to Neurological tests

Table 3. Values represent mean \pm SD of neurological test screening performed in six animals per group. * P < 0.05 was considered significant.

IV. DISCUSSION

Nitric oxide is an important bioactive molecule associated with the physiology of cardiovascular, nervous and immune system. Many studies have shown that nitric oxide is thought to be involved in synaptic plasticity contributing to learning and memory in several brain areas including the hippocampus. It is well established that NO synthases metabolize L-arginine to L-citrulline and NO via two consecutive single oxidation reactions. The inhibition of NO synthases by L-NAME has been associated with disturbances in the acquisition, storage, and retrieval of information ². In the presence of L-NAME, different areas of the brain related to memory seem to be injured ¹. The present study demonstrated that the rats from L-NAME group showed a number of neurological disorders such as ataxia, irritability to touch, hemiparesis and loss of memory, in agreement with previous authors 9. On the other hand, riboflavin supplementation was able to reverse the dangerous effect of L-NAME both in improving the performance of memory and also in balance ¹⁴.

In addition, the riboflavin supplementation clearly decreased in number and severity the signs of transitory ischemic attacks usually observed in SHR-sp rats. In fact, the very recent discovery of riboflavin brain receptors reinforces the idea that this vitamin may have an important role on brain functioning 23 .

Additionally, riboflavin benefit effects could be in part attributed to the riboflavin antioxidant properties. Such a mechanism of action has been linked to its chemical structure: the presence of a ribitol ring ⁴. The reduction of this ring (FAD, FMN oxidized form) produces the reduced forms of flavoproteins (FMNH₂ and FADH₂) ⁸ which allows the vitamin to have high affinity to react with various substrates, particularly molecular oxygen ^{12,13}.

Another important point to be approached is the fact that riboflavin, as mentioned above, also participates of homocysteine metabolism throughout regulation of metabolic pathways catalyzed by the enzymes methylenetetrahydrofolate reductase (MTHFR) and methionine synthetase ¹⁶. Such an effect was traduced by a sharp reduction of homocysteine blood levels here presented. This effect is extremely important because homocysteine by itself, is considered as a free radical and seems to be implicated in the development of stroke and neuronal damage as well ²¹.

V. CONCLUSION

The present study demonstrates riboflavin 's role in cellular oxidation-reduction, homocysteine metabolism, and antioxidant body defense. Yet, our results showed its action in enhancing the NO synthase action. These properties suggest that riboflavin can be a promising alternative strategy for the prevention of central nervous system's injuries sustained strokes and transient ischemic attacks.

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Temperature control for weld paste: a proposal for improvement in the SMT sector

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Abstract— Due to the great technological advance in the most varied segments of the automatic insertion sector, little is concerned with the temperature control of the weld paste that will be applied in the printed circuits (PCB), used in the most diverse equipment. Knowing that the process of applying the weld paste is one of the first steps of the sector, great attention should be paid to the quality of the weldpaste used, because the low efficiency in this step will generate great impacts for the other, as well as can impact the end customer. In order to give due importance to this stage of the manufacturing process this article shows the reality between equipment that has the control and temperature adjustment through air conditioners coupled to screen printer equipment, and those that perform the same function, however, without the control and temperature adjustment of the weld paste inside the equipment during the use and application of the same in the printed circuits. Performing a comparison between the equipment, it was observed how much an improvement not implemented for the whole plant, generated considerable impacts to the production process, which if it had been made could in addition to generate higher profits for manufactures, also generate greater confidence and customer satisfaction before the ready product produced with more quality.

Keywords—PCB, temperature control, weld paste, screen printer, SMT.

I. INTRODUCTION

The process of automatic insertion becomes increasingly essential and critical in the manufacturing environment through the high use of electronic plates in the most diverse equipment of everyday life.

The weld paste is a metallic powder that contains tin welding and stabilized weld flow to form the metal alloy between the components and remove the thin layer of oxide that forms on the surface where welding will occur [1].

It began to be widely used around 1970, when the Surface Mounting Technology (SMT) industry began to gain more and more space in the market.

The weld paste has limited service life and is temperature sensitive, so it is necessary to comply with the thermal criteria so that the degradation of the paste by rheology (study of the viscosity of matter) is avoided [2].

Technology deployments and quality acquired through equipment have a direct impact on SMD sector efficiency in obtaining satisfactory results [3]. SMD components are found in integrated circuits, resistors, capacitors, inductives, diodes etc., because they have reduced casings, it is not necessary to perform the plate drilling for the welding process, which increases the reliability of the plates assembly and reduces the manufacturing cost and the size of the circuits [4].

A fundamental equipment to obtain optimal performance in the SMD sector is the Screen Printer, responsible for applying the weld paste in the PCB (printed circuit) where the electronic components will be assembled.

Printed circuits usually consist of a plate of phenolite, fiberglass, polyester fiber, specific films based on various polymers, etc. On these plates, through thin a film of copper, silver or alloys based on another, the conductive lanes that will be fixed the components will be drawn [4].

By indication, the most effective way to carry out weld paste deposit is through the stencil printing process, where usually the stencil is formed by a sheet of metal with openings that correspond where the weld paste should be deposited. After being applied on the stencil the weld paste is rubbed over it with a squeeturn. The printed circuit (PCB) is then removed and proceeds to the next equipment that will continue the automatic insertion process.

Also through the guidelines of the company in question, the main characteristics of the weldpaste are viscosity and thixotropy that directly interfere with the efficiency of the creamy mixture of metallic powder and flow additives that is the composition.

For the manufacture of circuits with SMD technology it is necessary a thorough control of heating in the realization of welding [3]. In order to ensure that this process is efficient, temperature control in both storage and use of the weld paste is essential, because through the main characteristics of the weld paste (thixotropy and viscosity) is that a satisfactory weldability is obtained.

The aim of this article is to analyze the efficiency of screen printing equipment in the SMD sector that have or do not have air conditioners coupled for internal temperature control.

II. MATERIALS AND METHODS

The scenario of the auto-insertion sector currently revolves around two technologies, Thought-Hole Tecnology (THT), which would be the use of components that pass from one side to the other in the PCB, and Surface Mount Tecnology, in which the insertion of the components is on the surface of the PCB which reduces the dimensions of the components [5].

The migration to SMT has not yet occurred completely since the impossibility of manufacturing large-scale components such as connectors, which need to be welded throughout its perimeter so that the contact area is larger offering a higher mechanical resistance when compared to the components used in the SMT [6].

There are factories that have both technologies, which allows a larger margin of customers served and a more complete production process in order to perform both functions.

Since the European Union banned the use of weldpaste that used lead (Pb) in its composition, through the great impact caused on the environment by this chemical element [7], it was exponentially the increase in the use of lead free, which are metal alloys that have only tin and flow in their composition.

These, in turn need a higher temperature for the melting point, which would be from 183 to 213 °C, however came to be the alternative to the problems of lead weldpaste [8].

A series of parameters needed to be adjusted, from pcbs, as well as changes in components in the face of higher thermal exposure [5].

The study took place in a company of the industrial pole of Manaus/AM, which focuses on the production of radios and sets of automotive cockpits, with more than 10,000 employees, in more than 40 facilities, in18 countries.

A case study was carried out that analyzed and compared the difference between equipment in the SMT sector, which are responsible for performing the application of weld paste, with or without coupled air conditioning, in order to ensure the ideal temperature of the weld paste due to the importance of process efficiency.

III. RESULTS AND DISCUSSION

The Printer process is the most demanding, since printer configurations, cleaning of the materials used and attention to the environment where the folder will be inserted make this process an extremely important factor for satisfactory efficiency [5].

In an attempt to find the root cause of the problem, it was identified that only one production line had temperature control on the Screen Printer equipment. And when analyzing the factory's internal guideline, it was realized that it was an extremely important point for the efficiency of the process as a whole.

The control of the weld temperature is essential, as a large difference in temperature can damage the SMD components [9].

The weld paste must be between -26 and 43 °C, because below the lower limit the weld paste enters the freezing process and above the upper limit the flow activation process begins [1].

In the storage environment, the company has a quality control of the weldpaste through a software that informs if the weldpaste is in a position to be used, as well as the shelf life, ensuring that there was no problem in transport to the factory that should be placed in polystyrene box with ice as specified by the manufacturer and storage form.

The specifications of the company in question provide that for the stored weld paste at a temperature of 10 °C or less, valid for 6 months. The stabilization time at room temperature should be four hours for containers with a capacity of more than 1kg and two hours for containers with a capacity of less than 600g, with storage at room temperature of 22 to 25 °C of seven (7) days.

All these items were faithfully serviced and validated every day by the company's employees, however, with the
implementation of temperature meters, in other equipment that perform the same function, in order to perform the monitoring of the internal temperature inside the equipment, detected that with the high use of screen printer equipment, the internal temperature was higher than 27 $^{\circ}$ C , which compromises the quality of the weld during the application process in the printed circuit.

In October 2020, 144 tailings were identified for the weldpaste in the factory's production process, which meant 45% in discarded parts (scrap) with a cash value of approximately US\$ 938.00 dollars.

Using as an example a Screen Printer equipment that does not have automatic control and temperature adjustment, it is possible to analyze the amount of defects related to a weld paste with low viscosity, which totaled 137 tailings related to the weld paste, generating impacts on the downtime, rework and scrap process.

The difference is perceived through an equipment that has automatic internal temperature control and adjustment through air conditioners. The amount of tailings of the same parameters in the same time period were only 7 tailings. The difference is huge, which justifies the efficiency of the second example by the low amount of tailings for the same problem.

The investment for the deployment of air conditioners in equipment that did not have temperature control would be \$ 20,000 dollars, however, given the current costs with problems related to the weldpaste, it would take about a year and nine months for the investment to be paid. What in 10 years would be a profit of \$112,560 dollars.

IV. FINAL CONSIDERATIONS

Therefore, in view of the results obtained, it is possible to conclude that the equipment that has internal temperature control has a higher efficiency than the equipment that does not have to improve the production process as a whole, because it is one of the first steps. Therefore, the application of this concept leads any company that is part of the SMT sector to obtain satisfactory results for the company and for customers in order to produce with more quality, productivity and effectiveness.

The study of the weld paste is comprehensive, which allows to improve the techniques presented here, and if replication is properly analyzed for any company that wants to have an efficient production process in order to satisfy the company as a whole and the end customer that is the focus of the production performed, generating positive results for all involved.

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Performance of Social Educators in the institutional Reception of Children and Adolescents

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Abstract— The present work is part of the results obtained and presented in the conclusion work of the Social Work course, whose general objective sought to analyze the performance of social educators who work in institutional care for children and adolescents. The study consisted of two stages, the first being a bibliographic survey on the subject, and the second stage launched a field research at a host institution in Petrolina-PE to analyze the formative aspects that permeate the practice of social educators who work in the institution. We identified that there is a need for better qualification of social educators, due to the lack of public policies aimed at this field.

Keywords—Institutional Reception. Children and Adolescents. Social educator.

I. INTRODUCTION

This research paper discusses the institutional reception service for children and adolescents together with the work of social educators. Thus, we analyze the historical process and the characteristics that each period has on the host institutions, since they have undergone different transformations over time. In this way, we focus on the challenges and achievements that children and adolescents obtained from the relationship between the State, society and the family, resulting in the conquest of rights for children and youth.

It was based on articles and bibliographies by different researchers, such as Mariana Ferreira Garcia (2009), Vinicius Furlan and Telma Regina de Paula Souza (2013), Maria Luiza Marcilio (2016), Nilma Soares Barros and Luciene Alves Miguez Naiff (2015) at area of History, Psychology and Social Work, which we base this research on, which was part of an internship project initiated at a host institution, an entity aimed at welcoming children and adolescents in the São Francisco Valley, in the city of Petrolina / PE. The time frame of the work crosses the 16th to the 21st century briefly, as we elaborate a succinct historical retrospective started in the colonial period on the first forms of child and youth reception. We look a little at the present time, to follow the changes that the institutional reception policies have undergone, since to understand this entity and its different facets it is necessary to pay attention to the peculiarities that each period had, so that today we have the that we know by institutional reception policies.

The spatial feature is Brazil, since it is part of our social reality, and also due to the social issues that exist in the country, which make it difficult for the rights of children and young people to be correctly and necessaryly guaranteed. It is in this sense, that we realize the need to study the theme and produce works that add the issue of institutional reception.

It is necessary to discuss social problems and, through this study on institutional care, we are able to deal with a major social problem, which is the abandonment of children and young people, adding to the social fragility that families experience and the lack effecting public policies. Policies that exist, but that are not intended and applied correctly to families that do not have the necessary and fundamental resources for the human development of their dependents.

Based on these assumptions, the present work is structured in five chapters, in which the introduction already constitutes the first chapter, as we present its basic structure and discuss the objectives and perspectives of the work; the second chapter, entitled the historical process in the construction of the statute of children and adolescents, addresses the historical contextualization of the first institutions aimed at child and youth care, in which we seek to explain the changes undergone in such institutions and thus show some public policies for that group.

The third chapter was intended to sample data from the methodologies used for research and construction of the work, explaining in detail each step; the fourth chapter addresses the role of social educators, based on a dialogue on the training of educators and an analysis of the various aspects of this professional at the institutional level; and lastly we have final considerations.

In addition, the purpose of the work was to explain about the role of the social educator in the host institutions and about the various activities performed by them for the human development of children and adolescents. For this reason, we conducted an information survey with these professionals, to understand the social reality of educators, as well as those welcomed. In this way, a questionnaire was carried out so that social educators could contribute to the survey of the care legislation and the relationship of those welcomed with the professionals.

II. THE HISTORICAL PROCESS IN THE CONSTRUCTION OF THE STATUTE OF CHILDREN AND ADOLESCENTS

Initially, welcoming abandoned children was directly related to religious institutions, predominantly the Catholic Church, which provided assistance through charity. In this sense, the Roda dos Exposados, remembers its origin to the medieval period in Europe, precisely in Italy, being later propagated to other countries and even other continents (Marcílio, 1988, p.1-2). According to Marcílio (1988, p.58) "the tradition for Brazil occurred in the 17th century when the first Roda dos Exposados was established by the Crown in the city of Salvador, Bahia".

In this way, the "Roda dos Expostos" in Brazil consisted of an institution providing assistance to abandoned children, which started in the colonial period, and lasted during the Empire and the Republic. It was a way to prevent children from being abandoned in the most different places, without any basic social support, in addition to providing the anonymity of the person who abandoned them, so that there would be no subsequent link between the child and his / her affiliation, having also as a consequence the incentive to abandon. (MARCÍLIO, 1988).

In this way, it was seen the importance that the Roda dos Exostos and the places of reception had to "solve" the problem of abandonment. However, it is worth mentioning that this reception did not meet all the social needs that a child needed, due to a series of consequences arising from this type of reception. Among them, the lack of resources, which even today is one of the factors that hinder the guarantee of children's social rights. In addition, the infant mortality rate in these shelters and the use of the sheltered child as free labor that made it impossible for the necessary assistance that a child should have.

In this perspective, the history of the formation of the Statute for Children and Adolescents was directly linked to the organization of civil society and the formation of the great social movements that fought for the defense of the rights of "Abandoned Minors" who were in an irregular situation, and who in fact, they lacked due judicial and political support. (ABREU, 2004, p.107-115). Thus, the State began to have a duty to provide assistance to children and adolescents who were in a situation of vulnerability, but these actions were not aimed at the welfare of citizens, but rather a form of exclusion and internment. (MARCÍLIO, 1988, p.70).

Therefore, in order to validate the role of the State, the Code of Minors was created, the first in 1927, which aimed at repression and internment in case of physical and moral abandonment of children, which the power of decision was found in the figure of the Minor Judge. (SILVA; SILVA, 2016, p.6). In addition to this code that provided for a certain repression of children and adolescents, there were other bodies that had the same claims.

In this perspective, based on a brief historical analysis of the first institutions and social bodies for the care of children and adolescents, it is noticeable that, despite the objective being assistance and the provision of the basic and necessary resources for a person's life condition, these bodies were also susceptible to corruption and failures in their protection policies.

III. THE HOST CONTEXT IN THE RECENT SCENARIO

As a result of the political changes that occur throughout the historical process, there were a series of changes in social policies, including the approval of the 1988 Federal Constitution, called the Citizen Constitution, which provided basic rights to the population, such as education, health , work, social security and other rights, which symbolized a political-social achievement for society, according to article 6 of the Federal Constitution.

And for formal regulation of the 1988 Constitution, on July 13, 1990, the Child and Adolescent Statute (ECA) was created, which established the fundamental rights of children and adolescents. According to article 1 "this law provides for the full protection of children and adolescents". According to Article 3 ECA:

> Children and adolescents enjoy all the fundamental rights inherent to the human person, without prejudice to the full protection covered by this law, ensuring that, by law or by other means, all opportunities and facilities are available, in order to provide them with physical, mental, living, spiritual and social development, in conditions of freedom and dignity. (ECA, 1990, p.10).

In this way, ECA ensured the fundamental rights that the State must offer to children and adolescents. However, it is necessary to emphasize that, together with the State, the family has the role and the obligation, as well as the competent bodies, to ensure the rights and duties for children and adolescents, as determined by article 227 of the Constitution and the Article 4 of the ECA:

> It is the duty of the family, the community, society in general and the government to ensure, with absolute priority, the realization of the rights relating to life, health, food, education, sports, leisure, professionalization, culture, dignity, respect, freedom and family and community coexistence (ECA, 1990, p.10).

Consequently, ECA marked the break with the irregular tradition of welcoming children and adolescents and, thus, "the child is no longer an object of interest and concern in the private sphere of the family and the Church, to become a matter of social nature, which is the administrative competence of the State". (RIZZINI, 1997, p.24-25, apud Perez; Passone, 2010, p. 654).

IV. MATERIAL AND METHODS

Methodologically speaking, this work is configured as a research with a qualitative approach, carried out under the focus of two data collection procedures, namely: participant observation, which took place in a host institution in Petrolina / PE; and bibliographic research, as well as a questionnaire with eight questions in a semistructured way.

The performance of the work followed the following steps: 1) Reading and filling out the bibliographies on the topic; 2) Analysis of the historical context in which the Host Institutions emerged; 3) Analysis of the institutions, bodies, laws and constitutions that are related to the host entity; 4) Analysis of the professional role of the social educator.

In this way, the data collection technique was anchored in observation, for which we list the logbook as a collection instrument, which was of great relevance to collect information and contribute to the construction and analysis of data.

V. ARTICULATION BETWEEN SOCIAL EDUCATORS AND TECHNICAL TEAM

Often, those who received training for the profession of educator perceive specialization as a need to update their area. In this case, although there is often a disregard for policies that should provide training for these professionals, it can be seen that educators recognize the need for specialization for their role, which is a good sign, since some seek knowledge in the area in a particular way. However, although there is no initial preparation for the position, the institution annually offers lectures aimed at improving these professionals. According to technical guidelines:

The educator must have the capacity to perform his / her role with autonomy and be recognized as an authority figure for children and adolescents, also having the support of the service's technical team, who can share among themselves experiences and anxieties arising from the performance, seeking the collective construction of strategies for facing the challenge (ORIENTAÇÔES TECNICAS, 2009, p.53).

In this sense, it is also noticeable the dissatisfaction of educators in relation to the bodies responsible for the host institution, in which they should provide resources for their training as an educator, since what is theoretically established is not seen in practice.

Thus, when questioning social educators about the choice to be an educator, a majority said they had chosen

the profession due to family influence, others due to previous work with children and only one reported that due to lack of options, they decided to work in the area, , who over time ended up identifying himself as an educator. With that, we can see that the profession of social educator is still very trivialized and placed on the margins of society, since it arouses little interest in people, due to the lack of appreciation in the professional area.

An interesting question that we were able to perceive when carrying out the research was how the professionals perceive the work they develop as a social educator. The response was unanimous, since everyone recognized that their role as an educator is developed from an affective relationship with the sheltered, due to their daily contact with them. Affirming that an affective relationship is necessary to obtain respect and trust from children and adolescents, calling themselves "parents", protectors of these children.

Recalling that this is how educators see themselves performing their activities, but there is a separation between the personal and professional relationship, since the reception should not replace the family home. Therefore, educators must be very careful between this fine line of personal and professional, without neglecting affection and compassion for those welcomed.

Then, we set out to know the challenges faced by these professionals, since in every institution there are problems regarding the success of the network of services they work on, especially when dealing with the issue of reception, which are responsible for the lives of children and adolescents in a situation of social vulnerability.

According to the educators, the problems in the service network in the researched institution consist of the lack of support from higher bodies to provide support due to the institution, so that there is a good performance of the proposed activities. And also, there are some problems directed to the personality and divergence of characteristics of the sheltered individuals, which requires particular care for different situations.

Regarding the relationship between the educator and the host, all said they had a healthy relationship with the children and adolescents of the institution. Regarding the perception of social educators about institutional reception policies, it is common to note the flaws of the institution, which, according to one of the educators, for the organ to provide a good reception must undergo considerable changes in search of improvement, being commonplace in such situations. institutions that requires public as well as private investment. Regarding the articulation of the educators' work with the other professionals of the institution, the interviewees stated that there is this dynamic of articulation with other employees, such as social workers, psychologists, directors and other professionals who participate daily in the lives of children and adolescents.

However, social educators on the night shift, unlike morning educators, have little articulation with other professionals, due to the time when the number of workers in the institution is reduced.

Thus, from the description anchored here of the educators' perceptions of their performance, we can point out necessary changes in the institutional care system from its primary structure, which is the proposal of public policies aimed at selection, up to the training of educators who will act in the care of children and adolescents. In this way, they will be able to ensure that legally ethical, philosophically humanitarian and socially fair work is carried out.

VI. CONCLUSIONS

Although there is a qualification problem, we could see that the exchange of knowledge and experiences between educators provides a good performance of their work. Furthermore, we realize that the greatest difficulty for educators concerns the devaluation of these professionals.

Thus, we saw that the proposal of our work on the role of social educators in the institutional care of children and adolescents, is a theme that can raise several debates about professional assistance within these institutions. In this sense, we consider the need for greater socio-political visibility of educators who play an indispensable role in the functioning of host institutions, which are still reasonably invisible by training public policies.

As a conclusion, we point out the need for further research that takes a look at the host institutions, their practices, policies, limits and potentialities in the social role they develop and their ethical commitment to guarantee human rights.

We also recommend reflecting on some questions that can be raised to guide new research, asking about: what training policies have already been thought for social educators in host institutions at regional and local level that still need to be applied? What do the hostages indicate about the role of social educators? How effectively is the practice of the technical team articulated with the work of social educators in educational promotion and in the psychosocial context of those welcomed? Anyway, we realized that during the realization of this work some questions emerged, but due to the time to deepen our readings and to the production of this, we ventilate questions to other people who are interested on this theme or, even, for us in another investigative opportunity.

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Analysis of the physicochemical parameters of the water quality of stream Urumutum in the city of Tabatinga - AM

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Abstract — Water is an essential resource for the maintenance of life that everyone and it is up to all human beings to preserve our water resources. This work aimed to evaluate the physical chemical parameters of the water of the Urumutum stream, which is located on the INCRA road, in the rural area of the municipality of Tabatinga-AM. For the analysis of water quality, two collections were carried out, in a period of one month. The parameters analyzed were: ammoniacal nitrogen, electrical conductivity, biochemical oxygen demand (BOD), chemical oxygen demand (COD), dissolved iron, nitrite, nitrate, Ph, temperature and turbidity. The results obtained in the laboratory analyzes were compared with the water quality standards established by CONAMA 357/2005, in which some parameters outside the established standards were observed. Being them, the electrical conductivity, BOD, COD, temperature and dissolved oxygen, showing high degradation of the water course generated by the accumulation of residential waste that consequently alters the water quality of the stream. Based on the study, it was possible to conclude that the water quality of the Urumutum stream is in a critical state due to anthropic actions. Public policies must be taken immediately in view of the fact that the lack of sanitation, added to the abandonment of public power, can generally cause serious problems in the health of residents, leading to an increase in diseases caused by contamination of the stream water.

Keywords— Physical-chemical analysis, degradation, water quality.

I. INTRODUCTION

Water is an essential natural resource for the survival and development of life on the planet. We can use it for various activities of extreme importance, such as supplying houses and industries, irrigation, transportation. It is estimated that 97.5% of the water available on the planet is salty and is not suitable for any type of supply or irrigation. The fresh water available on the planet corresponds to 2.5%, most of which is difficult to access [1].

Water quality standards vary for each type of use. Therefore, potability standards are different from bathing standards, which, in turn, are not the same as those agreed for irrigation water or for industrial use. Resolution 357/2005 was created by the National Council for the Environment (CONAMA), which reconciles the classification of water bodies and the environmental guidelines for their classification. establish the conditions and standards for the discharge of effluents.

The municipality of Tabatinga is located west of the interior of the state of Amazonas on the left bank of the Solimões River, with a population of 67,182 inhabitants [2]. Population growth in recent years has been one of the major problems in the municipality. Due to large irregular occupations and the lack of basic sanitation. Streams such as Urumutum have been significantly affected by the anthropic occupation of its banks.

Water quality is related to natural phenomena and anthropic actions, due to the irregular use and occupation of its banks. Anthropic actions are one of the main causes of the imbalance and alteration of water quality, through the generation of domestic effluents, industrially or in a dispersed form, contributing to the materialization of organic and inorganic compounds in water courses and changing their quality [3]. In this context, it is necessary to verify the current situation of the waters of the Urumutum stream, which frequently receives discharges of domestic effluents and solid waste. Thus, the present study aimed to analyze the water quality of the Urumutum stream on the effects of the occupation of its banks, analyzing the physical and chemical aspects of the stream water.

II. METHODOLOGY

The Urumutum stream is located on the INCRA road, in the rural area of Tabatinga-AM, with coordinates 4 $^{\circ}$ 12'16.8" S and 69 $^{\circ}$ 55'15.3" W. This area was selected for study due to irregular occupation on the banks the stream and measure the impacts generated in the stream water by the anthropic action generated in recent years.

Water samples were collected randomly at 15 m from the margin. The samples were collected at 20 cm from the stream surface in a polyethylene container. After collection, the samples were stored in thermal containers with ice to preserve their characteristics and transported to the laboratory of COSAMA, agency Tabatinga - AM. The analyzed parameters were; Ammoniacal nitrogen, Electrical conductivity, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Dissolved Iron, Nitrite, Nitrate, Ph, Temperature and Turbidity.

On-site analyzes of the following parameters were carried out; Hydrogenionic potential (pH) through the Phmetro brand HACH; Temperature (° C) with the help of Phmetro brand HACH.

In order to obtain the parameters of Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand (DBO), it was necessary to send the samples to the laboratory, LUPA An Análise bromatológicas Ltda, located at Avenida Joaquim Nabuco – Downtown of Manaus - AM.

III. RESULT AND DISCUSSION

The characterization of the water quality allows to measure the impacts generated by anthropic actions in the water courses, enabling its adequate management and, additionally, its recovery. The monitoring of water resources is very important, since it is through contamination that harmful agents or pathogens are introduced that alter the characteristics of the watercourse. One way to measure or analyze water quality is through indexes, called Water Quality Indexes (AQI) [4].

To determine the quality of the stream water, the results obtained from laboratory analyzes were used and compared with the parameters established by CONAMA resolution 357/2005, which provides for the classification

Table 1 – Conama357 Standards

Parameters	Conama 357			
Ammoniacal Nitrogen	2,0 mg/l			
Electric conductivity	10 - 100 µS/cm			
DBO	\leq 5,0 mg/l			
COD				
Dissolved Iron	\leq 0,3 mg/l			
Nitrite	\leq 1,0 mg/l			
Nitrate	$\leq 10 \text{ mg/l}$			
Ph	6,0 - 9,0			
Temperature	20 - 25 °C			
Turbidity	$\leq 100 \text{ NTU}$			
OD	$\geq 6 \text{ mg/l}$			

In the study carried out by [6], the water quality parameters of the stream do Gigante from city of Manaus-AM were evaluated, where the results of the water quality parameters resulted in values much higher than those allowed by CONAMA 357/2005, resulting in in the total contamination of the stream in that study area, due to the large release of domestic sewage and the large accumulation of waste on the banks of the stream.

The Urumutum stream, although it obtained results outside the standards stipulated by the CONAMA resolution 357/2005, compared to the study of [6] is not in a state of total contamination, but it is at great risk if we do not take corrective measures and monitor the course d ' Water.

After the comparative analysis of the laboratory results of the water samples, the parameters Electrical conductivity, Biochemical oxygen demand (BOD), Chemical oxygen demand (COD), Dissolved oxygen (OD) and Temperature, do not meet the water quality standards for CONAMA resolution 357/2005, for class II fresh water. The results obtained are shown in Table 2.

Table 2 – Lab res	ults
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Parameters	Results
Ammoniacal Nitrogen	0,23 mg/l
Electric conductivity	-85,6 µS/cm
DBO	11,3 mg/l
COD	21,8 mg/l
Dissolved Iron	0,29 mg/l
Nitrite	0,12 mg/l
Nitrate	0,08 mg/l
Ph	6,4
Temperature	27,6 °C
Turbidity	6,57 NTU
OD	4,21 mg/l

Ammoniacal nitrogen results from the decomposition of organic matter present in the watercourse. Following the determination of Conama 357/2005 for freshwater class II, it indicates the corresponding value of 2.0 mg / l, therefore, the result indicates that the parameter is within the standards defined by Conama 357/2005.

According to [7], when the dissolved oxygen parameter is high, it means that the aquatic environment is in favorable conditions, as it reveals a higher consumption of O_2 by microorganisms in the decomposition process of organic matter. The result found was 4.21 ml / L, therefore, dissolved Oxygen is not within the standards published by Conama Resolution 357/2005.

The result of turbidity indicates that the presence of particulate matter in suspension or clay particulate is at low levels. Therefore, turbidity is at a satisfactory level according to the rules of Conama Resolution 357/2005.

The black waters of the Amazon are slightly acidic and have little electrical conductivity due to the poverty of dissolved ions [8]. In the results obtained in this study, an extremely low level of conductivity was observed, resulting in negative and unusual values, remaining outside the standards established by Conama Resolution 357/2005.

Of the parameters analyzed, what draws the most attention is the high value of Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand, in the case of BOD the result is 11.3 mg / l, a value greater than 5.0 mg / l stipulating CONAMA 357 resolution for Class II waters. The high levels of BOD indicate large amounts of organic matter present; from domestic sewage or organic matter from solid waste discharged into the water [9].

The COD indicates the amount needed for the oxidation of organic matter. second [10] to assess the biodegradability of an effluent, we correlate the BOD and COD values: The closer the BOD value is to the COD, it means that the effluent is more biodegradable. In this context, the result of the water samples from the Urumutum stream shows that the COD is higher than the BOD value, presenting a low self-cleaning power in the watercourse, which characterizes the eutrophication potential of the stream.

IV. CONCLUSION

Water is an essential resource for the maintenance of everyone's life and it is up to all human beings to preserve our water resources. In the study it was possible to conclude that the Urumutum stream is in a critical state due to anthropic actions. One of the main problems is the accumulation of residential waste that is dumped in the stream by the residents who live in the surroundings.

Public policies must be taken immediately, considering that the lack of sanitation, associated with the abandonment of public power, can generate serious health problems for residents, leading to an increase in diseases caused by contamination of the igarapé waters.

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Differential manifestation of teacher self-efficacy in Brazilian university professors in the health area

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Abstract— Self-efficacy has occupied the research space due to the relevance it holds as an explanatory mechanism of human performance to understand the characteristics of the population, the study analyzed the differentiation of beliefs of self-efficacy of university professors who teach in the health area according to gender, marital status, age, seniority at work, religion and training graduate academic. A cross-sectional and quantitative study was attended by 189 university professors working in a private university in northeastern Brazil. The differentiation indicate that Women perceive themselves more self-effective in the elaboration of didactic strategies to favor interaction in class; older teachers consider themselves more effective in didactic strategies for the planning of classes and postdoctoral teachers stood out for the higher sense of self-efficacy regarding didactic strategies for class planning, didactic strategies to actively implicate students and didactic strategies to favor interaction in class. Self-efficacy as an explanatory mechanism of human performance is determinant and therefore it is important to be enhanced in university professors for the pursuit of a higher quality of teaching-learning of future health professionals.

Keywords—Self-efficacy, self-efficacy beliefs, university professors.

I. INTRODUCTION

The concept of self-efficacy arises in the conceptual framework of Cognitive Social Theory [1,2] associated with individuals' perception of their ability to plan and perform the desired tasks [3-6]. This denotes that self-efficacy beliefs allude to each person's judgments about their ability to perform a particular activity.

The theory of self-efficacy [1] aims to demonstrate how people's cognitive, behavioral, contextual and affective aspects are conditioned by self-efficacy. For this reason, they have gained a prominent place among the explanatory constructs of success and failure in human action [7-8]. Self-efficacy falls within one of the founding mechanisms of human agency [1-3]. The sense of "being an agent" symbolizes intentionality in the influence that the individual exerts on the functioning itself and on the circumstances of life itself [3].

By interfering with the exercise of control, selfefficacy beliefs influence people's performance, persistence and motivation to perform certain tasks. Individuals are likely to perform activities in which they believe they have more capacity to succeed than tasks in which the sense of competence is evaluated by the individual as reduced. Thus, self-efficacy makes a difference in the way people feel, think and act and this is reflected in choices, conducts and performance [9].

The literature consulted highlights positive selfefficacy as a factor associated with personal success, professional satisfaction and successful individual experiences and work motivation [4, 6, 10-13], having a mediating role in the relationship between the overload of and the dimensions of burnout in teachers [5]. Feelings of self-efficacy are highlighted by the significant relationship between burnout and academic teacher performance [14], availability for involvement in collaborative practices [15] and the remarkable impact on academic performance of teachers [16, 17]. Teachers, confident in their beliefs, with the potential to teach, research and manage, are the fundamental elements to improve the effective learning process [18] and to put into action their application capabilities of various didactic strategies, in particular those indicated as representative of university education, such as the planning of the teaching-learning process, the involvement of students in this process, the interaction and creation of a positive learning climate in the assessment of students' learnings [19]. On the other hand, the theory of self-efficacy [1] adds a collective dimension to the individual agency through a sense of shared effectiveness once people share knowledge, skills and resources, support each other, form alliances and work together to solve their problems and improve quality of life [20]. In fact, teachers, by understanding themselves more capable of developing their educational actions effectively [21] influence the level of persistence in the face of difficulties and the creation of higher expectations in relation to students [22]. Because it is a construct that does not only respect selfregulation and individual motivation, but which can become a collective phenomenon, with this study, it is intended to analyze the differentiation between teachers' beliefs of self-efficacy Brazilian university students due to sex, marital status, age, seniority at work and graduate academic training.

II. METHODS

2.1. Participants

A representative sample was used, composed of 36% of university professors from a universe of 530 [23], consisting of 189 teachers, 56 men (29.50%) and 133 women (70.40%). The mean age is 44.75 (SD = 9.94) and is between 27 and 77 years old. Of these, 31 aged 35 years

or less (16.40%), 75 aged between 36 and 45 years (39.70%), 55 in the 46 th and 55-year-old stagger (29.10%) and 28 aged 55 years or older (14.80%). It is noteworthy that 50% have less than ten years of teaching experience, 26.40% have 11-20 years of teaching service. As for the level of training, it is verified that 2.1% are specialists, 50.30% masters, 36% doctors and 11.60 post-doctors. We aggregate the specialists and masters, which makes up 52.40% in this category. As inclusion criterion was to be a university professor in undergraduate health courses at a private University in northeastern Brazil.

2.2. Instruments

Participants completed questionnaire of а sociodemographic and professional data built for this purpose and the self-efficacy scale of the university professor [24], in the Portuguese version. The Likert scale contains 44 quantitative type items, whose answers range from one to six and is divided into two domains: the first evaluates the beliefs in the capacities of each teacher by going the answers from "incapable" (1) to "very capable" (6); the second measures the beliefs of self-efficacy, and each of the answers varies between "never" (1) and "always" (6). The scale measures the dimensions: didactic strategies for planning classes, didactic strategies to actively implicate students; didactic strategies to favor interaction in class, and didactic strategies to evaluate learning.

2.3 Procedure

The descriptive, cross-sectional and inferential study was carried out after prior approval by the Ethics Committee (2,988,258) of Plataforma Brasil and signing the free and informed consent form of the participants. The data collected were processed in the computer program SPSS – *Statistical Package for Social Science*, version 22.0.

Exploratory data analysis was carried out so that we can safely determine what kind of statistical tests to use. In the present sample, the reliability indexes of the instrument were $\alpha = 0,836$ for didactic strategies for the planning of classes, $\alpha = 0,789$ for didactic strategies to actively implicate students, $\alpha = 0,823$ for didactic strategies to favor interaction in class and $\alpha = 0,824$ for didactic strategies to evaluate learning. The proportion of variability in the responses resulting from differences in respondents varies between reasonable and good, and therefore their permissible reliability [25].

Indications regarding the normality of variances were found in the four dimensions of the scale (*Kolmogorov*- Smirnov, p = 0,000; Shapiro-Wilk, p = 0,000). Exploratory data analysis revealed that the assumptions underlying the use of parametric tests [25] were met. Considering the objective of the study, the analysis of the data focused on the use of the difference's tests. Student's Test T, intersubject design and Unifactorial variance analysis (ANOVA) Unifactorial (One-Way Analysis of Variance, F), inter-subject design [25] were used, given that the results make it possible to make inferences. Ethical procedures, correct reference, voluntary participation, anonymity and confidentiality of data were fulfilled.

III. RESULTS

The differential results according to gender indicate statistically significant differences in the level of didactic strategies t (187) = -2,197, p = 0,029. That is, women (N = 133; M = 89.33; SD = 5.85) self-perceive themselves more capable of performing didactic strategies to favor interaction in class in their academic context than men (N = 56; M = 87,11; SD = 7,43) (Table 1).

Dimensions	Sex	N	Μ	SP	t	df	р
Didactic strategies to favor interaction in class	Male	56	87,11	7,15	-2,197	187	0,029
	Femeal	133	89,33	7,02			

Table. 1: Distribution of self-efficacy of university professors as a function of sex

Source: this table was development based on the SPSS analysis.

The marital status did not indicate significant differentiation (p < 0.050) in relation to representations of teacher self-efficacy in any dimension of the scale measured.

Regarding age, the study shows that teachers, in the age group "56 years or older" (N = 28; M = 135.39; SD = 11.24), more self-effective perceptions of didactic

strategies for the planning of classes [F(3, 186 - 4 = 6.026), p = 0.001] than teachers aged 35 years or less (N = 31; M = 125.10; SD = 11.71) and aged between 36 and 45 years (N = 72; M = 127.39; SD = 11.50) (Table 2).

Dimensions	Age	Ν	М	SP	Р	df	F	ANOVA
	≤ 35	31	125,10	11,70	0.002			
Didactic strategies for planning classes	<u>≥</u> 56	28	135,39	11,24	3	3	6.026	0.001
Didactic strategies for plaining classes	36-45	72	127,39	11,50	0.005	5	0,020	0,001
	<u>></u> 56	28	135,39	11,24	0,005			

Table. 2: Distribution of self-efficacy of university professors according to age

Source: this table was development based on the SPSS analysis.

Regarding antiquity, it was observed that the group of most experienced teachers, framed in the 11-20 years age (N = 46; M = 131.50; SP = 8.47) and those with 21 or more years of experience (N = 43; M = 131.70; SP = 8.79) more self-effective perception swells in the field of didactic strategies for planning classes [F(2, 178 - 3 = 5.516), p = 0.005] than less experienced teachers, this is 10 years or less of service (N = 90; M = 126,51; SP = 11,60)

(Table 2). Differentiation was also evident in relation to the didactic strategies dimension to actively implicate students, to favour teachers with 11-20 years of experience (N = 48; M = 10.85; SD = 11.74) when compared to the less experienced (N = 91; M = 95,48; *SP* = 8,02), [F(2,181 - 3 = 5,724), p = 0,004] (Table 3).

Dimensions	Antiquity (Years)	Ν	Μ	SP	р	df	F	ANOVA Sig	
	≤ 10	90	126,51	11,60	0.021	2	5,516	0,005	
Didactic strategies for planning classes	11-20	46	131,50	8,47	0,021				
	≤10	90	126,51	11,60	0.019				
	<u>≥</u> 21	43	131,70	8,79	0,017				
Didactic strategies to	≤10	91	95,48	8,02	0.003	2	5 724	0,004	
actively implicate students	11-20	48	100,85	11,74	0,005	-	5,721		

Table. 3: Distribution of self-efficacy of university professors depending on antiquity

Source: this table was development based on the SPSS analysis.

Regarding academic formation, the results suggest significant intergroup differences [F(2,185) - 3 = 5.497, p = 0.005], with postdoctoral studies being the highest levels (Table 4). Tuckey's Post Hoc test revealed that postdoctoral teachers (N = 21; M = 136.67; SP = 6.57) perceive higher self-efficacy beliefs in the field of didactic strategies for planning classes than doctoral teachers (N = 67; M = 127.91; SP = 10.30) and then non-doctorates (N = 98; M = 128.79; SP = 11.87). Regarding didactic strategies to actively implicate students [F(2,188) - 3 = 4.625, p = 0.011], postdoctoral teachers (N = 22; M = 102.77; SP =

16.17) report higher self-efficacy beliefs than doctorates (N = 68; M = 96.94; SP = 7.30) and then non-doctorates (N = 99; M = 96.54; SP = 7.48. The study also revealed significant differences in the level of didactic strategies to favor interaction in class [F(2,186) – 3 = 4.638, p = 0.011]. That is, postdoctoral teachers (N = 22; M = 91.18; SP = 6.42) showed higher self-efficacy beliefs than doctorates (N = 68; M = 86.99; SP = 7.17). However, it did not expose differentiation related to beliefs in didactic strategies to assess learning (p = 0.073) depending on the level of training of participants.

Dimensions	Academic level	N	М	SP	р	df	F	ANOVA Sig.
	No Doctor	98	128,79	11,87	0.008		5,497	
Didactic strategies	Post-Doc	21	136,67	6,57	0,000	2		0.005
for planning classes	Doctor	67	127,91	10,30	0.004			0,005
	Post-Doc	21	136,67	6,57	0,001			l
	No Doctor	99	99,54	7,48	0.009			
Didactic strategies	Post-Doc	22	102,77	16,17	0,009	2	4,625	0.011
students	Doctor	68	96,94	7,29	0.021			0,011
	Post-Doc	22	102,77	16,17	0,021			
Didactic strategies	Doctor	68	86,99	7,17				
to favor interaction in class	Post-Doc	22	91,18	6,57	0,020	2	4,638	0,011

Table. 4: Distribution of self- efficacy of university due to academic training

Source: this table was development based on the SPSS analysis.

IV. DISCUSSION

The results found from the application of the instrument created by Prieto (2007) were analyzed as a function of the objective of the research assumed, namely, the differential manifestations of the self-efficacy of Brazilian teachers, due to gender, of marital status, age and academic formation and fall within the specific, differentiated and particularizing character [1]. The results indicated differentiation in teacher self-efficacy associated with gender at the level of didactic strategies to favor interaction in class, benefiting female teachers. This disagrees with Martín [26] who found no differences in this area between Spanish and Italian university professors. Also, the study by Covarrubias and Mendonza [10] did not demonstrate gender as a variable that differentiates feelings of teacher self-efficacy between males and females. This evidence allows us to consider the importance of future investigations that compete to patent the intrinsic or extrinsic factors that contribute to teachers holding the beliefs of higher self-efficacy than men when deals with the didactic strategies dimension to favor interaction in class.

It was possible to perceive greater teacher self-efficacy at the level of didactic strategies for planning classes according to the age of the participants, always in favor of the higher age level. These differences may be closely associated with the interpretation of previous personal experience [1]. That is, successful experiences tend to develop or sustain beliefs about the individual's ability to engage in certain tasks, generating subsequent influence on motivation and persistence to engage in tasks of the same domain.

Antiquity also emerged in this study as a differentiating variable in the perception of self-efficacy at the level of didactic strategies for planning teaching classes and didactic strategies to actively implicate students. it is possible to realize that less experienced university professors feel less effective. Martín's study [26] showed no significant differences between these professionals due to antiquity. The findings allow us to deduce that self-efficacy beliefs are determined by several personal, intrinsic, extrinsic and/or contextual factors, whereas by the collective effect of the phenomenon [20] require to be revealed with a view to promoting teacher self-efficacy among university professors.

Although the literature refers to the importance of selfefficacy beliefs in successful personal experiences, job satisfaction and motivation [4, 6, 11-13], persistence and positive expectations [22] and involvement and collaboration [15], studies on the academic training of participants, which allow corroborating or contrasting the results obtained and better accessing knowledge about this professional group are scarce or non-existent, deserving this area their deepening through new studies.

Focusing attention on the training of university professors, the study of Vizcayo, Lópes e Klimenko [19] pointed out that most teachers feel able to use various didactic strategies, although the relationship between selfefficacy beliefs and their performance varies from one dimension to another.

In this study, it was found that teachers with postdoctoral training significantly more positively evaluate didactic strategies to actively involve students and didactic strategies to favor interaction in class, what in our opinion presupposes the relevance and originality of the study under consideration in the knowledge of this professional group. High levels of teacher self-efficacy are positively associated with performance [17] and with the findings, it is admitted that the most qualified teachers tend to evidence and seek to maintain a high awareness of selfefficacy at work.

V. CONCLUSION

The study reveals several differential manifestations of self-efficacy according to gender, age and academic education among university professors. That is, women perceive themselves more competent in the field of didactic strategies to promote interaction in class, older teachers consider themselves more effective in developing didactic strategies for planning classes and postdoctoral studies stood out by the higher sense of self-efficacy in relation to didactic strategies for planning classes, didactic strategies to actively implicate students and didactic strategies to favor interaction in class. This fact, revealing the importance of continuing teacher training.

Considering the results expressed in this study, it is deduced that it would be advantageous to facilitate the continuous training anchored in the development of the sources of information of self-efficacy. That is, direct experiences, vicarious learning, persuasion and physiological and emotional states, as well as the sharing of practical experiences that allow to expand self-efficacy in domains such as didactic strategies for planning of classes, didactic strategies to actively implicate students, didactic strategies to favor interaction in class and didactic strategies to evaluate learning, essential dimensions for improving the quality of university education.

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Using the Buriti Petiole (*Maurítiaflexuosa*) to teach biology from the perspective of Sustainability: Conceptions and Practices for high school teachers

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Abstract— This project refers to the constant concerns of those who are concerned with education, specifically, teaching practice regarding the use of teaching resources. Thus, the work aims to build teaching materials using as a raw material the buriti petiole as well as its products. The project was developed based on a literary review focusing on action research. 15 schools, 32 teachers and 350 students participated in the project. The practical part of the project started with cutting the material (petiole of the buriti), removing the bark and drying it in an oven. After cutting and drying, the stems were prepared for the production of teaching materials. The materials produced were: anatomical models of the human body; cells; food chain game among others. In the evaluation, the anatomical pieces were the ones that had the highest approval by teachers in 80%, whereas for students it was the game of the food chain 45%. Among the anatomical pieces, the skeleton had the highest appreciation by teachers 77%, while the kidneys drew more attention from students 48%. For the parents, the digestive system was 38%. Thus, materials constructed with buriti stalk become a mediating tool between biodiversity and the possibility of learning from natural resources.

Keywords—Didactic resources. Pedagogical practice. Bidiversity.

I. INTRODUTION

The educational literature has highlighted the importance of innovation and the application of different teaching materials in the teaching and learning processes. The authors start from the premise that teaching requires study, reflection beyond the planning of the actions themselves.

If we ask a teacher what teaching materials he uses in his biology classes, the answers will mostly refer to a few items: textbook, blackboard, videos and some other texts, as well as teaching objects. If the question asks him to explain the purpose of using a certain material, the answers will oscillate around something like: "facilitate or improve student learning". A concept should not only serve to identify a material, but contain elements that are associated with its basic functions. The first aspect that we perceive in this search for a concept is the diversity of expressions that are usually associated with what we call here didactic material. In addition to this term, there is also teaching material, teaching resources or means, didactic resources, pedagogical material or resource. "In summary, the words means, resource, material, auxiliary, combined with didactic, instructional, teaching, teaching-learning, educational and other terms, are expressions frequently found in educational literature" (CASTOLDI et. al; 2009). The practices combined with the demonstrative experiments makes them arouse the students' curiosity and observation skills, emphasizing sensitivity as a way to draw their attention, leaving the teacher to mediate this knowledge, linking the practice with the theme already

taught, making it as part of the development of classroom learning. (ARROIO et. al, 2006).

The use of methodological practices, it is necessary to stimulate students to seek knowledge with practice, using alternative methodologies making the student visualize something concrete, stimulated manual and creative skills in learning the discipline of Chemistry through the interaction of practice with the theory. (CARNEIRO; RANGEL; LIMA, 2011. SANTOS; SILVA 2011).

The interaction between practice and theory has been used by riverain and Amazonian indigenous people for years,through toys built with the stalk (petiole) of Buriti, as a form of figures that portray their daily life contextualizing the life of the jungle with the imagination of children thus teaching the youngest, the stories and legends that pass from generation to generation. (SILVA; CARVLHO, 2012).

Buriti for being a species native to the Amazon region, easy to access and with several purposes and options for the construction of handicrafts using its parts, its stem is a lightly brown wood when dry and when green they are white, its wood is widely used by riverside dwellers and rural residents in making handicrafts for the purpose of supplementing family income. (SAMPAIO; CARRAZZA, 2012).

In view of the need to produce new methodologies for increasing the teaching-learning process, as well as valuing biodiversity in our country, there was a possibility of using the buriti stalk as a tool in the construction of didactic materials for science teaching, the use of it provides a wide view in 3D and touch, being able to consider that the student will have better learning.

The definition of didactic material starts from a definition of education understood as a mediating activity of social practice. Libâneo (1985, p. 143), when referring to the fundamentals of teaching work from the perspective of the referred pedagogy, says: content and didactics of science and health the essential in teaching work is, therefore, the direct encounter of the student with the training material, with the mediation of the teacher.

The multiple subjective and sociocultural conditions that mediate the pedagogical act pose three aspects that have significant effects on the didactic process: the didactic means of stimulating the student in the face of these mediations; the differentiation of teaching work in the face of cultural differences; the methodological flexibility of the teacher that will allow him to make pedagogicaldidactic decisions in the face of concrete and specific pedagogical situations in the classroom (SOUSSAN, 2003). In this sense, the article aims to build teaching materials using as a raw material the buriti petiole as well as its products (educational games, models, educational toys, anatomical pieces, among others).

II. MATERIALS AND METHODS

The project was prepared based on a literary review, with a focus on research, which sought to obtain data on alternative materials to improve science classes in elementary schools in public schools in Imperatriz, Maranhão.

Action research requires a relationship structure between researchers and people involved in the study of the participatory / collective reality. Thiollent says:

> Search-action is a type of social research that is conceived and carried out in close association with an action or with the resolution of a collective problem and not which researchers and participants representing the situation of the reality to be investigated are cooperatively committed and participatory. (THIOLLENT, 1985: 14).

Putting the research action into practice, the practical part begins, with the collection of the buriti stalk at the Aurora farm, owned by Mr. Rafael Almeida, located at TO 23, in the municipality of São Miguel do Tocantins, in the extreme north of the state do Tocantins, Brazil.For the collection, a stick with a machete at its end was used, the stalk was removed and cut from the leaf blade (like leaves) and soon after it was again cut into pieces of approximately 30 cm.

After being cut to the boards, they were taken to the sun for 3 days until complete drying, then the peel was removed, thus enabling the beginning of the construction of the teaching materials as shown in figure 01.



Fig.1: Shows the sequence of the process. Source: Authors – 2019

With the help of a stylus and a knife, the imperfections that remained on the boards were removed giving it straight and patterned lines, after this procedure they were ready for the start of activities.

With the standardized splints, the pedagogical models were made, with the observation of the figure to be reproduced, with the help of a stylus, the molding of the boards begins according to what is desired and with the measurements. Figure 02.



Fig.2: Shows how anatomical pieces were found Source: Authors – 2019

With the pieces ready and cut, the polishing starts with the help of sandpaper No. 230, after polishing, the pieces already acquire a pleasant aspect. Then the powder (cellulose) was placed on some pieces to make them more presentable. Cellulose was produced from the stem itself without the bark.

Using the stalk, other materials from the buriti palm were built, all handmade to prove the project proposal figure 03.



Fig.3: Shows the final composition of the pieces. Source: Authors – 2019

For the making of the educational games, six pet bottles were used, which were covered with cellulose removed

from the buriti stalk, white glue, decorative tape and buriti fiber. For the production and cellulose, pieces of buriti stalk were placed in the blender and beat until it became powder, then took to the oven at 50 $^{\circ}$ C for 24 hours to dry (remove the water). For coloring, natural dyes taken from seeds and leaves were used.

After this stage, the effectiveness of the materials was evaluated. Where the biology professors expressed their opinion figure 04.



Fig.4: Models built using the buriti petiole (stem). Source: Authors – 2019

III. RESULTS

The presence of teaching materials in high school classes has been encouraged and it is rare to discuss teaching without mentioning this teaching resource. However, the use of teaching materials is not enough if they are restricted only to the manipulation of students in a playful manner and without an educational function. It is necessary that its use is linked to well-defined objectives in terms of promoting learning, that is, a careful planning of action.

The important thing about the action is that it is reflective and that the student learns in a meaningful way, developing activities in which they reason, understand, elaborate and rework their knowledge, and the use of materials can bring a great contribution in this sense. After all, the student is an active subject in the construction of his knowledge; he learns from his experiences and actions, whether individual or shared with the other. (FIORENTINI; MIORIM, 1990, p. 6).

Although we know that the teaching materials alone will not teach the content, as it is necessary, in most cases, that the teacher intervenes, and for this it is necessary that the teacher, who is willing to make use of these teaching trends, do a study of the alternative teaching materials you are planning to use. It is worth emphasizing that this project should not only be about how to use a certain material, but a study about the conditions, contents and motivations for using didactic material in the classroom. Only the presence of teaching materials is not able to positively transform the teachinglearning process. It is extremely important that the teacher knows how to use it, knows how to incorporate it in his daily practice, according to the structural conditions of his school and the needs of his students.

The use of alternative teaching materials allows the student to visualize and construct meanings, leading him to reasoning. Through it, the teacher observes, estimates, relates information, seeks solutions to the problems presented, compares the results, produces new ideas, and then reaches abstraction. Thus, the construction of knowledge occurs.

Thus, what was built and produced with the buriti stalk was put into practice. Among all the manufactured materials, the ones that drew the most attention were the anatomical pieces, graph 01.



Graph 01: Shows the satisfaction of parents, teachers and students about the material Source: Authors – 2019

Analyzing the results, it was observed that the anatomical pieces drew more attention than the educational games, this result is related to the way they were constructed and to the contents that were being applied at the time of the activity.

According to BECKER, 1992 apud SILVA et al. 2012, p. 2

There is no doubt that teaching resources play a major role in learning. For this process, the teacher must bet and believe in the student's ability to build his own knowledge, encouraging him and creating situations that lead him to reflect and establish a relationship between different contexts of daily life, thus producing new knowledge, raising awareness still the student, that knowledge is not given as something finished and finished, but that it is continuously under construction through the interactions of individuals with the physical and social environment.

Among the anatomical pieces produced with the buriti stalk, the one that drew the most attention was the graphic human skeleton 02.



Graph 02: Present to the satisfaction of teachers, students and parents about the anatomical pieces built with buriti stalk. Source: Authors – 2019



Fig.5: Material that stood out in the evaluation. Source: Authors – 2019

Because it depends on greater creativity in the construction of each piece, the skeleton was what attracted the attention of both teachers and students. Our body has always aroused the curiosity of science and people, to know how we are trained.

This activity made it possible to observe the concept of environmental education, when teachers and students realized the importance of natural resources associated with teaching materials in the perspective of sustainability. Around this theme, it was observed that the doubts and fears in relation to the human need to explore and remove natural resources in an unsustainable manner are the consequences of the various transformations and behaviors of people in relation to the future of the planet. The main focus is the search for sustainable development, which allows the non-depletion of the natural resources available on the planet, preserving water, air, soil, fauna and flowers. Thus, teachers from three different locations in the city were asked how they use natural resources in the preparation of their classes.



Graph 03: shows the result of how teachers use natural resources as a teaching methodology. Source: Authors.

Analyzing the graph, it is observed that only one parameter "sometimes" stands out among teachers from the periphery of the city (80%) and rural areas by 10%.

It is clear that greater knowledge is needed on environmental issues related to natural resources as tools for teaching.

There are several definitions available in the literature for Environmental Education as a method for teaching. According to Reigota (2006), environmental education is understood as political education, in which it prepares subjects to participate actively, thus claiming ethics, social justice and the formation of citizenship in their relations between society and nature .

Thus, the concept of Environmental Education according to Federal Law No. 9,795 / 99, in its article 1 of chapter I, is defined as:

The processes through which the individual and the community build social values, knowledge, skills, attitudes and competences aimed at the conservation of the environment, a common use of the people, essential to the healthy quality of life and its sustainability. (BRAZIL, 1999).

In this sense, Environmental Education is considered a process that involves cultural values, behavior, science, technology, education, knowledge and the environment in the search for sustainable development to maintain nature and its social implications. Due to environmental problems in contemporary society, such as environmental degradation, identified in the waste of natural resources, in poverty, consumerism, the use of unsustainable technologies and lack of environmental responsibility.

Environmental Education has a fundamental role in the formation of critical citizens in relation to processes related to the environment.

Thus, environmental education aims to enable attitudes and behaviors in relation to consumerism in our society, as well as providing changes in values and perceptions about socio-environmental issues in a local and planetary way.

With this proposal, teachers were asked whether textbooks provide an environmental theme in the construction of knowledge using natural resources. The teachers' response is shown in graph 04.



Graph 4: Teachers' opinion on the theme EA in the textbook. Source: Authors

The way in which the theme is presented, natural resources in the textbook, according to 57% of teachers, is insufficient without further study. For 25% this theme is not considered. Around 16.5% consider that it is approached, but in a brief way and only 8.5% consider that the student's reality is adequate.

However, with the constant concern around the environmental issue, this scenario is changing, many of the new textbooks already address this issue, in a contextualized way. An example in the area of sciences is the textbook "CienciaCidadã" (Santos; Mól, 2010), by Nova Geração, which covers sustainability and the environment in almost every chapter. In this sense, it presents aspects such as consumerism, garbage, recycling, air pollution, global warming, ozone layer and sustainable agriculture, contextualizing with the content of Chemical Sciences. Thus, the student mediated by the teacher can relate to the content worked with their daily lives.

Support materials, such as textbooks, are fundamental tools for the classroom teacher. The book is an important kn

owledge support and serves as a guide for knowledge production activities. According to (BACHELARD, 1965). Science is essentially the social production of the scientific city, so the book, inasmuch as it conveys science to scientists, plays a decisive role in the construction of scientific knowledge, in keeping scientists in school.

However, the textbook is also an instrument for transmitting the ideological and cultural values of its authors, and teachers should not take the opinions or thoughts expressed in it as absolute truth, as, as stated by Lopes (1993, p.6), scientific thinking is placed in the book in a socialized way, the author expresses consensual truths. Having an organic character, the book establishes its own questions, and cannot be read without obeying the order of the chapters, without following the author's order of thought.

Thus, one can identify the complexity that is the textbook and the responsibility of the authors in the elaboration of this material, as they are values and ideologies, which often influence the teaching and learning process in a positive or negative way.

According to Lopes (1993, p.6), The book does not dialogue with the reader or polemic with his reason. It just confirms common knowledge and hinders scientific knowledge. In their eagerness to make science easy and accessible, the authors of chemistry textbooks abuse realistic metaphors, trivializing concepts. The goal is to keep the student away from the rational, making each and every concept visible and palpable.

Thus, as this project exposes, many authors of biology textbooks for high school use analogies to "facilitate" the understanding of the contents, creating obstacles to scientific knowledge.

Therefore, the teacher has a fundamental role in this process, that of mediator, seeking information and research. "When the textbook is insufficient in relation to the use of natural resources in the production of didactic materials, it is up to the teacher to seek to complement it, either to expand his information and the activities proposed in it or to circumvent its gaps.

Through the results obtained, it is possible to answer the initial question that guided this investigation: how to improve the qualities of high school biology classes so that the learning result is positive? Thus, it can be said that the main potentialities are related to the teacher's creativity, and this is passed on to students. This creativity promotes socialization in general and effective cooperation, in addition to the idea of making learning more attractive, captivating students' interest and attention.

Taking into account that not all schools have a series of resources (teaching materials) available, we believe that the teacher can stimulate the making of teaching materials, and we understand that the teacher can use these resources as one of the ways to develop his / her training and his pedagogical practice, making his work more meaningful. The making of different teaching materials with the stalk of the buriti allowed us to verify that there is a need for a greater dissemination of these materials and their potential. Knowing that the use of resources by teachers is unfortunately very limited. For a better use and use of these resources it was thought and to leave for the future some proposals and suggestions so that the teachers use more the didactic materials so that a more efficient teaching-learning process can be built.

IV. CONCLUSION

From the above, it is concluded that the use of different didactic resources is beneficial and necessary for the teaching of biology. However, most teachers are still resistant to more dynamic and innovative methods and remain linked to more traditional teaching methods.

For all of the above, whatever the reasons presented and the arguments discussed, the overriding fact is that the choice and use of appropriate and diverse teaching resources can influence the teaching-learning process. Therefore, greater incentive to innovation in the teaching action methodology is necessary.

Therefore, it can be explained that it is possible to work on concepts and meanings of the sciences combined with the environment, leaving the content of biology contextualized and interesting for the student. Thus, contributing to improve the teaching of biological sciences and the teaching and learning process, making the concepts more meaningful for the student. The importance of this analysis is emphasized here, since the thematic production of pedagogical materials using the buriti petiole to transform the biological science classes of public schools in Imperatriz - Maranhão, Brazil, into dynamic and attractive classes is a mandatory subject in all teaching. . modalities and in all disciplines, supported by Brazilian legislation.

Based on these results, the study demonstrated a proposal for pedagogical materials for high school with the petiole of buriti as a tool in contextualizing the practical with the theoretical, being a way of circumventing the lack of financial and physical resources, as it brings the daily life of the student. student to the classroom together with the idea of nature preservation, making the student seek knowledge on the subject and awareness of preservation. Thus, the materials built with the petit of buriti become a mediating tool between biodiversity and the possibility of learning from natural resources.

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Intellectual Property on Works of Art Made by Artificial Intelligence

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Abstract—Rembrandt is considered as one of the greatest painters in the history of art in Europe and the world. Artificial Intelligence (AI) has been gaining a field of academic study due to the possibilities of its use in several fields of knowledge. Its application can be in facial recognition, in music composition, art painting, among others. The objective of the work is to verify the ownership of a work of art made by AI based on the traces made by Rembrandt. The methodology research used was qualitative, exploratory and descriptive, bibliographic and case study. AI made a painting with similar characteristics to Rembrandt's works and a doubt arose about the intellectual property of the work. We conclude that because it is a new fact, there is no legislation to support the deed and as intellectual property is related to human invention, it cannot be attributed to the machine.

Keywords—Autonomous system, Copyright, Painting, Technology, Rembrandt.

I. INTRODUCTION

Rembrandt was a Dutch painter, engraver and draftsman, considered as one of the greatest artists of all time, mainly from the Baroque period, however, the recognition of his work took place only in the 19th century. The height of his fame and prosperity occurred in 1634. His painting focused on portraying people and the most common themes in his work were sacred themes, group portraits and self-portraits [1, 2].

Intellectual Property (IP) is a vast and very important field for a nation's socioeconomic growth, constituting a public policy that fosters development, stimulates creation and protects knowledge. It also translates into rights aimed at the creator and encourages the transfer of technology [3, 4, 5].

According to the World Intellectual Property Organization (WIPO) the sum of Intellectual Property (IP) rights covers the domains of human activity. IP covers three categories of law, namely: Copyright; Industrial property; and, Sui Generis Protection [5]. Copyright aims to protect works created by the human intellect, which can be artistic, literary or scientific. In Brazil, the legislation dealing with the subject are Laws 9,609 of 1998 and 9,610 of 1998, which have among its principles the non-mandatory registration of the work, as proof can be made through documents, photos or other means. The offices responsible for registering copyright in Brazil are the National Library and the School of Fine Arts [6, 7, 8, 9].

The legislation about computer programs does not conceptualize who is the individual who owns the software or who is the figure of the author, citing only that the owner may be a natural or legal person, recommending the concept of author of the Copyright Law number 9,610 of 1998 [6, 10].

Law 9,610 of 1998 says that the production of artistic works are expressions of human creativity, capable of conversion into private property, moral protection and temporary patrimonial protection, ensuring their financial return. Therefore, for an adequate commercialization process, it is necessary to adequately define who owns the intellectual property to be protected, objectively defining the owner of the intangible asset [6, 9, 11].

Innovation is a field that allows for several possibilities of exploration regardless of its field, be it technological or social. Technological development reduces space-time and allows global integration, facilitating the occurrence of immediate interventions and without constituting an obstacle, the distance between the interventionist and the intervention site and this action can be done by humans or by a machine [12, 13].

The Fourth Industrial Revolution was a concept developed by Schwab at the World Economic Forum in 2015, considered from the technological evolution and with the inclusion of emerging technologies such as Artificial Intelligence (AI), digitization, sensing, 3D printing and convergent mechanization in digital, physical and biological technologies. This is also called the third generation of automated systems, autonomous and advanced technologies, which generate products and services, in addition to deciding, acting and creating works of art without depending on human guardianship [14, 15, 16].

Man has always sought to understand human thought for thousands of years, mainly using philosophy and later psychology and neurosciences, trying to create or build intelligent systems or entities [17].

In the past, AI was seen as a technology related to science fiction or something surrealist, later migrating to the cinema and being shown in futuristic films. As time passed, it went through a phase of experiments and then humanity began to use its countless uses. AI is already a reality and is revolutionizing the world, just like the internet, and covers a variety of topics such as general use such as learning, perception and specific tasks such as playing, voice and facial recognition, driving autonomous vehicles, among other activities [16, 17, 18, 19, 20].

Alan Turing and John Von Neumann were the pioneers and creators of the technologies that served as the basis for AI in the 1950s, formalizing the architecture of today's computers. The term Artificial Intelligence was first used in 1956 by John McCarthy at an expert conference realized at Dartmouth College. In 1957, Herbert Simon said that a computer would defeat a human being in a game of chess, which was proven 30 years later [21, 22, 23, 24].

Since the 1950s, AI has been the subject of studies and currently has attracted interest from the academic and scientific community, due to the possibility of its numerous applications, such as in finance, transportation, public service, pharmaceutical industry, medicine, aviation, marketing, among others, mainly due to the technological evolution of computers in the last decades, the need to solve complex problems and perform human activities, with the added benefit of providing productivity gains, improving efficiency and reducing costs [25].

Nowadays AI already has the capacity to insert itself in the matters that are configured in the legislation related to copyright, although that right is intrinsic to an individual or creation of the intellect and not to other beings or things, because the author has to be human. In a certain period, the copyright of a photo was given to a monkey, however, a court revoked that benefit due to the interpretation of the law [9, 26, 27, 28].

Among the objectives of AI, it is possible to mention the interaction between humans and machines, which can also be used to replace human beings in specific tasks. The main research areas of AI are specialist systems, learning, knowledge representation, knowledge acquisition, robotics, distributed artificial intelligence, among others [29, 30].

AI technology has been growing geometrically, since the decade of 2010 its growth has been projected around 60% per year. It is considered as a disruptive innovation. Its application has become common on the internet, serving as a basis for several tools. AI is already being used to produce literary, artistic, musical works, among others, which will impact on the copyright arising from Intellectual Property (IP) in relation to copyright ownership [17].

In the case study, AI was trained with the works of the painter Rembrandt with the aim of making a painting with a similar style and, in the eyes of people who are experts in art, the work could be credited to the painter for presenting all the characteristics inherent to his other works. This condition created doubts about copyright, since the existing legislation attributes creation only to the human intellect, therefore, only individuals have this attribute. For the creation of the work, the AI used algorithms to identify the geometric patterns of the painting, in order to recreate a work that could be characterized as an authentic Rembrandt painting, but without any human contribution in the creative process or originating from the human intellect [13, 15].

The objective of the work is to search for fundamentals about the ownership of works of art, using to achieve this objective, the legal bases and the rules and resolutions of the Brazilian institutions responsible for the registration of intellectual property.

II. METHODOLOGY

Regarding the method, the research is qualitative [31]. Regarding the objectives, the research is exploratory and descriptive. The research is exploratory because there is not much information about the object of study, application of AI in the production of a work of art. The research is descriptive because it is intended to observe the data, analyze, classify and interpret. The research technique was bibliographic and study of a case, selecting one of the uses of AI, in order to better understand and with greater depth the subject studied [31]. In the data collection, technical procedures were used to do documentary research and the collection of secondary data in websites, magazines, books, academic works and legislation.

The case study aims to deepen the question: who is responsible for the ownership of new artistic works produced by AI? In this way, according to the theoretical foundation, the Industrial Property Law branch is separated - because it is a law on: patents, industrial design, brand, geographical indications and repression of unfair competition – and also moves away from the Sui Generis Protection Law branch - as it is a law on integrated circuit topography, cultivar and traditional knowledge. In relation to Computer Program Copyright, it only applies when it comes to ownership of the software responsible for creating the AI.

III. THEORETICAL FOUNDATION

3.1 REMBRANDT

Rembrandt is considered to be one of the greatest painters of all time. In his painting there is emphasis on lights and shadows and most of his paintings portrayed people, in addition to some self-portraits that varied throughout his life and captured his essence and his spirit. His last painting was done in 1669, in the same year of his death. His works have more than 350 years of creation, therefore, they are not protected by the copyright, and can be copied and used by anyone, as it is a work in the public domain and the patrimonial right no longer exists [1, 2].

The creation of an artist is intertwined with his manual and artistic skills, but his connection concerns the idea in the conception of the work and his creative spirit and this condition will be taken into account when evaluating by specialists, who also takes inspiration into account [10].

3.2 INTELLECTUAL PROPERTY (IP)

New ideas are the principle and seed that cultivates successful economies, however, the idea itself produces little in terms of economic value. The ability to transform a new idea into an innovative product or service and achieve commercialization is what adds value to the innovation process [11].

The flow of innovation goes through the innovative idea initially. A great idea demands certain resources for its achievement and, depending on the amount needed, it may become economically unfeasible, in other words, it is not possible to put it into practice, according to current technologies, and turn it into a product or service with commercial scale production. To achieve the concept of innovation, therefore, the idea must necessarily reach commercialization capacity. As everything starts with the new idea, here is the importance of the World Intellectual Property Organization (WIPO) on an international scale and of the INPI in the Brazilian territory regulating IP.

WIPO defines IP as:

refers to creations of the mind: inventions; literary and artistic works; and symbols, names and images used in commerce. Intellectual property is divided into two categories: Industrial property includes patents for inventions. trademarks. industrial designs and geographical indications. Copyright covers literary works (such as novels, poems and theater), films, music, artistic works (for example, drawings, paintings, photographs and sculptures) and architectural projects. Rights related to copyright include those of performance artists in their presentations, phonogram producers in their recordings and broadcasters in their radio and television programs [5, p. 2].

Article 2 of Law No. 9,279 of 1996, defines Industrial Property as the segment of intellectual property destined at industrial activities aiming at protection for: invention patents; Industrial draw; brand; geographical indications, and; suppression of unfair competition [32].

3.3 ARTIFICIAL INTELLIGENCE (AI)

Artificial Intelligence (AI) is the ability of machines to act in some type of behavior equivalent to human, in the sense of carrying out actions controlled by computers and that to be performed by humans require intelligence, in this case, understanding intelligence as a set of various components, among them creativity. AI has the ability to learn after several training sessions, which allows it to accumulate experiences through attempts at mistakes and successes, so they can make different decisions according to the situation and the existing parameters in their memory [10, 28].

Among the errors attributed to AI, it is possible to mention the case of an internet company that marked black people as gorillas in a facial recognition application, which caused embarrassment in society. In another case, the AI error caused the death of a worker in an automobile factory. These cases point to doubts in relation to the responsibility for moral and criminal damage and in which legislation the action would be interpreted, which could be the Civil, Criminal and / or Customer Protection Code [10].

When human beings perform a communication process through language, they make use of an extremely complex process, without any effort, because the communication process happens between intelligent beings. In order for a computer to be able to understand natural communication, it is required no less than the human ability to contextualize and process, making a connection with the message to be transmitted back, and AI technology is fundamental to development of this type of system [33].

There are several possible definitions for AI as shown in Table 1.

Author	Definition
John McCarthy, 1955	it is the science and engineering of making smart machines, especially smart computer programs
McCarthy; Hayes, 1969	a machine is intelligent if it is capable of solving a class of problems that require intelligence to be solved by human beings
Minsky, 1980	it is the science that allows machines to perform tasks that would require intelligence, if they were performed by humans
Feigenbaum; Barr, 1982	it is the part of computer science that comprises the design of computer systems that exhibit characteristics associated, when present in human behavior, with intelligence
Charniak& McDermott, 1985	it is the study of mental faculties through the use of computational models
Rock, Knight, 1994	the area of Computer Science oriented to understanding, building and validating intelligent systems, in other words, which exhibit, in some way, characteristics associated with what we call intelligence
Nikolopoulos, 1997	it is an area of computer studies that is interested in studying and creating systems that can exhibit intelligent behavior and perform complex tasks with a level of competence that is equivalent or superior to a human specialist
Russell, Norvig, 2009	it is the study of intelligent agents capable of realize their environment and carrying out actions with the expectation of selecting an action that maximizes performance
European Commission, 2020	refers to systems that exhibit intelligent behavior, analyzing their environment and taking actions - with some degree of autonomy - to achieve specific objectives
Santos, 2020	it is a part of computer science research that seeks, through computational symbols, to build mechanisms and / or devices that simulate the human being's ability to think, solve problems, which means, to be intelligent

Table. 1: Possible Definitions for Artificial Intelligence.

Source: Own authorship (2020) based on [34, 35, 36, 37].

In Table 1, all the authors associate that to be AI, it has to solve problems with the same capacity that humans have to solve the issues, that means, it requires that it be done in an intelligent, autonomous way, besides having the ability to learn and replicate that learning.

The context for the study of AI is based on the following categories [17]:

- systems that act like human beings: The Turing Test is positioned in this context, because some questions are asked and during the process it is verified whether the machine is able to distinguish them as humans do, verifying its language processing capacity, knowledge representation, reasoning and learning. Example: robots;

- systems that think like human beings: with regard to "cognitive modeling", which emerged in the 1960s with the aim of building accurate and observable theories about the way the human mind works. Example: artificial neural networks;

- systems that think rationally: based on the "laws of thought", which is based on Aristotle's philosophy that

tried to codify the correct reasoning, syllogism, using as a premise logic to solve any problem and write them in the form of notation, and;

- systems that act rationally: the approach is made by the "rational agent" where it is expected that the thing will be done correctly in order to achieve the objectives and have a rational behavior that does not necessarily involve logical reasoning. It covers all other systems.

The history of AI development between the 1940s and the 1970s is shown in Table 2.

Table.	2:	History	of Al	Develo	pment	Between	the	1940s	and the	1970s.
		~								

Period	Description						
1940s	The mathematical model for artificial neurons was the first work related to AI and was done in 1943 by neuropsychologist McCulloch and logician Pitts;						
	In 1949, Donaid field cleated the algorithm to modify the connection weights between neurons.						
1950s	 In 1951 Marvin Minsky and Dean Edmonds created the first neural network; In 1956 it was the first time that this name was given by John McCarthy at a meeting at Dartmouth College, in presence of Marvin Minsky (Harvard), Nathaniel Rochester (IBM) and Claude Shannon (Bell Laboratories). 						
1960s	In the mid-1960s, the US Department of Defense provided funding for AI; Between 1952 and 1969 it was a period of great progress, much enthusiasm and high expectations, taking as an example the General Problem Solver system, GPS, which was designed by Ernest and Newell, in 1969.						
1970s	In 1974 there was a progressive reduction in research, development was restricted to the academic environment and mathematical formalization.						

Source: Own authorship (2020) based on [38, 39].

The Fig. 1 below represents the evolution of AI from the 1980s to 2018, it shows that in the early 1980s, there was a return to financing for projects aimed at the development of AI, which left the academic environment and entered the industrial segment. In 1986, neural networks returned. In 1987, this technology was discredited and there was a reduction in financing. In 1991 AI was used in the Gulf war. At the end of the 1990s, there was another positive wave, where AI began to be used in logistics, data mining, medical diagnosis, among others. In the 2000s, intelligent toys appeared [38, 39].

1980-1987:		1994	2000	2011	2017
AI Boom	1987-1994: Second Winter 1994-F Modern	Present: 1997 1 Age	2004	4 20	2018
O-O-B- M in	oom of Expert achines in dustry like	Two robotic of drove long distance on th	cars Hon a pe ne robo	da Asimo, rsonal ot, is	Google's AutoML lets AI generate
the R1/XCON to help sales representatives avoid errors in product suggestions.		IBM' defea cham	s Deep Blue ted chess pion.	IBM's W beats bes Jeopardy	Vatson st
			Kismet, a s machine ca of expressin emotion is introduced.	ocial In pable V ng Si ar IP	Introduction of Virtual Agents with Siri, Google Now, and the release of IPSoft's Amelia.

Fig. 1: Evolution of AI from the 1980s to the present day.

Source: [40]

AI is related to several areas that were important for its structuring such as philosophy, biology, computing, communication, education, engineering, psychology and sociology [38].

The commercialization of AI became a reality in the period between 1980-1988, when companies had the need to reduce costs and one of the ways found was through specialist systems [38, 40].

3.4 COPYRIGHT

The Brazilian Law number 9,610 of 1998 in its 1st Article establishes as copyright, "the rights of author and those related to them", with copyright being the literary, artistic and scientific creations, called "intellectual works", which are described in its 7th Article, assuring its authors, among them: writers, composers, photographers, painters, among others, as well as those who are connected to them: artists, interpreters, performers, among others, the moral and patrimonial right to use it, in the form of the law. In the scope of copyright, the following segments stand out: Copyright; Related Rights, and; Computer Program [6].

Copyright is a premise that aims to protect the work made by an artist, avoiding its misuse. Copyright belongs to the Private Law branch whose objective is to regulate the relations originating from the legal field, related to the creation of intellectual works and their economic content. The works can be literary, artistic and / or scientific, among others. Protections can be of two types: Moral Law and Property Law. Moral Law creates a link between the work and its creator while it exists in life, it cannot be commercialized, being inalienable and imprescriptible. On the other hand, Patrimonial Law refers to the economic / pecuniary use of the work, its usufruct and means of transfer, that means, it is linked to the ownership of the work and allows the recovery of the invested capital. For a creation to be protected, the work must be a product designed by the human talent or intellect of its creator and be original. The property of creation has the transmissible character because the right can be passed onto the heirs [6, 41, 42].

The author is an individual, as determined by the 11th Article of Law number 9.610 of 1998, who identifies himself as the creator of the work. It is also allowed by law to be a legal person, adding your name or something characteristic that can be identified as the author [43]. Author is the subject "who unites, in modern language, inspiration (idea) with a good deal of perspiration (work) in the physical and mental effort to produce the corporeal basis of his intellectual creation. Without work there is no protected intellectual authorship" [44]. The legislation lists several items that are considered as production of the human intellect such as the works of drawing, painting, printmaking, sculpture, lithography, kinetic art, among others. Computer programs, despite having specific legislation, is on the list of a literary work [6, 42].

Copyright considers that only the individual has the ability to create, as the individual is normally an inventive and creative being, and that this ability could not be realized by any other means than through human beings. The law was enacted in 1998, and at that time, AI was not yet well developed and lawmakers could not contemplate other forms of creation [6, 42].

In the case of AI, the protection given is to the software, which is related to the computer program, whose term is 50 years, counting from the first day of the year following its publication. There is no obligation to register in Brazil [42].

Computer programs are: "the organized set of instructions necessary for the operation of automatic information processing machines [...].", concept applicable to AI [11, p. 67].

Regarding copyright, Chapter I, Section 9 of English legislation reads as follows: "In the case of a computergenerated literary, dramatic, musical or artistic work, the author must be considered the person by whom the necessary steps are taken to create the work", therefore, this interpretation of the law regarding the ownership of the artistic work is not a specific Brazilian case [45].

Regarding English legislation, Section 12 says the following: "If the work is computer generated, [...] the copyright expires at the end of the 50-year period from the end of the calendar year in which the work was done" [45].

Academics and the United States Copyright Department (USA) mentioned that computer programs cannot own copyright because software does not have legal ownership and this condition does not allow them to be proprietary of goods and only the programmer, the user, both or no one can hold that possession condition over propriety. They understand that the programmer has rights, because they are outsourced and do not have formal employment with those who hire him to carry out the programming and only relate to the computer program. Regarding shared law, the understanding is that both are necessary to create the work that will be generated by AI [46].

The European Union, Australia and the USA have already positioned themselves in several opportunities that copyright protection is only restricted to human creation, therefore, this vacuum is not exclusive to Brazilian legislation only. The variety of creation made by AI is independent of human intervention, but it is inspired by a database that already exists in its memory and that was fed by a human being, because it is an autonomous system and without predictability of results, and this situation is totally contrary to what determines the 7th Article, of being works of creation of the spirit and presenting traces of creativity [47].

IV. DISCUSSION AND RESULTS

Since 1999, the growth of the internet in the world has occurred and in parallel the development of AI as a tool to help network users. When the law was published, AI was not yet at the level of commercialization and legislators were not knowing how far this technology would evolve and under what conditions its use would occur, therefore, the law aimed at protecting works conceived by the spiritual creation of the author and authored by individuals. The future has come at a great speed and it imposes itself on the existing and prior norms to its conception and placing on the market for the benefit of humanity.

AI-based systems are used in the most varied fields of knowledge, which results in several products, from the medical field to the cinematographic studios, passing through the field of literature and the arts.

AI generates an impact in the different branches of law and more specifically in Copyright Law, because the current legislation in the world is prior to the advance of the technological development of AI, which considered only the human being capable of creating a work of art, as it understands that the individual was the only one with reasoning capacity. With the dissemination of its use aimed at artistic creation, there is a gap in relation to the protection of the work generated by AI, as there is no basis for solving this problem, especially by WIPO, which constitutes the highest institution related to IP. The case of the work of art called "The Next Rembrandt" was what motivated the discussion in the academic and legal circles about the ownership of the authorship of the painting, which makes the issue emblematic.

The process of advancing AI over the artistic environment is also already a reality, artistic works have been built through the application of this technology, causing questions about the ownership of intellectual property and copyright.

The issues related to the protection of the copyright of non-human creation, did not start in this specific case, because there was already a concern about works made by computer, which is a tool that every day becomes an ally of human beings and helps them to solve complex problems, therefore, the works generated by the computer are not protected under the laws currently in force in the world, since it is not the result of human intellect. Neither the legislation covers copying of protected work that is used as AI data entry.

From the studies realized until now, it is observed that the global legislation has not yet been updated to resolve the doubts regarding authorship and responsibility originated from the action of AI, in order to clarify who is responsible for commercial exploitation, for the violation of rights of others and other types of liability for other damages, in addition to other infractions that happen to be committed by the AI, which creates a legal uncertainty. Thus, there is no legal basis for recognizing authorship of the works produced by AI, as well as the ownership of the subject of the work.

In the creations made by AI there is no physical effort to carry out the work of ideation and creation of an art that is characterized as something that originates from the intellect and that makes a link between the author and the work. It is also noticed that the origin of the work does not come from the spirit of the author. The level of involvement and control does not belong to the human being, as in photographic records, but exclusively to the machine.

The 45th Article of Brazilian Law number 9,610 of 1998 determines that works of unknown authorship belong to the public domain, it is possible to insert in this article the creations made by AI, that do not fit the existing legislation or do not have legal precedent. The 12th Article of this law determines that the creation has an identification that can attest to the authorship of the work, which can be the real name, a pseudonym or a brand or character, which does not happen with AI [6].

The work done by the AI will have two categories related to the ownership of the work created, one being the creator who will be the individual who owns the copyright and the other the owner of the work whose link is associated with ownership and economic rights and not always is related to the creation of the work or the creative process of the work.

There are some already famous cases on the internet, such as Microsoft's AI software, sponsored by the Dutch bank ING - recognized as an innovative financial institution - that after studying the Dutch artist Rembrandt's artistic works, produced a new "original" Work, a painting which expresses all the characteristics of the painter and which is shown in Fig. 2 a).

For AI studies, 346 works by the painter Rembrandt were used, which were digitized in high resolution, storing 150 gigabytes of digitally rendered graphic data, the result of a digital analysis from pixel to pixel. Machine learning of the geometric patterns common in Rembrandt's works allows the generation of an algorithm based on facial identification technology. As a final result, after the creation of 168,263 fragments of paintings from the 346 works, the final painting was done by the AI using a 3D printer to better represent "the map of heat, texture and thickness of the layers that an authentic Rembrandt would have" [48]. The "original" final work has since challenged and surprised experts on the subject as can be seen in Fig. 2 a). The new work was entitled "The Next Rembrandt".



Fig. 2: a) Illustration of the final work The Next Rembrandt produced using Microsoft AI. b) Self-portrait made by the painter at the age of 34 (1640).

Source: [49, 50].

The paintings shown in Figure 2 have similarities, as they are self-portraits painted in light gray, with shadows on one side of the face and in the background, they are figures that look mirrored, where the screen is best seen from afar and generates feeling of depth, the face lines are distinct and characterize a character thinking and with a serious face [1], therefore, the painting shown in Figure 2 a), made by the AI, could be inserted in the works produced by Rembrandt.

The result shows that the learning done by the machine resulted in a work done autonomously by the AI and that did not have human interference, with the characteristics of Rembrandt's work, with the operations being carried out using the algorithms employed and that it would not be possible to be used by a human being, where all the characteristics and other pertinent elements of his work were inserted, resulting in a work related to the one he would have produced.

The atmosphere created in the work, reproducing one of the characters already portrayed, using precision in the brush strokes, creating an environment composed of shadows and light, which are perceived in Rembrandt's original works.

Rembrandt's works are already in the public domain and, therefore, could be used by AI as a field of study and this condition does not violate copyright protection legislation. The authorship of the work is still debatable, due to outdated legislation in a global way for this problem, which constitutes a field of questioning and studies on copyright, since AI has no personality, whether it is equivalent to the person individual or legal entity, or another name, so that the work can be individualized and its author can be properly identified. This condition provokes heated debates with some currents considering the attribution of authorship to a machine as coherent and on the opposite side there is a current that holds the condition that the result of the product does not come from a spirit creation and therefore, the copyright cannot be attributed to a machine. A third current based on existing legislation and definitions argues that these works made by AI should be placed in the field referring to the public domain, since their actors would be in the field of indetermination or of unknown authors.

V. CONCLUSION

Technology is increasingly incorporated into the daily lives of humanity, being used in several areas. With technological advancement, its applications become viable and are increasingly considered. Nowadays, with technological advances, it is not possible to attribute only the human being the capacity of the intellect.

As with jobs, the creation of works by AI can inhibit human creation, since the individual will not have a great power to compete with a machine.

Resolving who owns the copyright will generate a situation of reliability at the time of the negotiation between the seller and the buyer, in addition to creating a scenario of certainty that the transaction has been made in accordance with the law. It will also serve to resolve doubts about authorship and the use of creations protected by intellectual property to generate new works. In addition, it will serve as a parameter for a new creation and how these issues will be resolved within the scope of justice, consequently not remaining a legal uncertainty.

Legislation is a dynamic tool, but its speed of reaction is very slow in relation to the rate of growth of the technology. The legislation on authorship of creation by machine must be updated so that someone can be held responsible for any errors, for economic and patrimonial exploitation, according to the specific rules and legislation of each case, so that there are mechanisms and legal instruments for resolving doubts, generating legal certainty and minimizing conflicts.

Existing legislation should define in the near future about the ownership of the works made by AI, one that the winning chain is believed to be the one that establishes its insertion as "public domain", from its generation, which will raise the impediment of commercial exploitation of the work by technology companies, which already have a financial gain linked to market exploitation during their public exposure. There is also a gain on the software through the use license, when it is used by third parties.

The current legislation indicates that intellectual property is linked to human inventiveness. Therefore, the possibility of IP being attributed to an AI leads the case presented, "The Next Rembrandt" to great uncertainties given the inexistence of jurisprudence that differs from the current legislation and the inexistence of international legislation that points to the other directions in the future. Thinking about new and original artistic productions through AI and thinking about arguing about the possibility of attributing the title of these works to an AI is entering a sea of uncertainties, without a horizon that points to a legal or jurisprudential support that justifies a certain argument, which, later on, would result in a loss of cause.

Technological advances are contributing to an acceleration in the field of AI and this condition is not

accompanied by the legislation of most countries, and these countries have not yet established a doctrine regarding the copyright of works made by the machine, which demonstrates that this field is not fast in its fundamentals and takes a long time to answer society, which causes legal uncertainty and the citizen expects justice to be faster in responding to their demands, which can be done even with the use of AI, indeed.

The scope and speed of technological evolution is much greater than the capacity for legislative progress. The legislator should look for ways to keep legislation less backward and with the capacity to define issues related to technology, especially in relation to IP ownership resulting from the creation made by an AI, in a way that brings security to the legal system.

As long as there is no legislative update, the solution will be based on the study between the parties involved in the achievement of the works made through AI and the attribution of copyright over those involved in a given phase.

As with human creation, the one performed by AI is the result of previous works lived and learned over time, having its entire creative process influenced by the experience and contact with other works.

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Empirical Assessment of China's outward foreign direct Investment to Africa

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Abstract— China's economy's progress and relations with other developing countries have received much attention, particularly how Sino-African relations have evolved since 2000. However, China's foreign direct investment (FDI) on economic development in Africa requires empirical assessment. This study investigates the causal effect relationship between GDP and China's outward FDI in Africa from 2003-2018 using panel data analysis. Contrary to the limited existing literature in Africa, an advanced econometric approach such as dynamic panel data estimation isused to ascertain the effect of China's exports to Africa, China's imports from Africa, Gross Annual Revenues of Chinese Companies' Construction Projects in Africa, and China's outward FDI to Africa. Our results suggest that China's outward FDI to Africa exerts a positive and significant impact on GDP.

Moreover, there is a positive relationship between China's exports to Africa, China's imports from Africa, Gross Annual Revenues of Chinese Companies' Construction Projects in Africa, and GDP. The causal effect finds a short-term relationship between GDP and China's outward FDIto Africa. The results show a strong implication in 39 Africa countries. More precisely, China's outward foreign direct investment in Africa and the Gross Annual Revenues of Chinese Companies' Construction Projects in Africa will surely have positive effects on the GDP (current US\$) and the country's economic growth. Thus, the study recommends implementing measures and policies to manage China's outward FDIto ensure robust economic development.

Keywords— China's outward FDI, GDP, China's exports to Africa, China's imports from Africa.

I. INTRODUCTION

As a rising economic powerhouse, China's economic ties with other countries have received worldwide attention. Of interest is the growing social, economic, and political relationship between China and African countries. In unity, China has established several trade policies and mutually beneficial foreign investment policies to propel economic development. It also comes as part of a rise open Chinese economy, which has become a much proactive player in the international arena in the early 2000s. China's outward foreign direct investment (OFDI) has advanced technological and managerial knowledge in Africa. It has introduced industrial projects and improved trade and commerce in recipient African nations. Over the past decade, outward foreign direct investment to other nations, especially African countries, has progressed due to the forum's relationship on China-Africa Cooperation (FOCAC). According to China-Africa Trade and Economic Cooperation, between 2009 and 2012, China's foreign direct investment in Africa spread at an annual rate of 20.5%. Flows peaked in 2008 at US\$5.5 billion (partly attributable to the purchase of 20% shares of
Standard Bank-South Africa). However, recent economic data indicates that Chinese FDI annual flows to Africa reports have fluctuated throughout the past decade.

Africa remains a major import source for the Chinese economy, the second-largest overseas construction project market, and the fourth largest investment destination of China (Claassen et al., 2012). Butcher et al. (2019) indicate rapid growth in China's OFDI to SSA in the past few years. As shown in figure one, bilateral trade between China and Africa increased from 1.75 billion USD to 204 billion USD from 1992–2018. China's imports from Africa have exceeded its exports in recent years due to economic development and increasing demand for natural resources for the domestic

market. In this context, more attention is being paid to FDI and Trade between China and Africa. FDI and trade have become the inevitable choice for sustained economic development. Therefore, assessing China's OFDI, its role, and its influence on trade and economic development in Africa is the central aim of this study. Meyersson et al. (2008) found that exporting natural resources from Africa to China compared to the rest of the world has huge positive effects on Africa's economic growth and investment. Sharing a similar view with Drummond and Liu (2013), who say rising trade links with China, is beneficial to Africa since it enables African countries to diversify their export across countries.



Fig.1: China-Africa bilateral trade. Notes: Figure plots the total trade, imports, and exports between China and Africa for each year from 1992 to 2018. Source: China Africa Research Initiative.

In promoting trade cooperation, the Chinese government, through its "Going Global" policies, encourages and supports Chinese enterprises in increasing their investment portfolios, especially in Africa (Dong* and Fan, 2017). As shown in Fig. 2, as at the end of 2015, China's cumulative FDI in

Africa exceeded USD 43.30 billion. Most of these investments channeled into energy, mining, construction, and manufacturing. China has become a development model for African countries and an alternative source of trade and finance to Africa's traditional development partners.



Fig.2: China's overseas investment in Africa (2003–2018). Notes: This figure plots China's OFDI in Africa for each year from 2003 to 2018. Source: China Africa Research Initiative.

Over the years, China has emerged as an FDI provider as there has been a substantial increase in investment in other economies. These have motivated various studies from various researchers. Cheng and Zihui (2009) analyzed the destination of China's OFDI, concluding that the real GDP of host economies and the distance among host countries. They concluded thatChina's OFDI flows and OFDI stocks had a significant impact on the host countries. They also examined the differences in the investment behavior of China across developed and developing countries. They suggested that China's OFDI tends to be induced by market-seeking and resource-seeking motives with developing countries. Dong et al. (2011) found that infrastructure and natural resources are principal factors attracting Chinese OFDI in Africa. Chinese investors choose to invest in countries that are geographically near to them (shorter distances away) and are less concerned with the strength of the host countries' institutional factors.

Our study contributes to the literature by assessing the widespread notion that FDI has a positive impact on host countries, especially in the African context. First, we quantitatively assess Chinese OFDI impact on trade and import to Africa. Second, we investigate the main drivers of OFDI transfer from China to Africa. Third, we assess the current situation of Chinese OFDI and evaluate how African countries can effectively use such investments to improve economy and efficiency.

The paper is structured as; Section two (2) provides an overview of the literature concerning the relationship between FDI and economic growth and trade and the determinants of FDI to Africa. Section three (3) discusses Chinese FDI flows to Africa between 2003 and 2018, while section four (4) gives an empirical analysis of the determinants of Chinese FDI flows to Africa. Section five (5) concludes the study with suggested recommendations.

II. RELATED LITERATURE

The substantial increase in recent years and the anticipated long-term outlook is the driving force of attention from various scholars and researchers to China's Outward foreign direct investment (FDI). Numerous studies have examined a series of issues regarding China's FDI outflow, with some studies investigating the trend and driving forces using diversified approaches, attaining different outcomes. The connection between FDI and economic growth has been evaluated in the literature. The World Trade Organization (WTO) acknowledges the impact of FDI in developing countries, including Sub-SaharanAfrican (SSA) economies, aids in economic growth acceleration and effective resource utilization. Not only does FDI inject capital into the domestic market, but it also plays a critical role in technological spillover and the advancement of managerial skills. Research believes that technology and knowledge can be transfer to the host country (Grossman & Helpman, 1997; Frankel & Romer, 1999). FDI is seen to be embedded with new technologies and know-how not available in the host country and could accelerate the speed of adopting technology and improving production efficiency in the host countries, thus promoting economic development. Outward FDI to host countries is considered a major factor contributing to economic growth (Yao & Wei, 2007). Abdouli and Hammami (2017) used the GMM model to investigate seventeen (17) countries in the Middle East from 1990-2012 and empirically established a bidirectional causality relationship between economic growth and FDI. Another study by Hsiao et al. (2006) found FDI has a unidirectional effect on GDP growth using time-series and panel data spanning from 1986 to 2004 for China, Korea, Hong Kong, Singapore, Malaysia, Philippines, Taiwan, and Thailand using Granger causality relationship. Falki (2009) and Agarwal (2000) described the link between foreign direct investment and economic growth to be negative. Adams et al. (2015) concluded that FDI does not have a significant independent effect on economic growth in 22 sub-Saharan African countries. Agbloyor et al. (2016), in similar research, indicated no significance of FDI promoting economic growth in Sub-Saharan Africa. It was confirmed in related research by Asamoah, Mensah, & Bondzie (2019). Belloumi (2014) attributes the phenomena to inadequate investment in human capital, quality infrastructure, and economic freedom, evident among SSAs.

Abeliansky and Martínez-Zarzoso (2019) used simultaneous gravity equations to study Chinese imports, exports, and foreign direct investment (FDI) of 167 countries from 2003 to 2012. They concluded that outward Chinese FDI is related to higher exports and imports and that China trades more with countries hosting Chinese FDI. Furthermore, Broadman (2007) used firm-level data of the World Bank Africa Asia Trade Investment (WBAATI) survey and the World Bank's newly developed business case studies in Africa and found a positive link between foreign direct investment and Trade among Chinese firms involved in Africa. Yeboah and Agyeiwaah (2019) revealed that China's contribution to the total number of FDI registered projects in Ghana is very significant though the total sum tends to be lower. Chinese OFDI in Ghana had a significant positive impact on Ghana's employment (Boakye-Gyasi and Li, 2015), construction (Kwasi and Li, 2016), and Agriculture (Kojo, 2013). Claassen et al. (2011) state that China's outward FDI is concentrated in diversified, medium growth economic performers in Africa, with Southern Africa being the most popular region for China's outward FDI. Their research reveals China's OFDI to Africa hovers around agricultural land, market size, construction, and oil. The causality tests conclude that the relationship between African GDP and Chinese FDI is bi-directional. The top 5

destinations of Chinese FDI in Africa in 2014 were Algeria, Zambia, Kenya, Republic of Congo, and Nigeria. Algeria accounted for more than 20% of all Chinese FDI flows to Africa in 2014 (China Africa Research Initiative). Doku, Akuma, and Owusu-Afriyie (2017) established that a percentage increase in China's FDI stock in Africa, all things being equal, would significantly cause an increase in Africa's gross domestic product (GDP) by 0.607%, using the fixed effect estimation method. However, Zhang, Alon, and Chen (2014) found a contrary conclusion. They proved that Chinese FDI net inflows to SSA have no significant effect on the sub-region's economic growth. Adisu et al. (2010) found that Chinese investment has motivated people to access critical resources (oil, bauxite, etc.) in Africa.

2.1 Chinese FDI inflows to Africa, 2003-2018

According to the latest CEIC, China's Outward Investmentin Africa stood at USD 5.389 billion(data reported in Dec 2018). It is an increase from the previous USD 4.105 billion for Dec 2017. The data reached an all-time high of 5.491 USD billion in 2008 and a record low of 74.810USD million in 2003(CEIC). Although a significant share of China's OFDI has been concentrated in the African market, investments have become more geographically diversified since 2003. It indicates that the bulk of Chinese FDI to Africa has been concentrated in the classifications assigned by Roxburgh et al. (2010) to be the major driver of African economic growth and lends preliminary credit to China's investment in Africa obtain greater market access. To have a clearer picture of China's interest in securing market access, the various recipient countries' GDP rates were used to sort host countries into three groups, according to average economic growth acquired between 1995 and 2005. This period was chosen on the presumption that countries that achieved good historic economic growth rates would capture larger volumes of FDI inflows. High growth economies include economies that grew more than five percent on average between 1995 & 2005. The medium growth economies obtained average economic growth rates of between three and five percent, while low growth economies obtained less than three percent growth rates. The bulk of Chinese OFDI between 2003 & 2008 went to countries that historically were medium growth achievers, such as South Africa, Tunisia, Egypt, Nigeria, Namibia, Kenya, and Mauritius, which also represents the larger economies on the continent (Claassen et at, 2012). It again seems to affirm the idea provided by Verachia (Gordon Institute of Business Science conference (IBSC), 2010) that China is interested in investing in Africa to gain access to larger markets for its products since around 97 percent of all Chinese FDI flows went to countries that could sustainably grow at more than 3 percent on average per annum. However, the clear interest in oil-exporting countries, coupled with diversified and stable growth achievers, follows a more traditional pattern of Foreign Direct investment. Since data concerning the exact sectoral composition of Chinese Foreign direct investment in Africa are fragmented and anecdotal, it is difficult to verify the nature of Chinese investment in Africa exhaustively. However, it is possible to examine the African countries that receive Chinese FDI and make some preliminary conclusions. An overview of deals end between Chinese and African firms confirms China's involvement in construction, mining, and oil in particular (Claassen et at, 2012).



Fig.3: The trend of China's exports to Africa, China's imports from Africa, China's outward Foreign Direct Investment to Africa, and Gross Annual Revenues of Chinese Companies' Construction Projects in Africa.

Figure 3 indicates China's exports to Africa, China's imports from Africa, China's outward Foreign Direct Investment to Africa, and Gross Annual Revenues of Chinese Companies' Construction Projects in Africa. China's exports to Africa have a downward and upward movement, which rose from 2003 to 2008 and slope downward in 2009. China's exports to Africa started increasing from the year 2009 to 2014 and fell sharply in 2016. It remained stable at the level but with little downward differences till 2018.

On China's imports from Africa, the trends follow that of export. The figures rose from 2003 to 2008 and dropped in 2009. It started rising again from the year 2009 to 2011 and started decreasing steadily from 2012 to 2014. In 2014, it fell sharply in 2015 and continued to decrease to 2016 and returned to rising rate through to 2018.

The trend rate of China's outward Foreign Direct Investment to Africa rose from 2003 to 2018; in 2008, it rose a record high of USD 5490.56 million and decreased in the year 2009. In the year 2009, it started increasing again till 2018. The trend of construction projects kept rising from the year 2003 to 2015 and declined slowly till 2018.

III. DATA DESCRIPTION

Our study uses panel data for the 39 African countries out of the 56 countries from 2008-2018, applying a dynamic panel data analysis. The selection of the 39 countries used for the study was solely based on the data's availability for the topic under study. Also, the choice of the starting period is constrained by the availability of data. World Development Indicators (WDI, 2019) was combed to collect the data for GDP measured as GDP (current US\$). The variables are; CEXPOT measured as China's exports to Africa, IMPORT measured as China's imports from Africa, PROJECT asGross Annual Revenues of Chinese Companies' Construction Projects in Africa, and COFDI dignified as China's outward Foreign Direct Investment to Africa data were extracted from China–Africa Research Initiative.

3.1 Methodology

Following the work of Kahouli (2017) and Moradbeigi et al. (2017), we employ the dependent variable in this model, GDP measured as GDP (current US\$). The independent variables are CEXPOT measured as China's exports to Africa, CIMPORT as a proxy of China's imports from Africa, PROJECT asGross Annual Revenues of Chinese Companies' Construction Projects in Africa and COFDI dignified as China's outward Foreign Direct Investment to Africa data was extracted from China–Africa Research Initiative. The functional form of the model is expressed as:

GPD_{it}

 $= D_{it}CEXPORT_{it}^{a1}, CIMPORT_{it}^{a2}, COFDI_{it}^{a3}, CPROJECT_{it}^{a4}, Y_{it-1}^{a5}Eq(1)$

Data for the equation's variables wereconverted into logarithmic terms to control for heteroskedasticity and provideconsistent results. Logarithmic transformation facilitates the explanation of the estimated coefficients as elasticities. Logarithmic transformation makes it feasible to solve or reduce the differences between the variables linked to the differences in their measure units.

The logarithmic transformation of equation (1) is given by:

$$lnGDP_{it} = \beta_o + \beta_1 lnCEXPORT_{it} + \beta_2 lnCIMPORT_{it} + \beta_3 lnCOFDI_{it} + \beta_4 lnCPROJECT_{it} + \beta_5 lnY_{it-1}\varepsilon_{it}Eq(2)$$

The subscript *i* signify the country (i = 1,...,39) and *t* indicates the time (t = 2003,...,2018). $lnCOFDI_{it}$ refers to the natural log of china outward foreign direct investment to Africa. $lnGDP_{it}$ reveals the natural log of GDP (current US\$) in Africa as a proxy of economic growth. $lnCEXPORT_{it}$ shows China's natural log exporting to Africa, the natural log of China importing from Africa is represented by($lnCIMPORT_{it}$), while ε_{it} is the error term. $\alpha 1$, $\alpha 2$, $\alpha 3$, $\alpha 4$, and a5 are the output elasticities, respectively concerning COFDI, GDP growth, inflation, Export, and Import.

GMM Estimation Equation

LNGDP = C(1) + C(2) * LNCEXPORT + C(3)* LNCIMPORT + C(5) * LNCOFDI + C(6) * LNCPROJECT + ε_{it} Where;

COFDI= Log of Chinas outward foreign direct investment,

GDP= Log of Gross Domestic Product (CURRENT US\$),

CPROJECT=Log of Gross Annual Revenues of Chinese Companies' Construction Projects in Africa,

CEXPORT= Log of China's exports to Africa,

CIMPORT= Log of China's imports from Africa,

 $\boldsymbol{\varepsilon}_{it}$ is the within-entity error.

The subscripts i and t represent countries and periods, respectively.

In this study, a dynamic Panel data study is used to test the three-way relationship. The first step of our analysis ensured the stationarity of the series or the order of each variable's integration. Therefore, the research of the stationarity of each series is based on two types of tests. First-generation tests Kahouli and Maktouf (2014a), Madalla & Wu (1999), and second-generation tests Pesaran, (2003). Both tests are based on two hypotheses: the null hypothesis of a unit root (non-stationary) against the alternative hypothesis of no unit root (stationary). The test results are presented in Table 2 for a sample of 429, consisting of 39 countries in Africa.

After the order of integration signified expected of the different series, the Perdoni cointegration test was applied, allowing us to study the existence of a long-term relationship between all the variables involved. Then, we proceeded to the model estimation using the Fully Modified Ordinary Least Square (FMOLS) to complete the cointegration test.

IV. OUTCOMES OF ECONOMETRIC MODELING

The outcomes of the estimate made for Africa. The first step is to provide the unit root test to determine the stationarity of the variables. The second step implements the Perdoni cointegration test to check for cointegration between variables. Once the relationships are determined, a Vector error correction model can, therefore, be estimated.

4.1 Outcomes of Unit Root Tests

The table below gives the outcome of the unit root tests, according to Levin-lin-Chu (2002), Im-Pesaran-Shin (2003), and Maddala & Wu (1999), respectively.

Since Levin's test, Moradbeigi et al. (2017), suggests the dependence between individuals below the alternative hypothesis, the Im-Pesaran-Shin test intervenes to lift this

hypothesis and suggests independence between individuals under the alternative hypothesis. The test McKinnon (1973) and especially the PP-Fisher test, is requisite. Typically, the outcomes in Table 2 indicate that most of the variables used are integrated from I (1). On the other hand, the PP-Fisher test does not reject the unit root's presence's null hypothesis. The variable export is not stationary in level. On the other side, the null hypothesis of providing a unit root is declined, with one accord for all series in the first difference.

Table 2. Unit Root Tests Result

	C		DC		1	(XX7	
LI	LC	1	PS		N	IW	
				ADF -Fishe	r	PP - Fisher	
Level	First.	Level	First.	Level	First.	Level	First.
	Deference		Deference		Deference		Deference
0.93568	-12.6727	0.52246	-13.7407	88.7988	339.934	181.521	824.442
(0.8253)	(0.0000)***	(0.6993)	(0.0000)***	(0.3125)	(0.0000)***	(0.0000)***	(0.0000)***
-4.53120	-7.46429	0.45949	-2.79519	90.7015	115.900	90.7015	196.503
(0.0000)***	(0.0000)***	(0.6771)	(0.0026)***	(0.1541)	(0.0035)***	(0.9978)	(0.0000)***
-1.98280	-10.9078	1.72654	-9.25495	58.2810	240.921	56.3113	438.944
(0.0237)**	(0.0000)***	(0.9579)	(0.0000)***	(0.9854)	(0.0000)***	(0.9813)	(0.0000)***
-1.87435	-13.7949	2.19777	-10.5182	54.1927	266.305	55.6008	412.435
(0.0304)**	(0.0000)***	(0.9860)	(0.0000)***	(0.9953)	(0.0000)***	(0.9928)	(0.0000)***
2.35420	-4.61700	3.24760	-6.63321	66.6319	193.094	69.0363	386.045
(0.9907)	(0.0000)***	(0.9994)	(0.0000)***	(0.9182)	(0.0000)***	(0.0406)**	(0.0000)***
	LI Level 0.93568 (0.8253) -4.53120 (0.0000)*** -1.98280 (0.0237)** -1.87435 (0.0304)** 2.35420 (0.9907)	LLLC Level First. Deference 0.93568 -12.6727 (0.8253) (0.000)*** -4.53120 -7.46429 (0.0000)*** (0.0000)*** -1.98280 -10.9078 (0.0237)** (0.0000)*** -1.87435 -13.7949 (0.0304)** (0.0000)*** 2.35420 -4.61700 (0.9907) (0.0000)***	LLC First. Level Level First. Level Deference Deference 0.93568 -12.6727 0.52246 (0.8253) (0.0000)*** (0.6993) -4.53120 -7.46429 0.45949 (0.0000)*** (0.0000)*** (0.6771) -1.98280 -10.9078 1.72654 (0.0237)** (0.0000)*** (0.9579) -1.87435 -13.7949 2.19777 (0.0304)** (0.0000)*** (0.9860) 2.35420 -4.61700 3.24760 (0.9907) (0.0000)*** (0.9994)	LLC IPS Level First. Level First. Deference Deference Deference 0.93568 -12.6727 0.52246 -13.7407 (0.8253) (0.0000)*** (0.6993) (0.0000)*** -4.53120 -7.46429 0.45949 -2.79519 (0.0000)*** (0.6771) (0.0026)*** -1.98280 -10.9078 1.72654 -9.25495 (0.0237)** (0.0000)*** (0.9579) (0.0000)*** -1.87435 -13.7949 2.19777 -10.5182 (0.0304)** (0.0000)*** (0.9860) (0.0000)*** 2.35420 -4.61700 3.24760 -6.63321 (0.9907) (0.0000)*** (0.9994) (0.0000)***	LLC IPS ADF - Fisher Level First. Level First. Level Deference Deference Deference Deference Deference (0.8253) $(0.000)^{***}$ (0.6993) $(0.000)^{***}$ (0.3125) -4.53120 -7.46429 0.45949 -2.79519 90.7015 $(0.0000)^{***}$ (0.6771) $(0.0026)^{***}$ (0.1541) -1.98280 -10.9078 1.72654 -9.25495 58.2810 $(0.0237)^{**}$ $(0.0000)^{***}$ (0.9579) $(0.0000)^{***}$ (0.9854) -1.87435 -13.7949 2.19777 -10.5182 54.1927 $(0.0304)^{**}$ $(0.0000)^{***}$ (0.9860) $(0.000)^{***}$ (0.9953) 2.35420 -4.61700 3.24760 -6.63321 66.6319 (0.9907) $(0.0000)^{***}$ (0.9994) $(0.0000)^{***}$ (0.9182)	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $

***; ** and * show stationarity at 1%, 5% and 10% level respectively.

4.2 Outcomes of Cointegration Tests of Perdoni (1999)

The Pedroni (2011) test was employed to examine the presence of cointegration among variables. The outcome showed in Table 3 reveals that the probability of the majority of tests is greater than 1%, which allows us not to reject the

null hypothesis of the presence of cointegration and to not accept the alternative hypothesis of the absent ofcointegration in the variables. The hypothesis of a longterm connection between these variables was confirmed no cointegration.

	Statistic	Probability
	Stutistic	Trobublity
Panel v-Statistic	-2.7495	0.9970
Panel rho-Statistic	5.6779	1.0000
Panel PP-Statistic	3.2342	0.9994
Panel ADF-Statistic	8.2119	1.0000
Group rho-Statistic	7.8709	1.0000
Group PP-Statistic	-6.9756	0.0000***
Group ADF-Statistic	0.8040	0.7893

Ho: No cointegration, Ha: All panels are cointegrated

***; ** and *, variables are cointegrated to 1%; 5%; 10%.

4.3 VECM Model

VECM Granger causality method makes it possible to examine the meaning and intensity of short-term relationships and indicate the rate of long-term adjustment.

We start with the long-term causality study between all the variables when c (1) has a negative coefficient and a significant p-value, which is less than 0.05, which is our case. Indeed, the outcome of our estimation of the VECM

model of the long-term relationship presents a negative coefficient (-0.01) and an insignificant p-value (prob = 0.0000>0.05). It allows us to conclude that the variables that both GDP and china outward foreign direct investment in Africa, which are explanatory in this specification, cause GPD, by the way. Hence, the process converges in the long run.

Table 4. Long	run	cointegration	test	results
---------------	-----	---------------	------	---------

	Coefficient	St. Error	t-Statistic	Prob
C (1)	-0.0096	0.0020	-4.7363	0.0000***

***; ** and * show significance at 0.01, 0.05 and 0.1 level respectively.

For the short-term causality test, the method is based on Wald's test and subsequently explains the probability connected with the chi-square test. When the probability of chi-square testing is less than 0.05, we notice a short-term causality between the explanatory variable end question and the dependent variable.

Table 5. Wald test outcome on the short-term causality between GDP and china outward foreign direct investment

Test Statistic	Value	Df	Probability	
F-statistic	18.5152	(2,274)	0.0000***	
Chi-square	37.0303	2	0.0000***	
Null Hypothesis: c (3) =	= c (4) =0			
Null Hypothesis Summa	ıry:			
Normalized Restriction	(= 0)	Value	Std. Err	
c (3)		0.0079	0.0055	
C (4)		0.0425	0.0076	
Restrictions are linear in	Restrictions are linear in coefficients.			

The Wald's test outcomes showed a probability of chi-square (0.0000) less than 0.05, which allows us not to accept the alternative hypothesis that stimulates the existence of a short-term relationship between GDP and China outward foreign *Substituted Coefficients:*

direct investment in Africa. It allows us to conclude a shortterm relationship between GDP and China outward foreign direct investment in Africa.

 $LNGDP = 80.3637 - 0.0014 * LNCEXPORT - 0.0078 * LNCOFDI + 0.0021 * LNCIMPORT - 0.0034 * LNCPROJECT + <math>\varepsilon_{it}$

Variable	Coefficient	St. Error	t-Statistic	Probability
LNCEXPORT	0.1728	0.0223	7.7329	0.0000***
LNCIMPORT	0.0731	0.0093	7.8855	0.0000***

Table 6 GMM Test Results

https://dx.doi.org/10.22	4avancea Engineering Re 161/ijaers.712.10	search and Science	(IJAERS)	[VOI-7, ISSUE-12, DEC-2020] ISSN: 2349-6495(P) 2456-1908(O)
LNCOFDI	0.0205	0.0071	2.9062	0.0039***
LNCPROJECT	0.0374	0.0152	2.4535	0.0147***
C	21.8692	0.1160	188.5258	0.0000
		Effects Specifica	tion	
Cross-section fixed (dum	my variables)			
R-squared	0.9893	Me	ean dependent var	23.7362
Adjusted R-squared	0.9880	S.I	D. dependent var	1.3290
S.E. of regression	0.1457	Su	m squared resid	6.9844
Durbin-Watson stat	0.7698	J-s	tatistic	329.0000
		Pro	ob(J-statistic)	0.0000***
Instrument rank			44	

***; ** and * show significance at 0.01, 0.05 and 0.1 level respectively.

The results in Table 6 show a robust Adjusted R-square of about 0.9880, indicating that about 98.8% change independent variable (GDP) is jointly explained by the explanatory variables (CEXPORT, CIMPORT, COFDI, and PROJECT), while only 0.05% present change in the dependent variable, that is, GDP (current US\$) fluctuation can be said to be explained by factors outside the model. The result also indicatesthat all the variables are statistically significant in explaining GDP evolution in Africa with the t-statistic value of all the variables at 1% level.

Furthermore, our estimates show that both the COFDI and CPROJECT are a major contributing factor to China OFDI and Africa. To be more specific, the COFDI and CPROJECT variables have a positive and significant coefficient (0.0205) and (0.0374), which implies that a 1% increase in both COFDI and CPROJECT leads to 0.39% and 1.47 increase in GDP (current US\$) in the long run.

However, our results show that the CEXPORT variable's impact also presents a positive coefficient (0.1728) but significant (0.0000) at a 1% level, which indicates that China exportingto Africa has a strongsignificant impact on GDP in Africa. China was importing from Africa (CIMPORT) as a variable with a positive coefficient (0.0731) and significant (0.0000) at a 1% level.China importing from Africa have a strong significant impression on GDP in Africa.

In this case, the China outward foreign direct investment in Africa as an independent variable and GDP as a dependent variable in the GMM regressionmodel indicates that China outward foreign direct investment to Africa leads to GDP (current US\$), which humbly means that when there is an increase in COFDI implies that a 1% level increase leads to 0.39% increase in GPD (current US\$). China's outward FDI in Africa has a strong impact on GPD (current US\$).

V. RESULTS AND DISCUSSIONS

The outcomes in Table 2 indicate that most of the variables used are integrated from I (1). On the other hand, the PP-Fisher test does not allow us to reject the null hypothesis of a unit root's presence. The variable export is not stationary in level. On the other side, the null hypothesis of the presence of a unit root is decline, with one accord for all series in the first difference.

The results showed in Table 3 reveal that the probability of the majority of tests is greater than 1%, which allows us not to reject the null hypothesis of the presence of cointegration and not to accept the alternative hypothesis of the absence of cointegration in the variables. The hypothesis of a long-term connection between these variables was confirmed with no cointegration.

Indeed, the outcome of our estimation of the VECM model of the long-term relationship presents a negative coefficient (-0.01) and an insignificant p-value (prob = 0.0000>0.05). It allows us to conclude that the variables that both GDP and china outward foreign direct investment in Africa, which are explanatory in this specification, cause GPD, by the way. Hence, the process converges in the long run.

The Wald's test outcome showed a probability of chi-square (0.0000) less than 0.05, which allows us not to accept the alternative hypothesis that stimulates the existence of a

short-term relationship between GDP and China outward foreign direct investment in Africa. It permits us to conclude the existence of a short-term relationship between GDP and China outward foreign direct investment in Africa.

The results in Table 6 show a robust Adjusted R-square of about 0.9880, indicating that about 98.8% change independent variable (GDP) is jointly explained by the explanatory variables (CEXPORT, CIMPORT, COFDI, and PROJECT), while only 0.05% present change in the dependent variable, that is, GDP (current US\$) fluctuation can be said to be explained by factors outside the model. The result also indicates that all the variables are statistically significant in explaining GDP evolution in Africa with the t-statistic value of all the variables at a 1% level.

Furthermore, our estimates show that both the COFDI and CPROJECT are major contributing factors to China OFDI to Africa. To be more specific, the COFDI and CPROJECT variables have a positive and significant coefficient (0.0205) and (0.0374), which implies that a 1% increase in both COFDI and CPROJECT leads to 0.39% and 1.47 increase in GDP (current US\$) in the long run.

However, our outcomes show that the CEXPORT variable's impact also presents a positive coefficient (0.1728) but significant (0.0000) at a 1% level, which indicates that China exporting to Africa has a strong significant impact on GDP in Africa. China was importing from Africa (CIMPORT) as a variable with a positive coefficient (0.0731) and significant (0.0000) at a 1% level. China importing from Africa have a strong significant impact on GDP.

In this case, the China outward foreign direct investment in Africa as an independent variable and GDP as a dependent variable in GMM regression model indicates that China outward foreign direct investment to Africa leads to GDP (current US\$), which humbly means that when there is an increase in COFDI implies that a 1% level increase leads to 0.39% increase in GPD (current US\$). China's outward FDI in Africa has a strong impact on GPD (current US\$).

VI. CONCLUSION AND POLICY IMPLICATION

There is a significant increase in the FDI level from China, as revealed by several studies and data. The positive effect or otherwise of this huge financial flow has generated debates in different quarters. This study examinedChina's outward foreign direct investment in Africa, China exporting to Africa, China imports from Africa, and Gross Annual Revenues of Chinese Companies' Construction Projects. To achieve this goal, we used annual data from 2008-2018 with a sample of 39 countries in Africa using econometric models based on the Vector Error Correction Model (VECM) and Generalized Method of Moments (GMM).

The empirical evidence revealed that China outward foreign direct investment in Africa, China exporting to Africa, China imports from Africa, and Gross Annual Revenues of Chinese Companies' Construction Projects in Africa increases GDP. However, China exporting to Africa and China importing from Africa are the major contributors to GDP in the short and long run. The empirical outcomes show a strong implication in 39Africa countries. Precisely, China's outward foreign direct investment in Africa and the Gross Annual Revenues of Chinese Companies' Construction Projects in Africawill surely have positive effects on the GDP (current US\$) and the country's economic growth.

Based on these findings, governments in Africa need to take advantage of the market or resource, asking Chinese FDI to benefit the region's manufacturing sector. It can be done by ensuring China's FDI is focused on positive backward and forward linkages with the manufacturing sector. Also, increasingdomestic content-based sourcing for production inputs where possible and contracting out of necessary intermediate good production activities in the production process to domestic entrepreneurs. The study also suggests that governments, in a bid to entertain Chinese FDIs in Africa, should export and import more from and to China as a lot of Chinese construction projects in Africa that have a strong impact on GDP (current US\$) in Africa. Equally, measures that could encourage the exporting of locally made commodities should remain promoted.

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The Influence of Miguel Reale's three-Dimensional theory on the Brazilian Civil Code and its Case Law

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Abstract— This article reviews the development of the three-dimensional theory of law and its impact on the Civil Code and case law, as a way to solve new problems claimed world around today, notably situations like the COVID-19 pandemic. Hence, the three-dimensional theory has apparently proved to be an excellent way to provide proper and fair guidance to solve new contractual issues.

Keywords— Three-dimensional theory of law; Standard; Law Science; Brazilian Civil Code; Law Case.

I. INTRODUCTION

This article aims at reviewing the threedimensional theory of law as developed by the jurist Miguel Reale, and its influence on the Brazilian Civil Code and the case law.

Firstly, a review encompassing the rule of law will be presented, distinguishing the legal order from the legal system. In addition, the paper approaches the Science of Law and the role it plays in understanding the standards either in place or existing. It will elucidate the approximation between Science of Law and Philosophy of Law commenced in the 20th century, which significantly increased the engagement of jurists in the Philosophy of Law aiming at a dialectic unit.

Thereafter, the paper approaches the legal system established by Miguel Reale through the development of his three-dimensional theory, based on the study of law as a set of standard, fact, and value. It will describe how jurists supportive to Miguel Reale's three-dimensional theory of law shall construe the standards, coordinating and systematizing them to rule out inconsistencies and incoherences of the legal order. In order to do so, jurists shall preform a joint analysis of the three elements (standard, fact, and value) considering the 'calibration rules', i.e., rules that allow changing the order standard, whenever required. Therefore, it presents the concretion of the threedimensional theory of law, showing that the legal standard, remaining unchanged, may have different interpretations depending on changes in the surrounding world. In addition, the paper explains that the current Civil Code was drafted by a commission of jurists supervised by Miguel Reale and, therefore, Reale's three-dimension theory influenced many of the Civil Code provisions, deliberately using an open, volatile or obscure language, in accordance with the general provisions.

II. METHODOLOGY

The methodology adopted in this research work is of a theoretical nature, using doctrines, jurisprudence, bibliographies in general, scientific databases and legislation, such as Brazilian Code Civil of 1916, Brazilian Code Civil of 2002 and Federal Law 8.009 of 1990.

The research took into consideration the analysis of concrete facts from the past and contemporaries, as a way to verify the incidence of Miguel Real's Threedimensional Theory on them, notably in contractual relations.

In fact, it was verified how Miguel Reale's Three-Dimensional Theory, known worldwide, has contributed to the evolution of law, mainly to give a sustainable direction to the interpreter, as a way of adjusting the interpretation of the legislation to new concrete cases, providing a solution unpredictable and extraordinary situations.

Finally, the adopted research presents practical results of the incidence of the Three-Dimensional Theory in the Brazilian Civil Code and in the Brazilian jurisprudence, as a way to give a fair solution to their disputes.

2.1. LEGAL STANDARD AND SCIENCE OF LAW

The legal standard derives from a final ruling issued by the competent legislature, giving rise to its character of decidability. Legal standards will always be established by a legislature. Therefore, our behaviors are ruled by legal standards that enforce specific behaviors that are mandated, allowed or prohibited. Consequently, it has imperativeness when it dictates behaviors to individuals, i.e., it means that something has the 'duty to be' as it is an order for the human conduct.

The set of legal standards makes up the legal order, which is incoherent and abounds in inconsistencies, i.e., antinomies. The legal order is markedly different from the legal system, established by the Science of Law through the jurist.

The legal system is not laid down by positive law, but by the Science of Law and it is not a reality, it is an ideal object. In order to know the law, the Science of Law shall put forward the systematic set of legal standards as a valid class.¹

The Science of Law is inherent to the knowledge and description of the legal standards, hence its descriptive nature where the jurist makes propositions. Since it is a judgment subject to the control of logic, its enunciate is either true or false. When jurists come to know and describe the standards, they build the normative system in order to provide unit and coherence to the standards. Science of Law belongs to the 'duty to be' category. For Miguel Reale, the legal dogmatics is not much different from the Science of Law, but the highest instance of application of the Science of Law. Here, the jurist stands to the theoretical level of general principles and concepts required to interpret, establish, and systematize the precepts and institutes making up the legal order.²

It is not so much a matter of judicial activity in a broad sense, a legal technique inherent to the work of attorneys, judges, prosecutors, reviewers, etc.³, but a scientific technique requiring jurists to use a technique aimed at systematizing and arranging the legal order, for the purpose of instructing the law enforcer, as well as of enabling the proper interpretation, evicting any antinomies, and filling any existing gaps.

Decidability became the core issue of science of law. That is why the jurist, in seeking decisions that are justifiable in the current legal standard, provides answers that are neither true nor false, but that are fit or not to demonstrate that a given decision can be sustained in the standard under analysis. For that reason, the scientificlegal enouncements that make up the legal theories entail programmatic consequences of the decisions. They are expected to assist solving social problems with no disruption.

Since the legal order has inconsistencies and incoherences, the science of law has the purpose of interpreting the legal standards and drawing conclusions, coordinating and systematizing them to rule out such inconsistencies and incoherences. To that, it shall create a unified view of the system, in order to give directions to the law enforcer. This is the reason why the legal order is a technical work, thus named as a technological thinking.

2.2. PHILOSOPHY OF LAW

Late in the 19th century jurists were associated exclusively to a strict positivist attitude, whose behavior faithfully followed the legal texts, that is, there was nothing but the subsumption of the fact to the standard, disregarding the historical reality and social values. This ended by creating a dualism, that is, as if there existed a law for the jurist, and another for the philosopher, each being isolated in their field of analysis.

However, due to the discrepancy between regular norms and the underlying flows of social life, the Science of Law was stirred by a movement called 'free law', which brought about questions regarding elements of certainty in the existing legal order. Thus, discussions arose about the general theory of interpretation, allowing the Philosophy of Law to be associated to the science of law, and vice versa.

Miguel Reale perceives the need for a concrete Science of Law, connected to axiological, economic and social processes, to be observed under multiple perspectives, in sundry forms and directions, with the many expressions employed by authors, such as 'legal experience', 'reality of law', 'law as fact, value and standard', 'case law of interests', 'case law of values', among others. Jurists become increasingly interested in Philosophy, and the same also happens with regard to the philosophers of law, who also abandon their formal and abstract schemes to come into contact with the positivity of law. Hence, there was a deep renovation in philosophical-juridical studies in the 20th century, with the growing interest of jurists in Philosophy of Law, understanding that the reason of this discipline could not be appreciated *in abstrato*, but in connection with the historical and sociological factors arising from the new attitude.⁴

There is no more room for the reductionist mentality of solving the social and historical problems existing in the 19th century, where law consists only of standard and, therefore, understanding the concept of legal experience will give meaning to the unity of law, and engender the required integration between Philosophy of Law, Legal History and case law. Thus, those adopting a three-dimensional position will understand the law in terms of concrete experience. As such, the isolated analysis of fact, value and standard is insufficient.

The axiological-normative framework of the legal reality makes it the object of philosophy by examining values as a transcendental condition of the experience of law and of the Science of Law, as it challenges the valuations materialized in juridical models.

The discourse on the validity of law is set out by three interconnected criteria, namely the validity that corresponds to the formal enforceability of juridical precepts (standard); the effectiveness that is the effective social equivalence to its content (fact); and the foundation that are the values that legitimize it in a society of free men (value).

This way, the three criteria are linked together in a three-dimensional framework, with one or the other prevailing depending on the circumstances, and shall be understood under a dialectic of complementarity.

2.3. DEVELOPMENT OF THE THREE-DIMENSIONAL THEORY OF LAW

Miguel Reale reports that, still in his youth, he used to overthink the fact that the great philosophers of Italian law, among others, such as Icilino Vanni and Del Vecchio, agreed on splitting the Philosophy of Law into three parts: (i) one designed to examine the theory of legal phenomena; (ii) another aimed at the interests and values engaged in the legal experience; and, (iii) the last one referring to the theory of legal standard.

In 1934, due to the disquiet in his subconscious, Miguel Reale had the first insight of three-dimensionalism, whose theory evolved in 1940 by opposing to Kelsen's theory. Reale disagreed that law could be conceived exclusively as a legal standard, as it shows the path, with the fact being the starting point of the standard towards a given value.⁵ In other words, while the system created by Kelsen was limited to the knowledge and description of legal standards, i.e., law should be seen as a system of standard, for Miguel Reale law is standard, fact and value, and fact could not be related to legal standard in the absence of an investigation of the axiological dimension of the social fact.

For Miguel Reale, law is standard, fact and value for anyone who analyzes it. The idea of threedimensionalism persisted in his consciousness, so much so that in 1953 he had another insight concerning the idea of dialecticity of the three elements, that is, he envisaged that the three elements are not only correlated, but are dialectical.

Besides stating the factual-axiological-normative nature of law, the three-dimensional theory enables the enlightenment and solution of both known and new problems claimed by the surrounding world today. It is premised on the result of the objective verification of the axiological-normative consistency of the moment of legal experience submitted to spiritual comprehension.⁶

It is therefore observed that when the jurist stands to the theoretical level of the general principles and concepts required for interpretation, establishment and systematization of the precepts and institutes that make up the legal order, the analysis of values and facts shall be objective, verifying the value encompassed by the standard and the fact also outlined in the standard, moving away from a subjective analysis for systematization.

To effectively correlate fact, value and standard a shared and concrete way, two premises must take place. One refers to the concept of value, which plays a threefold role of constitutive, gnoseological and deontological element of the ethical experience. Another one relates to the existing implication between value and history, that is, between ideal demands and their referencing in the historical-social setting as value, duty to be and end. The analysis of both premises effectively evidences the dialectic nature of law.⁷

It is also worth emphasizing that one can only speak of three-dimensionality with reference to the plan of culture, since the material or spiritual goods that men build throughout history always assume a factual basis, a determinant value of action, and a legal standard.⁸

Law is included in the dimension of human life, i.e., it exists in the existential process of both the individual and the collective, thus giving rise to the existential dialectic of law.⁹

For example, when one interprets a legal standard prescribing the payment of a bill of exchange on the date of its maturity, under penalty of protest and recovery, the creditor enjoys the right to promote the credit foreclosure. The foreign exchange standard stands for a legal provision based on a fact of economic order, aimed to ensure a value - the value of the credit -, the advantage of payment as stated on the bill of exchange. Therefore, there is an economic fact that attaches to a guarantee value that is externalized through a legal standard that covers both elements.¹⁰

Thus, the legal standard depicts the value-based integration of facts, i.e., it portrays the values that are gradually realized in the conditionality of historical-social facts.

Therefore, wherever the legal experience occurs, law shall be analyzed by abstraction in its threefold sense, that is, through fact, value and standard, according to a dialectical process of implication-polarity or complementarity. Its unity assumes the existence of correlation among factual, axiological and normative aspects.

2.4. CONCRETION OF THE THREE-DIMENSIONAL THEORY OF LAW

It should be noted that sometimes the words contained in the legal standards remain immutable, but their meaning undergoes a process of enrichment due to the interference of other factors that come to provide a new spirit to the letter of the law, and may give rise to changes in the normative semantics¹¹: (i) the impact of new valuations, or unforeseen changes in the hierarchy of dominant values; (ii) the supervenience of facts that increase or decrease data of the normative incidence; (iii) the intercurrence of other standards that do not exactly revoke an existing standard, but interfere on its field or line of interpretation; and (iv) the conjugation of two or more of the three above mentioned factors.

When interpreting the legal standard, one shall consider its social purposes and the values it intends to ensure, so that the interpreter shall take into consideration the axiological and social coefficient contained therein, based on the historical moment it occurs. In other words, the interpreter retraces the path of the normative formula to the normative act, taking into account the facts and values that gave rise to them, as well as the supervening facts and values since, as Siches teaches, the legal standard undergoes changes to fit into the new reality being experienced.¹²

For that reason, Miguel Reale explains that the unaltered legal standard starts having different

interpretations ensuing from changes in the surrounding world, like in the transition from individualism to a social understanding of law. He refers to the changes to the interpretation of Article 924 of the 1916¹³Civil Code that allowed a judge to reduce eventual fines in the event of substantial settlement of the liability.

He refers to a case where a seamstress failed to pay 2 (two) of a total of 22 (twenty-two) installments of a sewing machine. However, the contract provided that, nonetheless, a fine would still be applicable, and until 1930 the prevailing interpretation was in the sense that it was an enforceable standard. However, the Court of Justice of São Paulo later understood that this legal standard was of public order, and was up to the judge to make a judgment of equity to the specific case. The judge understood the exception as null and void by law, and also decided for the partial reimbursement of the installments paid by the seamstress.¹⁴

That change of paradigm ensuing from a new social reality was expressly incorporated into article 413 of the 2002 Civil Code¹⁵, in compliance with the principle of sociality provided therein since, in opposition to the provisions of article 924 of the 1916 Civil Code, the current law is decisive when it prescribes that judges have the duty rather than the responsibility of reducing, contrary to the provisions of the revoked legal instrument. The standard is of public order, and does not allow the parties to deny its incidence, establishing that the fine provided for is irreducible.

Miguel Reale's three-dimensional theory of law is applicable, based on the interpretation of article 317 of the Civil Code jointly with articles 478 and 479 of the same Code, to also allow the debtor to make use of the contract revision mechanism for excessive cost, through judicial intervention, as it is understood that the provision of Article 317 of the Civil Code is applicable to all installments, as a means to solving new problems claimed by the current surrounding world.

In other words, the standard of unchanged Article 317 of the Civil Code, when considered jointly with articles 478 and 479 of the same Code comes to have a different interpretation. It is so because the surrounding world undergoes changes that require new interpretation, notably in the light of the exceptional period we are experiencing as a result of the COVID-19 pandemic, in order to avoid the resolution remedy, and ensure judicial review, as a way of providing efficacy to the principle of contract preservation.

This interpretation is grounded on the objective observation of the factual-axiological-normative

consistency of the moment of the current legal experience, which allows the jurist to navigate the logical-systematic framework of the Civil Code, evaluating the content of the standards, considering the values in force by that time.

In this sense, an example was the case involving the delivery service.¹⁶ By virtue of the restrictions imposed on trade by the public authorities, the claimant company doing business of delivery services and snacks sought before the judiciary the reduction of rental fees during the COVID-19 pandemic, on the grounds that the pandemic affected its business activity. The trial court of the District of São Paulo granted the petition for urgent relief for that purpose.

The Court of Justice held that the COVID-19 Pandemic fits into the theory of unpredictability and, therefore, "Article 317 of the Civil Code and Article 478 of the same Code authorize, for unforeseeable reasons, the adjustment of payments", but eventually amended the trial court's decision by virtue of failure to prove financial inability on the side of the plaintiff, as well as the fact that it had always provided delivery services and maintained earnings during the quarantine, i.e., it was not affected by the effects of the restrictions imposed in relation to the COVID-19 pandemic.

In the same sense the case involving bakery and mini-market services. ¹⁷ The claimant company sought the reduction of rental fees during the period of the COVID-19 pandemic, because of the restrictions imposed by the public authority that restricted the exercise of its business activity. The trial court's judge granted the petition for urgent relief for a 15% reduction of the rental fees of the property object of the rental contract.

The Court of Justice of the State of São Paulo understood that the "intended reduction of the rental fees, within the period of quarantine imposed by the public authority, equivalent to 85 % (eighty-five per cent) coronavirus pandemic framed by the concept of unpredictable supervenient fact triggering excessive onerousness, thus authorizing the review of the rental contract - exegesis of articles 317, 'caput', and 478, 'caput', both of the Civil Code", in a way to produce the "additional applicability of the theory of unpredictability", justifying the requisites of the exceptional measure, and upheld the petition of the claimant company to reduce the rental fees in 30 % of the value provided for in the rental contract, by virtue of the peculiarities of the specific case.

For Miguel Reale, the legal standard is somewhat flexible, so that variations in interpretations shall be compatible with it. However, at specific moments flexibility no longer withstands and is broken. It means to say that the standard ceases to match the needs of life, and shall be revoked to allow to emergence of a new normative solution.¹⁸

In this way, the issue of three-dimensionality of law got new features when it proved that where is a legal phenomenon, there is always an underlying fact (economic, geographical, demographic, technical fact etc.); a value that assigns given meaning to that fact, ruling the human action in the sense of fulfilling a given purpose; and a standard that represents the relation that connects one of those elements to the other, fact to value. These elements (fact, value and standard) do not exist apart, but coexist in a concrete unit. They serve as links of a process where the life of law results from the dynamic and dialectic interaction of the three elements that make it up.¹⁹

It is thus observed that Miguel Reale's threedimensional theory of law is concrete and dynamic from the legal experience and, therefore, law corresponds to the legal standard, the facts and the values that gave rise to it, as well as to the supervenient facts and values existing in a dialectical process of complementarity.

2.5. INFLUENCE OF THE THREE-DIMENSIONAL THEORY OF LAW ON THE BRAZILIAN CIVIL CODE

In addition to the changes of principles to the Civil Code resulting from the valuation of the principles of sociality, ethics and operability, undefined general clauses and legal concepts were also introduced, making room for the judge's interpretation to decide on the specific case.

The general clause is substantiated in a normative provision that deliberately employs an open, volatile or obscure language of comprehensive semantic scope, addressed to the judge to grant him competence, in the specific case, to develop legal standards through referral to elements that ground the decision. The decision implementation may be external to the system, ensuring the rational control of the sentence.²⁰

The undetermined legal concept has in the antecedent (factual support) vague and obscure terms, and its consequent effect is determined. Its solution is predefined in the law, and whenever the enforcer finds it occurred, the judge shall apply the solution established by the legislator to the specific case.

Since Miguel Reale was one of the jurists participating in the coordination and drafting of the current Civil Code, his three-dimensional theory of law influenced the Civil Code wording, including undefined legal concepts and general clauses in its provisions. That is mainly because due to their vagueness the provisions are endowed with great flexibility, which allows matching the variations of facts and values with time span and the development of society, not demanding a new normative solution.

For example, the Civil Code has general clauses on the social function of the contract (article 421 of the Civil Code), as a way to protect the interests of the party that is weak or disadvantaged in a legal relationship, or due to a dysfunctional behavior, and the objective good faith (Article 422 of the Civil Code), as a sort of integrative function complementary to the contract that assigns duties to the parties, that will contribute towards a reasonable interpretation of contracts. Moreover, the general clause on the social function of property (Article 1.228, paragraph 1 of the Civil Code).

Likewise, with regard to undefined legal concepts, for example, they are found in the provision of Article 423 of the Civil Code, dealing with the standard of interpretation in accession contracts, since the antecedent comprises the 'ambiguous or inconsistent' expressions that shall be evaluated by the judge, while the legal consequence has been previously defined by the legislator in the sense of 'adopting the interpretation that is most favorable to the adherent'. The same is true for Article 424 of the Civil Code that uses the expression 'adhesion' in the antecedent and defines its legal consequence, even though the judge will valuate that expression through the analysis of business circumstances.

Thereby, jurists started understanding private law as an open system, equipped with mechanisms that allow data entry, processing and return with minor changes, in order to contemplate Miguel Reale's three-dimensional theory of law. This is so because the theory is concrete and dynamic in the legal experience, since law corresponds to the legal standard, facts and values that gave rise to them, as well as the supervenient facts and values existing in a consistent dialectical process of complementarity.

III. RESULTS AND DISCUSSIONS

The research approaches the reflexes brought by the current Brazilian Civil Code in contractual relations, as well as the Brazilian Courts have applied Miguel Real's Three-Dimensional Theory to solve new problems.

The concretion of general clauses established in the infra-constitutional laws, supported by the constitutional case law on fundamental rights, prevents the issuance of new laws every time a new problem arises²¹, and allows updating the Civil Code accordingly to the development of social facts.

The Superior Court of Justice, in the judgment of the special appeal 159.213/RS, expressly applied the threedimensional theory of Miguel Reale when deciding on the immunity from seizure of a leased property of a debtor, on the grounds of the applicability of the prohibition provided for in Article 1 of Law 8.009/1990, as follows: (i) Law No. 8.009/1990 normative obligation that restrains the general principle of the law of obligations, according to which the assets of the debtor is accountable for the debts of a debtor, whose interpretation shall always be driven by its leading purpose, considering the specific circumstances of each case; and, (ii) under a teleological and evaluative interpretation, actually grounded in the three-dimensional theory of law-fact, value and standard (Miguel Reale), lives up to the benefits of Law 8.009/1990 the debtor who, even if not residing in the only property of said debtor, uses the amounts earned from the lease of that property as complement to the family income, considering that the objective of the standard was observed, namely that of ensuring the family housing or livelihood.

In that specific case, the Court considered whether the legal hypothesis provided for in article 1 of Law 8.009/1990²² on the immunity from seizure for family assets, could be extended to the debtor who is not residing in the property, given that this factual support is not expressly provided for in the provision that provides that 'are owners and reside in it'.

The Highest Court of Justice held that if the only residential property of the couple or the family entity is leased, serving as income for the family who move into a rented property, it does not lose its intended purpose that remains that of guaranteeing family housing. This interpretation is based on the integration of fact, value and standard, with the preponderance of the first two, as a way of protecting the debtor's assets.

The Rio de Janeiro State Court of Justice, in the trial of the Civil Appeals 0419877-04.2010.8.19.0001²³, decided for the conviction of an engineering company for non-material damage to the condominium, based on Miguel Reale's three-dimensional theory of law, as follows: (i) the non-material damage [is] configured because the condominium may be equated with the legal person, according to enunciation 227 of the STJ Summary, by virtue of the modern legal theory of a civil system that is open and dynamic, and according to Reale's threedimensional theory of law towards extending the realities of fact, value and standard; (ii) Bill 80/2011 and enunciation 144 of the Third Journey of Civil Law that steps closer to the suffrage of that understanding; (iii) disturbances and position of helplessness of the condominium (and co-owners) in face of the vendor that

go beyond mere annoyance, considering the need to address the complaint to the court pursuing for remedy, as well as the abusive protest of debt in the circumstances of unenforceability; and (iv) non-material damage fixed at R\$ 10,000.00 (ten thousand reais), adjusted after publication and arrears interest of the summons.

In that specific case, the condominium filed a contract termination suit claiming for interim relief and compensation for non-material and material damages against an engineering company, on the argument of existence of flaw in the delivery of services that caused several inconveniences to the condominium.

The respective Court of Justice, by upholding the appeal of the condominium towards convicting the engineering company for non-material damages, understood that although the classical legal theory of the 1916 Civil Code perceives the condominium as an entity with no legal personality, the modern legal theory with analysis of the 2002 Civil Code, based on Miguel Reale's three-dimensional theory of law, which inspired the open and dynamic system, started appreciating article 44 of the Civil Code as non-imperative, but illustrative, as the enunciate 144 of the Third Civil Law Journey of the Federal Justice Council came to interpret when it asserted that "The relationship of legal persons governed by private law set out in Article 44; subparagraphs I to V of the Civil Code is not exhaustive".

Therefore, it considered that the condominium is comparable to the legal person for the purposes of enunciate 227 of the STJ Summary, which allows the recognition of non-material damage to the legal person.

On the other hand, the Highest Court of Justice²⁴, in the judgment of the AgRG in REsp 841.942/RJ, recognized the existence of general clauses in the legal order and, given their relevance, the judge may judge the questions inherent to them irrespectively the request of the party or stakeholder, as follows: (i) where the judge has to decide irrespectively the request of the party or stakeholder that occurs, for example, with matters of public order, the rule of congruence is not applicable. It means there will be no extra judgment, ultra et infra petita when the judge or court decides ex officio on said matters of public order; and, (ii) some examples of matters of public order: a) substantial: unconscionable contractual clauses (articles 1 and 51 of the Civil Law Code); general clauses (sole paragraph of Article 2035 of the Civil Code) on social function of the contract (article 421 of the Civil Code), social function of the property (article 5, XXIII, and 170, III, of the Federal Constitution, and article 1228, paragraph 1, of the Civil Code), social function of the company (article 170 of the Federal Constitution; articles 421 and

981 of the Civil Code), and of objective good faith (article 422 of the Civil Code); simulation of legal act or business (articles 166, VII and 167 of the Civil Code).

In that specific case, the Federal Government brought a special appeal before the Highest Court of Justice, preliminarily alleging infringement of Article 535 of the Civil Procedure Code/1973 and, on the merits, denial of effectiveness of articles 460 and 467 of the CPC/1973 in order to rediscuss the right to indexation with incidence of monetary losses due to inflation, recognized in the sentence uttered by the Court of origin, which was not even object of express request.

The Highest Court of Justice, however, held that the existence of general clauses, for being inserted in matters of public order, allows the judge to address the question, irrespectively the request of the party or stakeholder, not giving rise to violation to the principle of congruence, given its relevance.

IV. CONCLUSION

Miguel Reale's three-dimensional theory dissents from the classical interpretation based exclusively on the subsumption of fact to the norm, by adding the element of value in a dialectical process of complementarity with the other two elements. Therefore, it enhanced the process by absorbing the impact of new valuations, supervenience of new facts, and intercurrence of other standards resulting from the development of the surrounding world.

Hence, wherever the legal experience occurs, law shall be analyzed by abstraction in its threefold sense, that is, through fact, value and standard, according to a dialectical process of implication-polarity or complementarity. The unit to be implemented by the jurist assumes an existing correlation between the physical, axiological and normative aspects.Because of that the current Civil Code, through the incorporation of Miguel Reale's three-dimensional theory, notably by means of general clauses, allows the law enforcer to retrace the path of the normative formula to the normative act, considering the facts and values that gave rise to it, as well as supervenient facts and values, in order to keep pace with vicissitudes, ruling out the need for a new normative formula.

The concretion of the general clauses established in the infra-constitutional laws, supported in the case law, thus avoids the issuance of new laws whenever any new problem arises, and allows updating the Civil Code in the light of the development of social facts.

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- [12] ¹² DINIZ, Maria Helena. Compêndio de introdução à ciência do direito, 27ª ed., Saraiva, 2019, p. 453-454.
- [13] ¹³ Article 924. Where an obligation is partially fulfilled, the judge may proportionately reduce the sanction established in the event of late payment or failure to pay.
- [14] ¹⁴ Teoria tridimensional do direito, Ed. Saraiva, 5^a ed., 1994, 125.
- [15] ¹⁵ Art. 413. The sanction shall be equitably reduced by the judge if the primary obligation has been partially fulfilled, or if the amount of the sanction is manifestly excessive, considering the nature and purpose of the business.
- [16] ¹⁶ TJSP; Interlocutory Appeal 2195502-42.2020.8.26.0000; Rapporteur: Court Judge Silvia Rocha; Judging Authority: 29th Chamber of Private Law; Central Civil Jurisdiction - 13th Civil District Court; Date of Judgment: 10/22/2020; Date of Registration: 10/22/2020.
- [17] ¹⁷ TJSP; Interlocutory Appeal 2150756-89.2020.8.26.0000; Rapporteur: Court Judge Tercio Pires; Judging Authority: 34th Chamber of Private Law; Regional Jurisdiction III -Jabaquara - 3rd Civil District Court; Date of Judgment: 10/16/2020; Date of Registration: 10/16/2020.
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- [22] ²² Art. 1 The residential property of the couple, or of the family entity, is immune to levy execution, and will not be

accountable for any kind of civil, business, fiscal, social security or other debts incurred by the spouses or by the parents or children who own it and reside in it, except in the cases provided for in this law.

- [23] ²³ TJRJ, Proceeding 0419877-04.2010.8.19.0001, 27th Civil Chamber, Judge Antônio Carlos dos Santos Bitencourt, Date of judgment: 12/12/2014.
- [24] ²⁴ AgRg in REsp 841.942/RJ, 1^a T., Rapporteur Minister Luiz Fux, Date of judgment: 06/16/2008.

Work-life balance of engineering professionals: A bibliometric analysis

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Abstract— The concept of work-life balance refers to achieving a balance between professional and family life through the management, organization and prioritization of family tasks and work routines. This study aims to review the literature on the work-life balance of engineering professionals through a bibliometric analysis, evaluating the evolution of the concept since its inception. The study was based on a bibliometric analysis of 58 articles from the Scopus database, from 2006 to June / 2020. The following bibliometric techniques were used using the VOSviewer software: citation analysis, co-occurrence of authors and keywords. In addition, an analysis of publications by year, countries, institutions and most influential journals is carried out. The results show that this study presented significant managerial and academic contributions. In the managerial factor, it contributes to the fact that intervention policies on the part of the industries are carried out with engineers, in relation to job satisfaction, health and safety, which were the main aspects identified that impact on the work-life balance of engineering professionals. It is also worth mentioning the organizational climate, identified as a factor that impacts the satisfaction and, consequently, the work-life balance of female engineers, who live in a work culture dominated by men. As an academic contribution, it provides comprehensive data from the main authors, journals, institutions and countries that have shaped the literature in this field of research. When analyzing the gradual evolution of the concept over the years, it indicates that the theme has not been exhausted and studies are still needed to continue the research.

Keywords— Work-life balance, balance, work, family, engineering.

I. INTRODUCTION

There are several approaches that define work-life balance. Malone and Issa (2013) state that work-life balance is related to increasing efficiency at work, through time management to achieve a balance between work and family. Soni and Bakhru (2019), complement when conceptualizing that the work-life balance is the state of equivalence perceived and reached in the roles of work and family, in such a way that access to one domain increases the success of the other. According to Helen et al., (2010), the work-life balance encourages the individual to divide their time based on priorities.

Researchers have attempted to conceptualize work-life balance in the field of engineering professionals in general, through theoretical frameworks (Chan et al., 2020; Sairam and Ramakrishnan, 2020; Ragothaman et al, 2019). In addition, studies link work-life balance with job satisfaction of engineering professionals, through empirical research. Managers need to seek alternatives to achieve the work-life balance of the engineering collaborators, with the objective of maintaining the wellbeing of the professionals combined with the productivity of the industry (Chan et al., 2019; Francis and Prosser, 2013).

However, no studies were found in the literature that carried out a bibliometric analysis on the work-life balance of engineering professionals in an attempt to identify the development of this concept over the years. Review studies by authors such as McFedries and Jurgenson (2013) and Pierce (2006), address some ideas about the experiences of professional engineers, assessing workload hours and working time at home and on weekends, which impacts on the time available for family demands.

As such, there is a limitation in studies that assess the difficulties faced by engineers in the work-life balance. There is a research gap that comprehensively assesses the concept from its inception to the present years.

Therefore, our objective in the present study is to review the literature on the work-life balance of engineering professionals, through a bibliometric analysis in an attempt to answer the following research questions:

i) Which the authors, institutions, journals and countries contribute most to the analyzed area of the study?

ii) What are the main aspects that impact the work-life balance of engineering professionals?

This section presented the introduction and objectives of the research. The next section describes the methods used. Following, the results and discussion of the bibliometric analysis are highlighted. Finally, the conclusion is presented with the limitations and suggestions of future studies.

II. METHODOLOGY

This study was based on data from Scopus, a comprehensive database widely used by researchers for bibliometric analysis in various areas. The Scopus database was chosen because it is among the largest bibliographic references in the multidisciplinary field of science. In addition, it is the largest base of abstracts and peer-reviewed articles, with wide coverage of journals classified with a high impact factor (Norris and Oppenheim, 2007). The study used a combination of keywords with truncation symbols and Boolean operators: "work-life balance" AND (engineering OR engineer*).

The study restricted the analysis to only the engineering discipline, giving a specific focus on a single area of investigation. The years of publication identified vary from 2006 to 2020, and the search was carried out in June / 2020. In addition, conference articles and book chapters have been eliminated from the study.

According to the conditions that were mentioned, the research presented a result of 65 articles. However, after reading the titles and abstracts of the articles, some were not suitable for the purpose of the research. For example, in the study by Kaur et al., (2018) entitled *"Work-life balance of women working in education"*, the object of study refers to the work-life balance, however, the research public and the journal are not in the engineering area. A total of seven examples not suitable for the study were eliminated. Finally, after a rigorous selection and complete reading methodology, 58 articles were selected to investigate the research question.

To perform bibliometric analysis techniques, such as citation analysis and co-occurrence of key words and authors, we used the VOSviewer software. After extracting the files, this software creates visual maps for analyzing data from bibliographic references, being easy to interpret (Van Eck and Waltman, 2009).

III. RESULTS AND DISCUSSION

This section presents the following results: most cited documents; publications by year, countries, journals and most influential authors, as well as analysis by keywords. We performed an analysis of the general data. The results show a total of 58 articles written by 147 authors and co-authors from 96 institutions, with publications in 38 journals and a total of 1581 references cited (Table 1).

Table 1. General survey data

Criterion	Quantity
Article	58
Authors	147
Institutions	96
Journals	38
References cited	1581

These data highlight a general analysis of all the articles reviewed in the research on the work-life balance of engineering professionals. The revised publications were analyzed according to the year of publication and an interesting evolution can be seen (Figure 1).



Fig 1. Number of publications per year

From 2006 to 2015, there is a variation between one and three publications. From 2016 to 2019 there is a gradual growth in publications. As the analysis was carried out in June, it is assumed that the year 2020 would register more publications when compared to the previous year.

Articles that obtained their studies with more than ten referenced citations were selected (Table 2).

Table 2. List of main articles according to number of citations

Ra nk	Article	Citations
1	The extent of regulatory consensus on health and safety expenditure part 1: Development of the J-value technique and evaluation of regulators' recommendations (Thomas et al., 2006).	48
2	The rhythms of project life: A longitudinal analysis of work hours and work-life experiences in construction (Helen et al., 2010).	38
3	On modeling telecommuting behavior: Option, choice, and frequency (Singh et al., 2013).	25
4	Sound the alarm: Health and safety risks associated with alarm response for salaried and retained metropolitan firefighters (Paterson et al., 2016).	20
5	Work-life balance and organizational commitment of women in the U.S. construction	15

industry (Malone e Issa, 2013).

6	Stress among South African construction professionals: a job demand-control-support survey (Cattell et al. 2016).	13
7	Predictive models for work-life balance and organizational commitment of Women in the U.S. construction industry (Malone e Issa, 2014)	13
8	Women engineers and work life balance a case study of women working in manufacturing industries in Mysuru city (Raghavendra e Raghunanda, 2018)	11

Of the analyzed articles, eight obtained more than ten referenced citations. The study entitled "The extent of regulatory consensus on health and safety expenditure part 1: Development of the J-value technique and evaluation of regulators' recommendations" (Thomas et al., 2006), was rated as most relevant with 48 citations. In this article, research engineers at the University of London (England), develop a technique with an index of quality of life according to the life expectancy, average income and work-life balance of professional engineers. The method is used to assess the degree of consensus on health and safety expenditures of professionals in different sectors of the industry.

The second most cited is the article entitled "The rhythms of project life: A longitudinal analysis of work hours and work-life experiences in construction" (Helen et al., 2010), with 38 citations. In this study, the researchers collected data from civil construction engineers regarding hours worked, satisfaction with the work-life balance and the ability to complete the necessary tasks at work and at home. It was found that the working hours were significantly in line with the participants' ability to complete tasks at work and at home, but not satisfaction with the work-life balance.

Next, an analysis of the most influential authors was carried out. The criterion of authors who presented more than 30 citations was adopted (Table 3).

Rank	Authors	Citations
	I 's seal II	55
1	Lingard H.	55
2	Francis V.	46
3	Alghaffar M. A	46
4	Stupples D. W.	46
5	Thomas P. J	46
6	Helen C. L.	38
7	Turner M.	38
8	Issa R. R. A	35

Table 3. List of the most influential authors

The authors' influence is measured by the number of citations of the articles published on the work-life balance of engineering professionals. In these conditions, the author Helen Lingard appears as the most influential with a total of 55 citations.

About the institutions, the University of Florida (USA), University of Melbourne (Australia) and Tun Hussein Onn University (Malaysia), were the ones that stood out the most with two publications each.

With a total of 38 journals, five most influential journals with three or more publications were selected (Table 4).

Table 4. List of the most influential journals

Rank	Journal	Number of articles	Citations
1	Journal of Professional Issues in Engineering Education and Practice	4	36
2	Evaluation Engineering	4	1
3	Construction Management and Economics	3	99
4	Journal of Construction Engineering & Management	3	21
5	International Journal of Engineering and Advanced Technology	3	4

In number of articles, the "Journal of Professional Issues in Engineering Education and Practice" and "Evaluation Engineering" appear with greater prominence. Regarding the number of citations, "Management and Economics" is the most influential with 99 citations.

A total of 17 countries were identified that published on the work-life balance among professional engineers, among these, nine appear with more than one publication (Figure 2).



Fig 2. Number of publications by country

The USA appears as the most influential country with 12 publications, followed by India and Australia, with 11 and 10 publications. Frehill (2006) conducted a survey of engineering professionals in the United States, and showed that the main reason that impacts men's work-life balance was the frequent concern of having to leave the field and seek opportunities for progress, or even others professional issues like salary. For women, the main reason was the negative organizational climate.

A study in India shows similar results for female engineers. Vettriselvan et al. (2019) conducted a survey of 50 female engineers, where most feel insecure in the workplace. In industrial work, women aim to satisfy the family's economic needs, the freedom of traditional society and social recognition. Therefore, gender inequality and, as a result, the negative organizational climate at work, ends up impacting the work-life balance.

A visual map of keywords was created using a complete counting method, with a minimum number of three occurrences, resulting in 28 out of a total of 412 keywords (Figure 3).



Fig 3. Co-occurrence of keywords

The keywords that most stand out in the theme are "work-life balance", "job satisfaction" and "construction industry". It is possible to observe that the work-life balance is related to job satisfaction of engineering professionals. Being the construction industry area the one that stands out the most in relation to publications in the analyzed field.

According to Chan et al. (2019), in China the imbalance between professional and family life is a factor found in the construction industry, this ends up harming the attraction of young engineers to the industry, with health and safety in the workplace being the most critical factors that impact no work-life balance. The same fact is found in Australia in the study by Francis and Prosser (2013), which ends up worrying industrialized countries regarding the aging of the workforce in the area of Civil Engineering.

The largest cluster (red) consists of eight keywords: "employment", "engineers", "job satisfaction", "job security", "personnel training", "professional aspects", "societies and institutions" and "wages". The main aspects that impact the work-life balance of engineering professionals are perceived: (i) job satisfaction and (ii) health and safety at work.

In the first aspect identified, career satisfaction through work is a fundamental tool to increase the performance of engineers (Martínez-Leon et al., 2018; Wei et al, 2016). The second aspect identified involves the CSR (Corporate Social Responsibility) practices of the industry, which include health and safety at work (Chan et al., 2019; Ling, et al., 2016). The lack of this internal dimension of CSR has a significant relationship with the commitment to the continuity of engineers in the profession (Al-Bdour et al., 2010).

The second largest cluster (green) consists of seven keywords: "work-life balance", "quality of life", "organizational commitment", "occupational risks", "human resource management", "health and safety", "engineering research" and "engineering". There is a relationship between the engineering area and the applied social sciences, because human resources management stands out among the articles evaluated, with studies involving occupational risk, health and quality of life of engineering professionals (Sairam and Ramakrishnan, 2020; Kannika and Chockalingam, 2019; Kumar and Chaturvedi, 2018).

IV. CONCLUSION

This research presented a study on the work-life balance of engineering professionals and a mapping of the development of the concept since its identification in the literature. The research used a bibliometric analysis of 58 articles in 38 journals from 2006 to June 2020. To answer the questions that were raised, an analysis of citations and co-occurrence of keywords and authors was carried out, in addition to the analysis by year most influential publications, countries and journals.

First, a general analysis of the data was carried out which showed that the concept has grown steadily over the past five years in terms of quantity of publication. With regard to the emphasis on referenced citations, the study entitled "The extent of regulatory consensus on health and safety expenditure part 1: Development of the J-value technique and evaluation of regulators' recommendations" (Thomas et al., 2006), was evaluated as most relevant with 48 citations. The USA and India appear as major influencers in the field of engineers' work-life balance, with studies that mainly assess issues of gender inequality and the organizational climate as an impact of the imbalance between the professional and family life of female engineers. In relation to journals, the "Journal of Professional Issues in Engineering Education and Practice" and "Evaluation Engineering" appear with greater prominence in the quantity of publications.

In a second stage of the research, the co-occurrence of keywords was performed. The keywords that most stand out in the analyzed theme are "work-life balance", "job satisfaction" and "construction industry". It is noticed that the work-life balance is related to job satisfaction of engineering professionals. The construction industry area appears more prominently in relation to publications in the analyzed field. It was identified that the main aspects that impact the work-life balance of engineering professionals are: job satisfaction; and health and safety at work.

This study presented managerial and academic contributions. In the managerial factor, it contributes to the fact that industrial intervention policies are carried out with engineers in relation to job satisfaction, health and safety, which are the reasons why young engineers may not pursue careers in civil construction, in disagreement with expectations of a set of work-life balance. The organizational climate is also emphasized as a factor that impacts the satisfaction and, consequently, the work-life balance of female engineers, who live in a work culture dominated by men. As an academic contribution, it provides comprehensive data from the main authors, journals, institutions and countries that have shaped the literature in this field of research. When analyzing the gradual evolution of the concept over the years, it indicates that the theme has not been exhausted and studies are still needed to continue the research.

Despite the methodological rigor in investigating the theme, this study has limitations. The study worked only with the Scopus database, in order to avoid duplicates, however, not including bases such as Web of Science (WoS) and ScienceDirect can lead to the exclusion of valuable articles in the field of engineers' work-life balance. As future research, it is suggested a research that includes other representative databases in the area of engineering

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Evolutionary analysis of cellular mobile phone technologies

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Abstract— This work presents a broad view of the evolutionary process in mobile systems focused on data transmission, through its characteristics it will be possible to understand the evolutionary process such as: Infrastructure, evolution of voice, data and image transmission signals. In the last decades several technologies in the area of telecommunication, known as generations, this terminology, with a number accompanied by a letter G, has a common history as: the evolution of information transmission technology without using wires, which begins with the first cell phones between 1970 and 1980 decades, during that period there were many changes, although the principle of wireless data transmission still remains. We seek to characterize this evolution until reaching the Fifth Generation, or 5G wireless device technology, which promises a higher data transmission speed compared to the other previous generations, showing dynamically the communication between different devices without the use of cables or other larger structures between devices.

Keywords— Generations, Wireless technology, Mobile telephony.

I. INTRODUCTION

The evolution of cellular mobile communication seeking to meet the needs of its users has enabled the emergence of several technologies. In this work, the evolution of cellular mobile communication, the technical requirements, technologies involved, characteristics and applications in the five generations of mobile communication networks will be presented.

The first generation mobile networks, wireless mobile phone technology depended on analog radio systems, so users could only make phone calls, but they could not send or receive text messages, as they depended on external modems attached to the devices for exchange data, and had download speeds that were always below 10 Kbits per second. The 1G network was replaced by the 2G that operated with a digital signal, not analog, with speeds of about 32 Kbps to 80 Kbps for the end user. Thus, users could send SMS and MMS messages and when GPRS was introduced in 1997, users could receive and send e-mails on the move [1].

[1]; [2] They mention that 3G started to be offered in 2001, in regions such as Japan, China and Europe through the UMTS system, allowing a greater amount of data, where at that time users could make video calls, share files, browse the Internet, watching TV, instant messaging and social media, quality streaming, downloads and playing online.

The introduction of 4G is five times faster, with speeds of up to 100Mbps download, 50Mbps upload and a latency (PING) of a maximum of 30 ms(milliseconds). All cell phone models launched since 2013 support this network [2].

The 5G network is to be launched, but is widely expected by the mobile phone industry, and there may be changes in the network, the way we use cell phones and the connection mold. Wireless technological evolution increasingly seeks to create smaller devices by changing the way we communicate.

The purpose of the proposed study is to describe the evolution of mobile network technologies and relate them to current 5G technology and their respective applications.

II. MATERIALS AND METHODS

This study is a descriptive and qualitative research for the collection of information, consulting in different electronic media, also with a scientific basis. Descriptive research has the primary objective of describing the characteristics of a given population or phenomenon, and qualitative exploratory research that aims to provide greater familiarity with the problem, with a view to making it more explicit and in possession of this information. It will be addressedhow is the status of 5G technology.

III. RESULTS AND DISCUSSION

[2] It says that the basic architecture of a cellular system consists of three components: Mobile Station (MS), Switching and Control Center (SCC) and Radio Base Station (RBS). In terms, the mobile units are in direct communication with the Radio Base Stations (RBS) through a radio connected to the Control Center by physical means of transmission. Thus, an ERB can exchange data with a single SCC, a SCC can communicate with several RBSs, being a fundamental part of the Mobile Communication System, given its coordination of functions and actions linked to the state of calls and the system.

According to the evolution process of cellular networks, as stages marked by technological advances and divided in Generations.

First Generation Systems (1G)

The AMPS analog system (ADVANCED MOBILE PHONE SYSTEM) is a North American standard that uses the 800 MHz band, it was invented by Bell Labs that operates in the frequency range from 824MHz to 894MHz with low quality connections, excessive consumption of battery and the ability to intercept and listen to users' communication. In AMPS it was already possible to communicate data through protocols such as X.25, allowing rates between 9Kbps and 14Kbps, first installed in the USA in 1982 and then in England and Japan [2]. Thus, the characteristics of the first generation are: a frequency of 800 MHz and 900 MHz, bandwidth: 10 MHz, with analog technology, frequency modulation (FM), its service mode was only voice, given poor voice quality. Interference, battery life was low, cell phones were large, calls could be decoded using an FM demodulator, number of users was limited, roaming was not possible between similar systems [3].

Second Generation Systems (2G)

The second generation systems were marked by several technologies, namely: GSM (Global System for

Mobile Communications), TDMA or D-AMPS (Time Division Multiple Access), IS-136 and IS-54 with digitized voice signal from 64Kbps on the IS-136 and compressed to 8Kbps on the IS-54 [4]. The OIS-136 and IS-54 are encryption and privacy algorithms accepted in TDMA, the modulation was done using the DQPSK technique with a rate of 48.6Kpbs for digitizing the voice and the data rate limited to 14Kbps [2]. In addition, CDMA (Multiple access by code division) has evolved to GPRS and EDGE, PDC (Personal digital cell phone) and PSC 1900 (Personal communication service), improving the quality of services [5].

The CDMA (Code Division Multiple Access) IS-95A or CMDAOne, has an architecture similar to that of AMPS and uses the same frequency range and some additional elements to compose the network as the BSC (Base Station Controller) responsible for controlling a group of ERB's, the HLR (Home Location Register) and the VLR (Visitor Location Register) which in turn are databases responsible for the information of subscribers and visitors on the network, the voice signal was digitized (via vocoders) at 13Kbps or 8Kbps . In CDMA the signal is modulated in QPSK uses spectral spreading techniques, and the GPS (Global Positioning System) system uses the CDMA technique with unique codes for its correlation properties which is much higher than TDMA, in CDMAOne the maximum data rate it is still limited to the same 14Kbps of TDMA [2].

GSM (Global System Mobile for Communications) is the most widely used digital cellular technology in the world and is based on TDMA networks, as it has a low cost of infrastructure and user authentication and entry into the network is done through data recorded on a smart card. Composed of some units such as CPU and ALU Timer, I / O Port, Security and Pure Logic, RAM, ROM and EEPROM memories, the user only needs to change the SIM Card to maintain the line and subscription data without the need for reprogramming on the cell phone [5]. Thus, GSM networks were allocated in 4 frequency bands: 850MHz, 900MHz, 1800MHz and 1900MHz. For the end user, the GPRS (General Packet Radio Service) increased data transfer rates in GSM networks to speeds of around 32 Kbps to 80 Kbps [4].

2.5G - Evolution of the Second Generation

The handsets decreased, however the data became 14Kbps and the networks started to use the following systems: multiple access by time division CDMA-One evolve to CDMA-1xRtt (CDMA IS-95C or CDMA2000 1x) and networks GSM-CSD and HSCSD for GSM-GPRS and GSM-EDGE networks. The EDGE standard (Enhanced Data Rates for Global Evolution) known as 2.75G, quadruples the speed improvements of the GPRS standard to a theoretical throughput of 384 Kbps, allowing to achieve theoretical throughputs of 473 kbit/s, being limited to the IMT-2000 specifications. (International Mobile Telecommunications-2000) from ITU (International Telecommunications Union), this evolution introduces a new hierarchical system of cells: macro-cells, micro-cells and pico-cells [3].

In the second generation the technology offered digital services, encrypted voice services and SMS text messages (short messaging service), access to e-mail and a small access to internet resource with a data rate of 64 ~ 144 kbps, and devices with IMEI and SIM card with some storage kbits, international roaming, limited number of users and hardware capacity, frequency from 850 to 1900 mhz.

Third Generation 3G Systems

At the end of the year 2000, the use of the third generation of wireless networks for mobile devices was made when smartphones appeared, with calls and SMS's, increased data transfer, real-time video transmission, access to streaming services, contact book, appointment book, calculator, world time, ring tones, personalized, color displays, digital photo camera, theme customization, digital service technology [4].

HSPA (High Speed Packet Access) is based on two protocols: HSDPA (High-Speed Downlink Packet Access) technology, a third generation 3.5G mobile phone protocol, where the speeds can reach approximately 8 to 10 Mbits / if used W-CDMA encoding and HSUPA (High Speed Uplink Packet Access). Both work using 5 MHz carriers, but HSDPA is directed to download, while HSUPA, in addition to this aspect, also focuses on uploading. HSPA + (HSPA Evolved) and 3.75G technology is one of the updates that work with rates of up to 168 Mb / s for download and 22 Mb / s for upload and among the factors that contribute to speeds is the use of MIMO (Multiple Input Multiple Output).

CDMA-2000 1xEV (Evolution Data) is an improved version that has two classifications: CDMA-2000 1xEV-DO (Data Only), which implements data channels; and CDMA-2000 1xEV-DV (Data and Voice), which allows the use of channels for both voice and data. CDMA-2000 technologies can work with various frequency bands, such as 450 MHz, 850 MHz, 1.9 GHz and 2.1 GHz [3]; [4].

Fourth Generation 4G

The service technology marked by LTE (Long Term Evolution) technology is based on data transmission using WCDMA and GSM technology.

It is based on IP technology in which it started to prioritize data traffic over voice traffic. It features features such as the Internet access service in real time with videos and Digital TV, Streaming and high definition video games, devices with IMEI, dual SIM memory card with 100 MHz bandwidth storage Mbits, latency time decreased to 5 ms and at theoretical average rates of 1 Gbps in the case of downlink, and 0.5 Gbps in the case of uplink and speeds of 100Mbps [6]. The actual rate achieved is 200 Mbps in Brazil for uplink and the frequency range used is between 2.5-2.690 MHz.The speed aspect, the level of compatibility of devices with LTE is determined in categories:

Category 1: download up to 10 Mb / s; upload up to 5 Mb / s; Category 2: download up to 50 Mb / s; upload up to 25 Mb / s; Category 3: download up to 100 Mb / s; upload up to 50 Mb / s; Category 4: download up to 150 Mb / s; upload up to 50 Mb / s; Category 5: download up to 300 Mb / s; upload up to 75 Mb / s.

While UMTS (Universal Mobile Telecommunications Service) and HSPA technologies are based on the W-CDMA standard, LTE uses the OFDMA (Orthogonal Frequency Division Multiple Access) specifications, which distributes transmission information among several parallel subsets of carriers favoring higher speeds for the downlink (download). Regarding uplink (upload), the scheme used is the SC-FDMA (Single Carrier Frequency Division Multiple Access), this manages to reduce the power and energy consumption by the devices [4]. The WMAN (Wireless Metropolitan Area Network), and IEEE 802.16 standards, the WiMAX (Worldwide Interoperability for Microwave Access), which provides for compatibility and interoperability between equipment based on the IEEE 802.16 standard compatible with Linux systems and IEEE 802.20, Mobile-Fi. The great similarity of the different 4G technologies is the use of the OFDM (Orthogonal Frequency Division Multiplexing) modulation technique [7].

Fifth Generation 5G

In 2015 the study of the 5G generation began, based on improvements to the LTE-M and NB-IoT, promising to improve three important characteristics: density coverage, device and battery life. The improvement of the architecture together with the advanced physical communication technology, such as high-order multiplexing and multi-input spatial multiplexing (MIMO), will provide greater simultaneous access capacity with intelligent and heterogeneous connection transmission accessed by a large number of devices wireless.

Technically, the 5G will introduce new elements like 5Gcore (5GC), and a new radio access technology called 5G New Radio (NR) is also expected to meet the requirements of IMT-2020. [7] describes the ITU-R and provides more advanced features compared to 4G LTE (IMT-Advanced) [8]. Code Division Multiple Access (CDMA), Orthogonal Frequency Division Multiplexing (OFDM), Operator Code Division Multiple Access (MCCDMA), Ultra WideBand (UWB), Local Multipoint Distribution Service (LMDS) and IPv6 network integrated and supported with each other, huge data capabilities, unlimited call volumes and infinite data will bring the world the opportunity for uninterrupted access to universal information, allowing consumers to enjoy high-speed streaming to devices in residential environments and for services collaboration between companies evolve [9]; [10].

This is how it should be understood: Core Net Work, the central element of the mobile communication system and its main activities is circuit switching, packet switching, charging, signaling with other networks and a database [11]. In the last generations of the mobile phone system, the (Home Location Register) and AUC (Autenthication Center) were introduced in the system mechanisms for with storing, identifying and authenticating users; RAN (Radio Access Network), aerial interface whose functions are: transmission and reception, channel coding and allocation, error correction and detection, power control, handover control, signal encryption, in addition to other functions; The UE (user equipment), set of the mobile terminal and its subscriber identifier USIM (Universal Subscriber Identity Module) [12]; [13].

In terms of physical characteristics, the spectrum can be divided into three frequency bands: up to 1GHz, up to 6GHze above 6GHz. The technical requirements established by ITU to IMT-2020, specify that telephone operators need at least 100 MHz of band and for frequencies above 6 GHz, the requirement is up to 1 GHz of band per operator [8]; [14].

Beamforming techniques can be used both at the transmitter and at the receiver, in order to increase the signal-to-noise ratio (SNR) and / or the margin of the communication budget link to compensate for losses in the mobile radio environment [13].

Every decade, a new generation of mobile services has emerged, with very different bandwidth and

conditions for the use of the radio spectrum, leading to possible needs for periodic reorganization of the available radio frequency bands (spectrum refarming). Brazil takes another step towards the deployment of 5G in a faster way for population access, and the certification requirements for 5G equipment were built based on international standards. With the publication of these requirements, the equipment industries are preparing to submit the first requests for approval of 5G equipment with Anatel [9]; [15].

IV. CONCLUSION

The telephone networks since its emergence, has undergone many transformations in telecommunication, and with these changes new technologies have emerged, that enabled communication between mobile devices with high performance even in places of difficult access. The analog signal became digital, the telephony device that previously had a fixed location, became a mobile device, with internal storage capacity, and now has access to the internet through wireless technology.

The 5G Technology is not a new technology, despite the name, but the unification of two previous generations the 3G and the 4G, in addition to an improvement in devices such as antennas for the distribution of signals, so that there is no loss or interruption of the signal. There is an expectation around this technology, the 5G is not only a necessity, but also a big bet on the future in addition to connecting our phones or computers, the internet of things (IoT) aspires to hyperconnectivity, the ability to simultaneously connect our homes (domotics), cars, watches and cities to the network.

In order to process, analyze and take advantage of the amount of data that this would support, constant stability is required. The 4G cannot guarantee these multiple connections, so it is necessary to implement the 5G.

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Tuberculosis and the under reporting of cases that evolved to death: Integrative Literature Review

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Abstract—Objective: This study aims to analyze the trends in scientific production on deaths from tuberculosis and the underreporting of cases, through the analysis of the behavior of notifications from health information systems. MethodIt is an integrative review of the literature by searching the databases, with the time frame between the years 2010 to 2020. For the treatment of the data, the technique of content analysis was used, with categorization of the findings. Eleven complete original articles were selected that answer the central question of the research, which were grouped in tables according to author, title, journal, year of publication, indexation base, objectives, methodologies and evidence. Results: The

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analysis of the literature made it possible to elaborate three categories based on relevant points, namely: Category 1- Linkage between health information systems; Surveillance of the Death of Tuberculosis; 2 -Tuberculosis Death Surveillance Actions. Studies indicate that a large part of deaths from tuberculosis are not included in the Notifiable Diseases Information System (SINAN) and Mortality Information System (SIM).Conclusion: This study shows the need to intensify the actions of tuberculosis death surveillance to increase the completeness of information systems, reduce underreporting and the number of unresolved cases, train and supervise the performance of the Primary Health Care health teams and the quality of filling out death certificates and compulsory notification, in addition to intensifying disease control strategies.

Keywords—Death. Notification. Tuberculosis.

I. INTRODUCTION

Tuberculosis (TB) is still a serious and challenging global public health problem. In the world, in 2018, about ten million people became ill from TB and 1.5 million people died as a result of it, with TB being the main cause of death by a single infectious agent. [1]

The Americas contributed 3% of the global TB burden, and Brazil occupied the top position on the continent, with 32% of cases. According to the World Health Organization (WHO), Brazil was the only country in the American continent listed among the 30 countries with a high TB burden that account for 87% of all reported cases and have an estimated incidence rate of 45 cases per 100 thousand inhabitants. In the same year, the Notifiable Diseases Information System (SINAN) of the Department of Diseases of Chronic Conditions and Sexually Transmitted Infections of the Ministry of Health of Brazil (DCCI / MS), registered 75,717 new cases of TB (36.2 cases per 100 thousand inhab.), with 423 cases notified after death. [2]

TB is a compulsory notification disease in Brazil and there is a network of great capillarity for the surveillance and control of the disease, present in all Brazilian municipalities, which implement different strategies and technologies to prevent new cases and reduce the disease burden. However, a portion of the population with TB is not captured by surveillance and health care services.[2]

The failure to detect TB cases is an important challenge to face, as it contributes to the maintenance of the transmission chain, prevents effective treatment and allows to underestimate the magnitude of the problem for Public Health. The post-death notification of a TB case can be considered a "sentinel event" that reports failure in individual care and compromises the effectiveness of the disease control service. [2]

In addition to SINAN, another important system is the Mortality Information System (SIM), responsible for compiling deaths from all causes. The quality of information is fundamental for epidemiological surveillance activities and the complementation or correction of data from a given information system can be carried out based on existing data in other information systems. This process of improving information has been suggested for TB control and has shown good results. [3]

The relationship between information systems has been increasingly used in health research and evaluation, based on the use of databases and computer programs, being a useful strategy for the identification of underreported TB cases and deaths and for improving information on closure of cases. [3]

Thus, this study aimed to analyze the trends in scientific production on deaths from tuberculosis and the underreporting of cases, through the analysis of the behavior of notifications from health information systems.

II. METHOD

The research is an integrative literature review, which has the purpose of gathering and synthesizing research results on a delimited theme, in a systematic and orderly manner, being an instrument for the deepening of knowledge about the investigated theme, allowing the synthesis of multiple published studies and general conclusions about it. [4]

Although there are variations in the conduct of methods for the development of integrative reviews, there are standards to be followed. In carrying out this review, six steps were used: selection of hypotheses or guiding questions for the review; selection of studies that will compose the sample; definition of the characteristics of the studies; categorization of studies; analysis and interpretation of results; and, report of the review. [5]

The guiding question for the elaboration of this integrative review was: What are the scientific productions available on deaths from tuberculosis and the underreporting of cases? The survey of bibliographic studies took place during the month of November 2020 and five databases were chosen: Latin American and Caribbean Literature in Health Sciences (LILACS), Virtual Health Library (VHL), in Scientific Electronic Library Online (SciELO), Scientific Literature (SCILIT) and Google Scholar.

Following, the validated MESH descriptors were used: "Tuberculosis"; "Notification" and "Death", using the Boolean operators AND, in Portuguese and English, in the last 10 years, published in the period from 2010 to 2020. A total of 7,062 articles were found, which after reading the titles and abstracts, arrived to the number of 11 articles that showed similarities with the object of this study. These were organized in alphanumeric codes, from TB01 to TB11, for better presentation and understanding of the results.

For data collection, it was decided to use the instrument validated by Ursi. The analysis of the selected studies took place in a descriptive manner, in order to enable observance and description of the data, thus, it was possible to gather the synthesized knowledge on the subject in question. Based on that, three empirical categories were elaborated, which will be presented and discussed below, in which Bardin's content analysis method was used to explore the content. To guarantee the success of this study, it was decided to describe and distribute the results in tables, highlighting the main findings of each research. As for the discussion, it was carried out in a descriptive way, in order to achieve the objectives of building an integrative review. [5]

III. RESULTS AND DISCUSSION

Tables 1 and 2 show the characteristics of these studies, in which articles in Portuguese (100%), with a quantitative approach (100%), published in national journals (100%) and indexed in the SciELO database (45,4%). In the present integrative literature review, a total of 11 original scientific articles were analyzed, which strictly met the selection of the sample previously established.

N°	Base	Author. Title. Periodic.	Objective	Methodology
		Year		
TB01	Google Scholar	OLIVEIRA, Gisele Pinto de et al. Linkage entre SIM e SINAN para a melhoria da qualidade dos dados do sistema de informação da tuberculose: a experiência nacional. CAD. SAÚDE COLET., 2010.	Demonstrate how the relationship with the mortality information system can contribute to improving the quality of the closure of cases reported in the TB surveillance system.	3,400 pairs of records were analyzed, resulting from the use of the probabilistic relationship technique between death certificates that presented TB with a basic or associated cause in 2006 and all notifications of tuberculosis in the years 2005 and 2006 in Brazil. Five blocking steps were performed and for the matching of records, the patient's name, mother's name and date of birth were used.
TB02	SciELO	SELIG, Lia. Proposta de vigilância de óbitos por tuberculose em sistemas de informação. Rev Saúde Pública, 2010.	Propose a strategy for surveillance of tuberculosis-related deaths based on the Mortality Information System.	Data on the 55 deaths related to TB, which occurred in two large hospitals in Rio de Janeiro between September 2005 and August 2006, were obtained from SIM. These cases were compared with the records at SINAN. The increase in the number of notifications and data completeness was evaluated, as well as the type of entry and

Table 1: Distribution of studies.

				outcome in SINAN.
TB03	Google Scholar	OLIVEIRA, Gisele Pinto de. et al. Uso do sistema de informação sobre mortalidade para identificar subnotificação de casos de tuberculose no Brasil. Rev Bras Epidemiol. 2012.	To analyze the underreporting of deaths from TB in Brazil, as well as to verify the impact that these cases would have on the notification rate of new cases and the proportion of deaths from TB in 2006.	The deaths registered in the SIM in 2006 and all TB notifications in the country from 2001 to 2006 were analyzed. The variables used for the relationship were: notification number, municipality and state of residence, name of the patient, date, year of birth, sex, mother's name and address. Six blocking steps were performed. Scores greater than 12.4 were considered even, while those below - 9.7, non-even. At the end of each step, a manual review of doubtful pairs was carried out.
TB04	LILACS	LARROQUE, Mônica Mussolini. et al. Mortalidade por tuberculose: municípios prioritários de Mato Grosso do Sul, 1999-2008. Arq. Ciênc. Saúde UNIPAR, 2013.	To study tuberculosis mortality as a basic or associated cause of death, in the priority municipalities of Mato Grosso do Sul.	SIM and SINAN data were used over a ten-year period. The variables studied were: sex, age group, race / color, education, clinical form and place of death.
TB05	SciELO	BARTHOLOMAY, Patrícia. Melhoria da qualidade das informações sobre tuberculose a partir do relacionamento entre bases de dados. Cad. Saúde Pública, 2014.	To verify the improvement in the quality of information about TB, after linking records and correcting the closure through the probabilistic link of the SINAN with SIM.	For the linking of records, a linkage was made between SINAN do Brazil records, years 2008 and 2009, with the objective of excluding notifications not removed by SINAN routines carried out by states and municipalities. The databases were built according to the outcome of the cases. For the linkage between SINAN and SIM, the database that resulted from linking records and the SIM records that mentioned TB as a basic or associated cause, between 2008 and 2010, was used in Brazil.
TB06	SciELO	ROCHA, Marli Souza. et al. Confiabilidade do desfecho do tratamento usando linkage de bases de dados para a tuberculose. Cad. Saúde Colet., 2015.	Analyze the agreement between the closure of the SINAN and the causes of death in the SIM.	A probabilistic linkage was carried out between SINAN 2006 and SIM from 2006 to 2008. The reliability of the closure was analyzed using the kappa index.
TB07	SciELO	ROCHA, Marli Souza. et al. Do que morrem os pacientes com tuberculose: causas múltiplas de morte de uma	Analyze the multiple causes of death in a cohort of patients notified with TB and present a proposal to	A probabilistic linkage was carried out between SINAN 2006 and SIM, 2006-2008.
TB08		coorte de casos notificados e uma proposta de investigação de causas presumíveis. Cad. Saúde Pública, 2015.	investigate possible causes.	Retrospective study carried out
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	LILACS	Gadelha. Et al. Subnotificação de casos de tuberculose a partir da vigilância do óbito. Rev. Eletr. Enf. 2016.	tuberculosis cases from the capture of deaths registered in the SIM between 2007 and 2011.	in a northeastern municipality, which used the probabilistic association technique between the SIM and SINAN records, using the Reclink III software. Odds ratios (OR) were calculated for individuals who died with TB not reported in SINAN, according to sociodemographic characteristics.
TB09	Google Scholar	PERES, Dalila Augusto; FAÇANHA, Monica Cardoso; VIANA JÚNIOR, Antônio Brasil. Incremento de casos e melhoria da informação sobre tuberculose no Estado do Ceará, Brasil, após o relacionamento de bases de dados. Cad. Saúde Colet., 2017.	Measure the increase in tuberculosis cases and the improvement of information about the registration of Acquired Immunodeficiency Syndrome (HIV) infection and closure in SINAN-TB, after its relationship with SIM and SINAN-Aids.	Sectional study based on the relationship of diagnosed TB cases and deaths with TB as a basic or associated cause in persons over 15 years of age, between 2005-2014, living in Ceará.
TB10	Google Scholar	SANTOS, Marcela Lopes. et al. Fatores associados à subnotificação de tuberculose com base no Sinan Aids e Sinan Tuberculose. Rev Bras Epidemiol. 2018.	To estimate the proportion and factors associated with tuberculosis underreporting in Pernambuco, among cases of TB / AIDS co- infection, based on data from the TB and AIDS Notification Diseases Information System.	A cross-sectional study was carried out, based on the records of the TB and AIDS Notification Systems, to identify cases of TB underreporting during the study period, by performing a probabilistic linkage using the RecLink III software.
TB11	SciELO	ARIDJA, Ursila Manga. et al. Casos de tuberculose com notificação após o óbito no Brasil, 2014: um estudo descritivo com base nos dados de vigilância. Epidemiol Serv Saúde. 2020.	Characterize cases with post-death notification of tuberculosis in Brazil in 2014.	Descriptive study of TB cases with post-death notification. The data are the result of linking SINAN with SIM and were described according to the basic cause of death: tuberculosis, AIDS and others.

Source: Research protocol, 2020.

Table 2: Evidence from the studies.

Nº	Evidence
TB01	When comparing the closure of cases before and after the relationship, there was variation in the percentage of deaths in 2006, from 5.6% to 6.4%. Although the changes observed in the other indicators were discreet, the method presents itself as a promising strategy to be explored with a view to improving the quality of information on the closure of TB cases.
TB02	Of the 55 deaths, 28 were reported in SINAN. The relationship of the systems enabled the following corrections: 27 new cases notified, 14 new notifications made by the unit where the death occurred and the closure of ten notifications. This represented an increase of 41 (28%) notifications to the 144 performed by the two hospitals in 2006. Nine cases were reclassified from TB without confirmation to TB with diagnostic confirmation, and five cases were reclassified from TB to AIDS as the basic cause of death.
TB03	SINAN had 547,589 notifications, while SIM had 6,924 records. Of these, 39.4% (n = 2,727) were not found at SINAN in the assessed period. It was observed that 64.5% (2,707) of deaths were reported in 2006 and, when analyzing the proportion of underreported deaths by region and federated units, it was found that the highest percentage was in the North, followed by the Southeast and Northeast. The increase in deaths that were not related to the SINAN database raises the notification rate for new cases by 3.7%. As for the proportion of deaths from TB, this inclusion was responsible for the 60.7% increase in this indicator. The relationship between databases is an important strategy for improving the quality of the TB surveillance system.
TB04	The TB mortality rates fluctuated during the study period in the priority municipalities. Amambai registered the highest coefficient and males represented 72% of the total deaths. The age group from 40 to 59 years old concentrated the highest mortality rate due to TB, 34.8%. According to race / color, the highest percentage (46.1%) were brown. The pulmonary clinical form was present in 89% of the cases and 83% died in hospitals. Only 53% of deaths registered at SIM had notification at SINAN and of these 67% had smear microscopy and 40% received supervised treatment. Of the notified cases, 37% underwent serological examination for infection with the acquired immunodeficiency virus and 10.1% were positive. The joint analysis of the multiple causes of death from TB demonstrates the need for more comprehensive discussions regarding the tendency of the disease to death, points out flaws in the notification process and reveals the importance of reassessing the procedures adopted as control measures in the priority municipalities of Mato Grosso do Sul.
TB05	The linking of records decreased the percentage of new cases with closure by transfer, with a variation of 34.8% in 2008 and 35.5% in 2009. After the link between SINAN and SIM, the percentage of deaths from TB increased, with variation around 15%. The results describe an alert situation with regard to the quality of the TB treatment outcome data at SINAN.
TB06	Of the 417 cases closed by death at SINAN, 88.7% were found at SIM. Of the 82 cases closed as a death from another cause, 42.7% had TB as a basic or associated cause in the SIM, while 41.5% had no mention of TB. The PABAK coefficient (Prevalence and Bias Adjusted Kappa) showed excellent agreement between the outcome of death in the closure field of SINAN and the presence or absence of TB death in SIM. A recommendation for States and municipalities that use the relationship between SINAN and SIM to increase the completeness and consistency of SINAN is to investigate in SIM not only the cases notified without termination, but also those cases terminated by abandonment and transfer.
TB07	There were 825 deaths, of which 23% from TB, 16% from TB and 61% without mention of TB. Two hundred and fifteen (42.7%) deaths occurred before the end of the basic treatment regimen and had no mention of TB, whose profile was different from the standard when TB was one of the associated causes. The high frequency of respiratory diseases, AIDS and ill-defined causes suggest a failure in the quality of information. A proposal was made to correct the associated causes in the SIM and to investigate death based on the list of presumed causes. According to the proposal, 26 deaths could have changed the basic cause. This study highlights the severity of the TB condition and the importance of linkage for TB surveillance and improving SIM and SINAN information.
TB08	Of the total of 147 deaths registered in the SIM, 72.8% had not been reported in the SINAN. Women were more likely than men to not be notified ($OR = 2.60$), people under the age of 60 ($OR = 1.86$) and with less than eight

	years of study (OC = 4.42). Strategies must be reframed timely diagnose cases and avoid failures in filling out reco	in order to increase the uptake of respiratory symptom ords.	ms,
TB09	There were an increase of 2,325 (6%) cases after the r associated cause) of the SIM and cases of TB / HIV core regarding the criteria for closure and registration of municipalities. We highlight the importance of inver- epidemiological surveillance in hospitals and health coordination to assess underreporting and timely capture of	elationship between SINAN, deaths from TB (basic binfection in SINAN, as well as improved informat nfection by HIV. The increase was greater in sn estigating deaths from TB, expanding centers centers, using data relationships by the munici of cases by health units.	or ion nall for pal
TB10	There was a 29% proportion of TB underreporting, and the clinical form of cavitary or unspecified pulmonary TB, served outside Recife and in services that are not special. The proportion of underreporting found was lower than account underreporting in view of mortality data. The variable most part, to the care network, and not to individual char professionals to notify information systems.	he factors associated with underreporting were: havin or having both types of TB at the same time; and ized for human immunodeficiency virus (HIV) / AII that observed in other Brazilian studies that took i riables associated with TB underreporting refer, for racteristics, which points to the need for training hea	g a be DS. nto the alth
TB11	In the 2,703 cases of TB with post-death notification, the years of age (80.8%), with education <8 years of study (became ill from TB in the pulmonary clinical form (75 (57.6%) and in municipalities with a human development people notified after death and the magnitude of this our services.	ere was a higher proportion of males (73.5%), over 56.5%), race / skin color black and brown (62.8%), v 2%); notifications by the public service also prevai index> 0.7 (66.6%). The described characteristics of tcome suggest weaknesses in TB care and surveillar	39 vho led the nce
Source	: Research	protocol,	2020

The analysis of the literature found made it possible to elaborate three categories based on relevant points, namely: Category 1- Linkage between health information systems, and2-Tuberculosis Death Surveillance Actions, which will be developed below.

Category 1- Linkage between health information systems

The article **TB 01** shows that of TB deaths registered in SIM in 2006, more than 50% had not been reported in SINAN. When analyzing the situation of closure, it was found that, for those notified in 2006, only 71.3% (n = 1,920) presented the closure of the case as death, 3.8% (n = 103) as treatment abandonment and 10.2% (n = 276) had no outcome information. [6]

The percentage of cases with death closure increased from 5.6 to 6.4%. It was found that those who were notified in 2005 had a lower proportion of the death outcome when compared to 2006. This fact suggests that the farther from the year of death the first notification is, the less the chance that the closure will be registered as death , that is, the first notification in the same year of death reflects the late diagnosis of the disease. [6]

Previous abandonment can be considered a risk factor for the occurrence of death. Thus, the need for health services to create alternatives that guarantee adherence to treatment for these patients is ratified primarily by the use of the Directly Observed Treatment Short-Course (DOTS) strategy, which is recommended worldwide. In addition, one must take into account the fact that the case evolves to death and be classified as abandonment of treatment by the UnityHealth (UH) of origin due to the lack of knowledge about the occurrence of death. [6]

The fact that 10.6%, in 2005 and 5.5%, of the cases in 2006 presented the type of closure as a transfer reinforces the need to follow up these cases to prevent them from getting lost and not reaching the UH for which it was transferred. Thus, it is essential that the UH that performs the transfer monitors the case until the other unit receives the same to continue the treatment. [6]

The cases that evolved to death in 2006 and presented a TB notification in 2005 or 2006 with closure due to cure can be classified as recurrence. However, these cases should be investigated, since the recurrence occurred in a short period of time, suggesting the possibility of an error in completing the closure or medical failure in the case discharge criteria, especially for those notified in the same year of death[6].

The article **TB 02** analyzed 55 deaths and found that only 28 were notified in SINAN, 22 of them with a period between notification and death less than or equal to one year, with a median of 41 days. These 28 cases generated 43 notifications, which do not represent duplicate records, as the notifications were made by different units or in the course of different treatments. [7]

SIM's relationship with SINAN made it possible to make new notifications, correct new notified cases and complete the closure. In SINAN, it was observed that 58% of notifications were made by hospitals, with a predominance of the type of reentry entry after abandonment and relapse, which indicates the importance of hospital care for a disease that should be primarily conducted in Primary Health Care (PHC), pointing out the delay in diagnosis and possible difficulty in accessing the health network in the area covered by the hospital.[7]

The number of individuals who die of TB after an episode of cure leads to reflection on the criteria for cure and the importance of a post-treatment surveillance system. Furthermore, the relationship of the banks makes it possible to reclassify some cases. [7]

The review of confirmation of pulmonary TB allowed the reclassification of the basic cause of death, from pulmonary TB without mention of bacteriological or histological confirmation (A16.2) to pulmonary TB with confirmation by microscopic examination of the sputum (A15.0). The information on Acquired Human Immunodeficiency Syndrome (AIDS) in SINAN allowed the reclassification of the basic cause of death from TB to AIDS. Patients had chronic comorbidities, other than AIDS, listed in SINAN and not mentioned in the Death Certificate (DC). [7]

The article **TB 03**points out that when analyzing the proportion of underreported deaths stratified by the federated units, a higher percentage was observed for the North, followed by the Southeast and Northeast. The South region had the lowest percentage of underreporting, despite having a total number of deaths from TB higher than the North of the country. This behavior indicates that was heterogeneous, not only between regions, but also among states in the same region, with variations between 16.6% and 54.5%. [8]

The increase in deaths that were not related to the SINAN database would increase the notification rate of new TB cases in 2006 by up to 3.7%, and by 60.7% the proportion of TB cases with death closure, which would increase from 5.6% to 9.0% in the same year. These increases differed between UFs in the country, varying from 1.5% to 7% for the notification rate of new cases and from 18.4% to 130.7% for the cases notified in SINAN with death closure. [8]

Since death is a final outcome for TB cases, the fact that 39.4% of deaths associated with TB are not included in the case register points to an evident mismatch between the LV of TB and assistance, since they are serious cases that were not notified, even at the time of death, which reflects the low coverage of the surveillance system.

TB deaths can be considered as a sentinel event, a concept defined by the occurrence of a preventable disease, disability or death, which can reveal the individual's high fragility due to the low socioeconomic, occupational, environmental or adverse health conditions, as for lack of adequate or timely action by health services. Unemployment, education and income are individual factors that increase vulnerability to TB and, therefore, can also influence access to health services, as well as quality diagnosis. [8]

Considering that, in Brazil, TB is a liability problem of Primary Care (AB) and that the capture of cases in a timely manner does not require highly complex care, there should be no obstacles that prevent access. Another hypothesis for the occurrence of underreporting may be related to the volume of cases notified. The highest proportion of notified TB cases occurs in the Southeast (45%) and Northeast (29%) regions, which appear with the highest rates of underreporting. [8]

The influence of structural and organizational aspects of health services, the flowchart of SINAN and the organization of SUS may explain part of the underreporting of cases to the surveillance system. It was observed that the search for SIM deaths using only the cases registered in the previous two years of SINAN and processing only the first two blocking steps were responsible for a high percentage of case recovery. [8]

The article **TB 04** shows that deaths from pulmonary TB are more significant from an epidemiological point of view than other clinical forms of the disease, because in addition to the lethality being higher in this form, it represents an important route of transmission and spread of the disease. As for the place of occurrence, 83.2% died in hospitals, which reflects the lack of responsibility of AB in the early detection of the disease and suggests difficulty in accessing health services for early diagnosis of cases and may represent a lack of training, commitment and guidance of health professionals.[9]

Of the 345 deaths registered in the SIM of this study, 185 (53.6%) had notification in SINAN. The evolution to death of hospitalized cases that do not have notification suggests that the diagnosis was made in the most severe form of the disease, since hospitalization was necessary for diagnosis and treatment. According to the Ministry of Health, the SIM has greater coverage than the SINAN indicating that a death from TB may be in the SIM and not have been notified in the SINAN. However, in 2003, WHO classified the SIM as medium quality, estimating a sensitivity ranging from 70% to 90%. [9]

The time elapsed between the date of diagnosis and death was less than one year in 127 (70%) cases, showing the severity of the clinical condition during care in the priority municipalities of Mato Grosso do Sul. In two large hospitals in Rio de Janeiro, it was observed that 79% of deaths had a period of less than one year between the date of notification and the date of death. [9]

The article **TB 05** shows that the linking of records using the linkage between the SINAN-TB databases with SIM brought important corrections for both systems. For Brazil, the percentage of deaths from TB among the newly diagnosed cases increased, with a variation of around 15%, and the percentages of cure, abandonment, transfer and death from other causes decreased in the two years evaluated. [10]

Among the UFs, those with the greatest increases, above 40%, in the percentage of deaths from TB were: Rondônia, Mato Grosso and Distrito Federal in 2008, and Acre, Rondônia, Roraima, Amapá and Minas Gerais in 2009. [10]

About 9,059 reported deaths were found in both systems, 7,939 deaths occurred up to 270 days after the date of TB diagnosis and records were considered related to the same event. In the case of deaths registered with basic TB cause, 63.8% (3,047) were closed in SINAN as death from TB, 24% (1,146) as death from other causes, 3% (145) as cure, 3.2% (154) as abandonment, 3.6% (172) as transference, 0.2% (9) as multidrug-resistant TB and 2.2% (103) were in a closed or ignored situation. The median time between the date of diagnosis and the date of death was 25 days for the period studied and the mode was equal to zero. [10]

Among the 2,144 deaths with TB as an associated cause and HIV as a basic cause, 57.1% (1,225) were terminated in SINAN as death from other causes, 30.1% (645) as death from TB and 12.8% (274) with other closures. Among those with a basic cause of diseases of the respiratory apparatus, 36.5% (54) were terminated at SINAN as death from TB and 50.7% (75) as death from other causes. [10]

The records with basic cause neoplasia or disease of the circulatory system presented the highest percentages of closure in SINAN as death from other causes, 62.3% and 60.2%, respectively. Among the records notified in SIM as death due to other infectious diseases (102), 53.9% (55) were closed in SINAN as death due to other causes. Other basic causes of death, such as digestive diseases, endocrine and nutritional and metabolic diseases, presented the percentage of closure in SINAN notifications as death from other causes, varying from 40.4% to 54.1%. The kappa index between SINAN and SIM for all SINAN records for 2008 and 2009 was 0.55, considered moderate. [10]

The probabilistic linkage between the data bases contributed to the improvement of the quality of SINAN, with positive effects for information on TB in Brazil. Although the SINAN routines for removing duplication and linking records are widespread in state and municipal PCTs and should be considered a permanent activity by technicians responsible for TB surveillance, the results indicate that they are not yet being implemented carried out properly. [10]

The reduction in duplicate registrations with an indefinite closure or transfer situation was considerable in practically all UFs in the country, generating an increase in the cure rate of around 3% for new cases. This result points to the improvement of the closure information, when compared with the highest percentages obtained after qualification processes carried out in previous years by other authors. However, the cure rates for most UFs are still far from the 85% level suggested by the WHO. [10]

The median of thirty days between the date of diagnosis at SINAN and the date of death at SIM refers to the difficulty in accessing health services for diagnosis and treatment. The high proportion of deaths that occurred shortly after the start of treatment was verified by other authors and reveals the limitations of health services in identifying early and treating a significant portion of TB patients in a timely manner. [10]

The article **TB 06** shows that of the cohort of 6,370 patients notified of TB in 2006 in SINAN, 417 (6.5%) were closed as a result of death, either due to TB or other causes. Of these, 370 (88.7%) were found in the SIM from 2006 to 2008. [11]

In SINAN, 335 (80.3%) of the endings died from TB, 95 (28.4%) of whom had TB as the basic cause in the SIM, 59 (17.6%) as an associated cause, 147 (43.9%) did not have TB as the cause of death and 34 (10.1%) were not found in the SIM. [11]

Of the 82 (19.7%) patients who died as a result of another cause at SINAN, 35 (42.7%) had TB as a basic or associated cause at SIM, 34 (41.5%) did not have TB as a cause of death and 13 (15.8%) were not included in the SIM. [11]

Of the 5,288 patients who closed for a different reason from death at SINAN, that is, closed as cure, abandonment, transfer, multidrug-resistant TB and with a blank / ignored closure situation, 132 (2.5%) presented TB as one of the causes of death and 323 (6.1%) died from other causes.Among the 665 patients with blank / ignored closure, there were 72 (10.8%) deaths, with 20 (27.8%) deaths with TB registered as the basic cause, 12 (16.7%) with TB as an associated cause and 40 (55.5%) were found in the SIM without mention of TB as a cause of death. [11]

The article **TB 07** shows that TB seems to be the main cause of death for patients notified with the disease. Approximately a quarter died of TB in the two years after diagnosis. This points to the magnitude of the problem, although there is effective treatment widely available in the public health system and it is considered a preventable death. [12]

In deaths with basic TB cause, the presence of septicemia, respiratory failure, pneumonia, symptoms and signs related to the respiratory system (hemoptysis, respiratory tract hemorrhage, respiratory arrest) as associated causes reflect the seriousness of the situation due the presence of respiratory conditions and terminal pictures, resulting in hospitalization followed by death. The problems associated with worse outcomes (diabetes, mental disorder and AIDS), which could have contributed directly to death, were less significant. The severity of the cases may be related to other comorbidities, such as circulatory system disease, digestive system diseases and neoplasms, as well as delayed diagnosis and failures in treatment and patient follow-up. [12]

The presence of comorbidities may be underestimated, as this information is based on an optional entry in the notification form. Still, they showed that individuals with two or more comorbidities tend to be older, female and have higher mortality from other causes.Contrary to expectations, a considerable proportion of deaths occurred within the treatment period and TB was not registered at least as an associated cause. Some situations could explain the lack of registration of the disease: patients who started the empirical treatment for TB, but who subsequently had their diagnosis ruled out and the diagnosis was not closed; the ignorance of TB on the part of the doctor who filled out the death certificate; and, finally, the lack of investigation of TB death when there is no laboratory diagnostic confirmation. [12]

The high percentage of deaths from TB points to the deficiency in the uptake and follow-up of cases in AB and to wide communication gaps between the hospital network, the urgency and emergency network and the

PNCT. Serious cases, when admitted to emergencies, continue to die, without a timely assessment of the patient's current and previous history or confirmation of the diagnosis. However, smear microscopy is an exam available on the network and, in a municipality with a high incidence of TB, it is important that health professionals are attentive to the occurrence of the disease. [12]

The results suggest that diseases of the circulatory system are related to the early death of the TB patient, given the higher percentage of deaths that mention these causes within the treatment period. This fact can occur due to the possible worsening of diseases of the circulatory system by TB. Although the association between TB and diabetes is recognized, due to the worsening of TB due to this condition or vice versa, there was no relationship in the analysis performed here. [12]

Deaths without mention of TB in OD that occurred during the treatment period, in which the basic cause was septicemia or ill-defined and unknown causes of mortality, possibly were deaths from TB, pointing to the low quality of the information and lack of investigation and, consequently, compromise the quality of death statistics. In order to qualify information on the causes of death in the SIM, the Ministry of Health recommends the mandatory investigation of deaths for specific groups (maternal, child, women of childbearing age and illdefined causes). Although this strategy is not implemented for specific diseases, its implementation must be strengthened in health services, given the good results achieved in the country. [12]

The article **TB 08** showed that among the cases of deaths reported in the SIM, 72.8% did not have access to TB diagnosis in a timely manner. The correction of the TB incidence coefficient in the analyzed period, from the inclusion of new cases of the disease identified through death surveillance, represented an average increase of 4.88% in this indicator. [13]

The notification allows to retrace the path taken by the patient, in different situations of the disease, allows to identify possible weaknesses in the organization of care for these users and makes it possible to track the opportunity for transmission. [13]

Considering that death and the most critical outcome for TB cases, the lack of awareness of its occurrence by the surveillance sector and underreporting show weaknesses in detecting cases of the disease.Such fragility signals deficiencies in the quality and opportunity for users to access health care, which may be associated with interdependent individual, factors of social and programmatic nature. The individual and social perspective involves risk perception, level of knowledge of the health and disease process, economic situation, gender and generational relations, cultural values, access to material resources and the ability to receive information, metabolize it and be able to incorporate it practical changes in everyday life. [13]

The lack of knowledge about the disease and its severity, difficulties in access would imply the late search for health services, in hospital diagnosis or at the time of death. [13]

The article **TB 09** shows that between 2005 and 2014, 38,782 TB cases were reported in SINAN. The annual average of cases was 3,844. After the relationship with SIM, there was an increase of 1,955 (5%) TB cases that evolved to death and were not reported in SINAN. 2,816 deaths from TB were observed as a basic or associated cause and only 861 deaths (30%) were registered simultaneously in SINAN and SIM. [3]

After being linked to SINAN Aids, there was an increase of 370 (1%) cases of AIDS / tuberculosis coinfection, corresponding to cases that were not reported in SINAN-TB and, also, were not included in the SIM. In the end, 2,325 (6%) TB cases were added to SINAN. In 2005, the increase was 5.4%, with a reduction in the following years, with 2014 being the lowest in the period: 4.5%. Even with the increase after the relationship, TB cases showed a decreasing trend (p = 0.009). [3]

The number of cases with "tuberculosis death closure" in SINAN-TB was 1,015 to 2,806 after the relationship with SIM and SINAN Aids, an increase of 176.5%. The number of patients who had TB as a cause associated with death went from 1,162 to 2,758 deaths, an increase of 137.3%. The proportion of deaths from TB as a basic or associated cause increased from 5.6% to 13.5% of cases, changing the evolution of cases that had been closed as a cure, abandonment, transfer and even a change in diagnosis, as they had their death registered in SIM and not registered in due time in SINAN-TB, that is, patients registered in SINAN-TB who died of TB as a basic or associated cause registered in SIM and whose records were not updated in SINAN-TB. [3]

Cure was the outcome of 26,908 TB cases (65%); death occurred in 5,564 cases (14%); abandonment in 3,488 cases (8%). Other results that deserve attention are 2,883 (7%) cases that presented "transfer" closure and 1,494 cases (4%) "without information", even after the relationship with SIM and SINAN-AIDS. It should also be noted that some cases of TB / AIDS co-infection had not been reported to SINAN-TB and were recovered after the systems were listed.The record of HIV infection in TB cases was positive in 2,044 cases (5.3%) and, after the relationship, in 2,623 cases (6.4%), an increase of 28.3% due to improved information, the from AIDS deaths in which TB was an associated cause and from the record of HIV infection in SINAN-AIDS cases. There was no information on HIV infection in 55.8% of TB cases. [3]

The increase in the prevalence of TB was up to 5.6% in half of the municipalities and up to 7.9% in three quarters of the municipalities in Ceará. There was an increase of 8% to 40% in the prevalence of TB, in the period, in 24 small municipalities in Ceará. In 22 (12%) municipalities there was no increase in cases after the relationship. In addition to the lack of registration of 6% of TB cases, it was found that less than half of the deaths were registered in SINAN-TB, a source of information for planning of disease control actions. This under-registration has been maintained in Ceará and Brazil, pointing to the need for reflection on the operational practice of TB surveillance, so that deaths registered in the SIM or cases of TB / AIDS coinfection in SINAN AIDS are investigated and have their registration verified at SINAN-TB and added, if not already notified. [3]

The article **TB 10** shows that the linkage between the 46,642 SINAN-TB records and the 1,307 SINAN-AIDS records showed 926 pairs (71% of AIDS records). These pairs represent individuals who were notified in both systems, from 2001 to 2010, while 381 (29%) existing records at SINAN-Aids with reports of TB coexistence were not found by the probabilistic relationship at SINAN-TB and, therefore, represent TB underreporting. [14]

The studies where the comparison with SIM is present usually present a higher proportion of notification due to the severity of the cases that died and the difficulty of diagnosing TB previously. The linkage between these systems makes it possible to locate patients before they become serious cases and can act to prevent more serious outcomes.Although we find underreporting in several systems, it is known that underreporting occurs mainly due to the lack of knowledge about the diseases that must be notified and due to problems in the notification flow by health professionals. [14]

Regarding the notification of the TB/AIDS association to SINAN, structural and organizational aspects of the SUS health services and the SINAN flowchart may explain part of the underreporting of cases to the surveillance system, however TB in Brazil is an aggravation AB's responsibility. Therefore, there should be no impediment to capturing or reporting cases. Despite this, AB still presents great challenges for TB control, such as the unsatisfactory decentralization program itself, in addition to structural and human resource deficiencies. Thus, the diagnosis of TB for co-infected persons is still predominant in hospitals and SAEs. [14]

The chance of underreporting for TB was greater among those diagnosed with cavitary or unspecified pulmonary TB and with both forms of the disease (disseminated / extrapulmonary / non-cavitary and cavitary or unspecified pulmonary TB) at the same time. Extrapulmonary TB presents its most complex diagnosis and, once identified, it could be thought that there is a greater concern in the correct notification. Thus, the chance of being underreported when having other forms of TB would be greater compared to the extrapulmonary type. On the other hand, pulmonary TB is responsible for transmission and, therefore, there should be more attention to reporting these cases and starting treatment. These cases are extremely important for TB control, since they can put your contacts at risk and spread the disease. [14]

The article **TB 11**identified that among the main contributing diseases, when TB was the basic cause of death, diseases of the respiratory system (52.7%), mental and behavioral disorders, caused by psychoactive use (10.0%), diseases of the circulatory system (8.9%), malnutrition (6.4%), diseases of the digestive system (5.1%), hypertension (4.4%), diabetes mellitus (4.0%) and diseases of the genitourinary system (3.9%). Among respiratory diseases, chronic diseases of the lower respiratory tract stood out. When TB appeared as an associated cause, malignant neoplasms were among the most common basic causes of death, and, less frequently, as associated causes (2.1%). [2]

Cases attended in the public health service were responsible for about half or more of the post-death TB notifications, for the three groups of basic causes of death (TB; AIDS; others). Finally, more than half of the cases were reported in municipalities with low coverage of the Family Health Strategy (FHS) with 54.2%, although with medium or high coverage of AB, of 42.1% and 35.3% respectively. [2]

TB cases notified after death presented TB and AIDS as the main basic causes of death. Higher proportions of males were observed, aged over 39 years, with eight years or less of study, race / skin color black or brown, with the pulmonary clinical form, and notified by the public health service. Furthermore, their municipalities of residence reported higher MHDI, low poverty rate, large population, low coverage of the Family Health Strategy and high or medium coverage of AB.It is known that men are more affected by TB and die more from this cause, compared to women, which may be related to the fact that they seek less health services, adhere less to treatment and have more risk factors. [2]

A higher frequency of people aged 60 years or older was identified among the post-death notifications of TB, when compared to that of other age groups. Many studies show that people of working age tend to have a high incidence of TB, pointing out the greater effectiveness of the alert for the detection of cases in this age group. However, the greater biological vulnerability of the elderly, especially related to the presence of other diseases, increases the risk of death from TB at this age, masks symptoms of the disease, reduces the alert for early diagnosis and delays treatment, providing an opportunity for underreporting and notification TB post-death. [2]

Black or brown people contributed more than 60% of all TB post-death notifications, according to this study.In addition to being the ethnic-racial group with the largest population in Brazil, the variable race / skin color black or brown has an important collinearity with schooling and income in the country, and therefore is associated with the pattern of seeking health services. Black and brown people are thus more exposed to delayed diagnosis and treatment, and timely notification of the disease. The result of the study corroborates this hypothesis and highlights the barriers faced by this contingent in access to quality health care in Brazil, one of the most unequal countries in the world. [2]

The pulmonary clinical form of TB, the most frequent in Brazil, contributed to most of the cases reported after death, as it was verified. People with pulmonary TB and notification only after death are still worrisome, due to their potential for transmission, although accurate diagnostic tests and free effective treatment are available throughout the country to provide a better prognosis than other clinical forms. [2]

However, cases with extrapulmonary TB were more frequent among people co-infected with HIV / AIDS. The strong association between extrapulmonary TB and HIV infection is known. In general, it is more difficult to diagnose this clinical form of TB, even more so in people with HIV, which favors the under-detection of TB in this population. [2]

People seen at public health services at the time of death were responsible for the highest proportion of TB post-death notification (with TB being the basic cause of death or not). This can be explained by the fact that the public service is free and its national coverage, and consequently, covers the majority of the population. In a, people served by these services have, on average, greater social vulnerability, which may have contributed to the high share of TB notifications only after death.[2]

Cases resident in municipalities with low FHS coverage and low or medium AB coverage contributed to a high proportion of TB post-death notification. This situation may reflect the population exposed to such coverage, since larger municipalities tend to have low coverage for this type of health care, especially for the FHS. Furthermore, these results may reveal territories where the gateway to SUS does not occur, effectively, through PHC, compromising the ordering of care, as well as the adequate management and surveillance of TB. [2]

Category 2- Tuberculosis Death Surveillance Actions

The **TB 02** article points out that the systematization of the procedures allowed the elaboration of a proposal for the surveillance of TB-related deaths based on the SIM in which every case of TB with death outcome must be notified by the unit in which it occurred death, regardless of whether it was previously notified or not. If it is a case previously notified, the notifications must be linked. The notification regarding the previous event must be properly closed after investigation and analysis (cure, abandonment, transfer, bankruptcy or multidrug-resistant TB) [7].

The surveillance of deaths from the SIM produced a substantial increase in the notifications made by the hospitals and a modest increase in the completeness of the data of both information systems, as well as the reclassification of records in the SIM. [7]

The notification records the path taken by the patient, which allows tracking of transmission opportunities. A patient who progresses to death without prior notification is an unknown case of the National Tuberculosis Control Program (PNCT) and, therefore, it is assumed that his contacts have not been evaluated. In this situation, it is recommended that the UH be triggered for a home visit, considering that the risk of illness from contacts is at least 15 times greater than in the general population. It is the role of the Epidemiological Surveillance (ES) to feed back the UH and its professionals with their data, which can encourage professionals to carry out notifications. [7]

The **TB 03** article shows that the adoption of systems relationship strategies is an important tool used by many countries to make estimates of incidence and number of cases. It is recommended, therefore, that the PNCT encourage such a practice, aiming at improving the quality of the TB surveillance system in order to generate reliable indicators to support decision making [8].

The TB 04 article shows that the objective of the PNCT is based on reducing transmission, morbidity and mortality from the disease in Brazil. Mortality studies are important to analyze the quality and timeliness of treatment and to estimate the number of cases that are not reported. However, it is essential to improve the registration system as well as conduct a study without different geographic regions, especially in those with a high incidence of the disease, such as the municipalities considered to be priorities. Several studies show that current treatment for TB is highly effective and that the death of a case should be a rare event. In Brazil, cases of drug resistance are less frequent and do not represent (for the time being) a risk for the increase in deaths. In this context, TB is recognized as a preventable cause of death [9].

In order to minimize limitations, constant training and improvement of the information system should be carried out throughout the country. The data show that, in some municipalities, the mortality rates are much higher than what is considered satisfactory for the WHO and well above the national data. This suggests that, in these municipalities, a more rigorous monitoring of TB control and notification programs would be essential. Actions such as early diagnosis, seeking respiratory symptoms, reducing dropout and ensuring follow-up until discharge and cure of diagnosed cases, as well as surveillance systems (notification), should be intensified. [9]

The analysis of the causes of deaths from TB considering its multiple associations and the operational problems in the registration and information systems of cases and deaths allowed a more comprehensive notion about the problem, which can assist in the prevention and control of the disease, as well as in the identification of operational problems in the case and death registration and information systems. [9]

The **TB 05** article shows that for health services to use this tool, it is important to invest in the qualification of technicians for handling the database and performing linkage. More than encouraging the use of robust tools, it is essential to develop the ability to analyze the data available in information systems. In municipalities and states where the number of reported cases is low, often only an adaptation of the information flow can minimize or correct existing failures. [10]

The **TB 07** article points out that systematic monitoring and the presence of a highly qualified team, combined with constant fieldwork, make the implementation and maintenance of this activity costly, making adherence more difficult of the local health sector. [12] The high percentage of deaths that occurred before the end of basic therapeutic treatment without mention of TB in OD refers to the discontinuity of treatment, a serious problem that threatens TB control in the country. The barrier to access to services and treatment had already been overcome, leaving the barrier to continuity of care, which should be considered a priority by services. On the other hand, the delay in diagnosis may have worsened the clinical picture. [12]

The surveillance of TB-related deaths will make it possible to increase the completeness of information systems, increase the proportion of closed cases, correct SINAN and SIM, rescue underreported cases and assess the quality of filling the SIM. All of these measures have the function of improving the sensitivity of the surveillance system and verifying the effectiveness of the treatment. [12]

The article **TB 08** showed that planning and management of actions, responsiveness of the institutions involved, adequate and stable financing facilitate access to health services, as well as quality of care, implementation and implementation of information technologies care that favor the existence of social contexts that favor the adoption of preventive measures. [13]

Therefore, it should be considered that the underreporting of TB cases represents a state of alert to local managers, as it signals delay in diagnosis and treatment, contributing to the inexpressiveness of the promotion and prevention actions in the community. The problem also points to deficiencies in the search for respiratory symptoms, in the identification of suspected cases and in the investigation of contacts. [13]

The lack of response from the AB services can lead to the search for emergency and specialized units. Implementing hospital surveillance centers and evaluating and monitoring notification routines by private services would be possible alternatives to induce the triggering of surveillance actions, especially in the rescue of cases not notified to the health authority. [13]

TB surveillance can be useful to increase the completeness of information systems, rescue and investigate the situation of closing cases, decrease underreporting, increase sensitivity of SINAN and SIM, assess the quality of death certificates, supervise surveillance epidemiology of health establishments and recover the examination of contacts not yet evaluated. [13]

Deficiencies in filling out the notification form, noncompliance with the deadlines for sending and fragility in the flow of information between the notifying units and the ES, may compromise a secure monitoring of the presented reality. The qualification of the technicians for handling the database and training for the professionals regarding the quality of filling in the notification register of TB cases are some significant actions that can minimize or correct existing failures. [13]

The article **TB 09** shows that the scarcity of cases that evolved to death is worrying due to the failure to register, but mainly due to the possible gap in care and the timely detection of cases, which would have allowed the case of TB to evolve with greater severity each day. Examination of contacts and the active search for respiratory symptoms with a timely diagnosis, in addition to overcoming social inequities historically related to TB and the proper monitoring of cases under treatment can reduce deaths. [3]

The article **TB 10** shows that individuals who were treated in municipalities in the interior or in the metropolitan region were more likely to underreport **TB** when compared to those treated in the capital. This finding may demonstrate the need for continued training of professionals to report cases in cities in the interior or in the metropolitan region. [14]

AIDS cases reported in units other than SAEs for HIV/AIDS are more likely to underreport TB because the professionals working in these services are potentially more capable of investigating, diagnosing and reporting more correctly for co-infections. [14]

The underreporting of TB represents great damage, since it is a prerequisite to start treatment. The extent to which non-notification is influencing the treatment of TB or whether these individuals, even though they are not registered, are receiving the appropriate treatment, as notification is required for the release of the drug for the treatment of TB. [14]

The article **TB 11** concludes that strengthening AB as a strategy for ordering health care should contribute to addressing the problem and possibly reducing the underdetection and underreporting of TB cases in the municipalities. [2]

IV. CONCLUSION

From this study it was possible to understand about the magnitude of factors related to the underreporting of deaths from TB, through the observation of the high proportion of cases diagnosed after death or untreated, treated for less than a month, and of those who died soon after hospitalization, in which the difficulties of health services at different levels of care became evident, when they failed to identify and treat cases in a timely manner.

Such characteristics make it possible to classify them as potentially avoidable, and should be given priority in public health interventions. In addition, the predominance of bacilliferous forms and the small number of cases identified in Basic Health Units, as well as those who received home visits, increase the risk of disease transmission between contacts, reducing or neutralizing the impact of activities of control.

Furthermore, tuberculosis death surveillance allows preventive and corrective actions to be implemented in order to increase the completeness of the information systems, reduce underreporting and the number of closed cases, supervise the epidemiological surveillance of the units and the quality of filling out the declarations of death, death, in addition to seeking contacts not evaluated by the health team.

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Hybrid Teaching: Teaching-Learning Process by Technological Tools, Challenges and Possibilities

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Abstract— Much is discussed about the effective use of electronic devices along the internet to develop educational practices in school environments, as well as, extend this action to create a relationship network for the external area and establishing a practical and productive communication to build this process of such singularity. and importance in the lives of so many people. In this scenario, it is extremely important to understand the challenges and possibilities that Hybrid Teaching in its implementation can contribute to the development of students' integral learning. In this context, this study has the general objective of reflecting and researching the challenges of contemporary education , comprises ing the dynamics that the hybrid teaching involves the teachers and student demonstrations as a nonlinear and highly active process. This study becomes considerable since it portrays a highly considerable level of relevance, consequently generating benefits for a promising educational future and its pedagogical aspects. However, the study was supported by a bibliographic research, which is based on references published in magazines, periodicals, books, allowing to establish a sum in order to enrich the research, which, in turn, is a way for researchers to interact about what has already been studied. This research presented a call for great reflections and a healthy debate about the great results that can emerge with the implementation of hybrid education. Theories committed to the radical change that education needs, the challenges imposed and possible to be overcome and the need for partnership with the technologies.

Keywords— Educational practices. Hybrid Teaching. Educational contemporaneity.

I. INTRODUCTION

Educational institutions demonstrate cultural roots that are linked strongly with daily methodologies in the classroom, providing techniques and tools often outdated and do not take effect, and n will materialize in the expected results over a term. Much is discussed about the effective use of electronic devices along the internet to develop educational practices in school environments, as well as, extend this action to create a relationship network for the external area and establishing a practical and productive communication to build this process of such singularity, and relevance in the lives of so many people.

It is with this perspective of a face-to-face and virtual education that according to Silva (2015), hybrid education is a teaching medium that links online activity and traditional teaching to meet the demands of contemporary students, which are inserted in a context which has Digital Information and Communication Technologies (TDIC). In this sense, the present research portrays a highly considerable level of relevance, consequently generating benefits for a promising educational future and its pedagogical aspects.

In view of this panorama that is of interest to all society and in relation to the need to rethink updated pedagogical practices for the current context, it was considered that opened space for the problems of this research, which is defined: What are the challenges and possibilities that Hybrid Teaching in its implementation in the designo of contributing to the development of the integral learning of the Students?

In this perspective, and s t and study d iscorre about the possibilities and challenges of hybrid teaching and, d iscut and on hybrid teaching, reflecting, in dialogue with authors and readers of this theme that in April and m spaces to analyze this for Education , the nalisa contributions of digital technologies to promote the dissemination of improving the quality of education and demand and Ntende r the challenges and alternatives that are envol vidos the dynamics of hybrid education.

This theme was motivated by the desire to reflect and research about the challenges of contemporary education and to understand the dynamics that hybrid teaching involves in teaching and student manifestations as a non-linear and highly active process. However, there are important tools that open another line of strategy in order to intensify investment in the training of professionals to encourage and present aspects that add values for teaching work and the search for satisfactory results through the range of opportunities that technology offers.

The act of researching indicates paths based on scientific and methodological knowledge that help to expose specific characteristics of a given subject. And methodology is the closest opportunity for fact-based understanding and social participation. In this same line of reasoning, Minayo (2004) says that research is a basic activity of science in its understanding of reality and questions, which, through a curious and restless look, seeks to investigate.

The current study was developed by a qualitative approach where according to Lakatos and Marconi (2017) it aims at a particular interpretation of the object being investigated. As, he focuses his attention on the specific, on the peculiarities, interests and is not only to explain, but to understand the phenomena he studies within the context in which they appear. S t a, it is the exploratory type , which According to Gil (2002) provides greater familiarity with the issues in order to achieve more detail and makes it more explicit. As well, enhances r discoveries ideas , always with a view critical.

However, study supported the was by bibliographic research. Santaella (2002) says that the bibliography helps to measure knowledge with other research related to its respective theme, seeking to detail and discuss it. In turn, it is based on references published in magazines, journals, books, allowing to establish a sum to this work in order to enrich the research, which, in turn, is a way for researchers to interact about what has already been studied and comes exposing other approaches, always punctuating a critical and non-linear view. Thus, the section of the theoretical framework, provides opportunities -If reflections on the possibilities of hybrid education, the need for training for professionals and the challenges that still exist in relation to its implementation.

This work presented a call for great reflections and a healthy debate about the great results that can emerge with the implementation of hybrid education. Theories committed to the radical change that education needs, the challenges imposed and possible to be overcome and the need to combine technological trends, punctuate with mastery the future that education in its greatness needs to prosper and the beneficial weapons that professionals in this sector have it in their favor, all in order to achieve meaningful and sustainable learning for their respective audiences.

II. HYBRID TEACHING : CHALLENGES AND POSSIBILITIES

The educational bias that has taken place recently opened dialogues for new discussions and , has contemporary practices along with technological and situational advances that strongly consolidate globalization in its broad sense. Much is discussed about innovation. creativity, connectivity within an educational environment, or more specifically, the traditional classroom. Using the reverent Freire (2007) which emphasizes that educational practice goes beyond the four walls, and Wed isquer space s as they are people with routines, planning and knowledge exchange s where is realized m the practice, as well as the mechanisms that assist in the effectiveness of the process. First, everything affirms the need for commitment in light of the reflection and construction of the critical, cohesive and responsible human being.

For a better understanding, it is necessary to better understand the concept of Hybrid and the basic proposal of the teaching pervaded by it. Thus, Moran (2015) states that hybrid means mixture and that education itself has always had this complex set of ideas, combining methodologies, time, space. And that from the understanding and development with the hybrid theory, it became more notorious, to realize the work connected with traditional practice and that together they can cross borders with creative, playful, flexible experiences and mainly with mobility to learn and teach in multiple ways.

Hoffman (2016) shows that even at the beginning of XXI century, punctuated the use of technology and how to add value in education, would make possible, as this had been strongly appearing and had perspective d the rapid development for society in general. In this context, the concept of Hybrid Teaching is gaining strength, associating the practice sustained in the traditional with a new model, through technologies and their diversity to foster gains.

According to Christensen , Horn and Staker (2013) hybrid education is a formalized education program, in which the student learns in line with the online methodology which he needs to be a collaborator to constitute a desirable level of control over his time, place, and aligned so that self-responsibility, is the face shape with their respective peers and teachers and on the environment are educational s, enabling s and traditiona ions.

As already mentioned, technological growth and the way technology is consumed and produced, go through the need to use them in favor of learning, always measuring and respecting such a challenge for professionals who, however experienced they may be, have not yet overcome practices traditional , where they focus the exercise of their functions on competences and skills centered on the orality and writing of our children and young people, and it is necessary to expand this system and offer resources that allow access, ease and mastery to bring them to favor of their learning in a broader and unlimited context.

Speaking of challenges within the Hybrid Education becomes a constant theme, but it is worth noting the quality level dent r the this context, for through technological resources, students gain dynamics, practicality, integration with their peers and teachers, as well as the possibility of having a replay to consider your doubts and reflect on such knowledge that will not actually be consolidated.

According to Neto (2017) the context in hybrid teaching can not be d efinid the with the idea of himself as the opposite and different from the real, but as a way variable to be, considering its peculiarities and its same process as divers ificado, but search for the same result, the significance and relevance in learning. The interactions carried out on the virtual network are endowed with a potential reality, where they are constituted by information from the most diverse origins, highly integrated and with the potential to change the structure of passive to active and critical human thinking.

Rovai and Jordan (2004), highlights mixed education as a cornerstone for the modern school . And in this situation it is essential practices and ideal to take to strengthen the process, there is af lexibility human resources to monitor and manage the demands of the new generati the and allowing tailoring teaching to the way of how the student will learn to dream success . Still in this new teaching format , which links technology to face-toface moments , class time is no longer defined as in the traditional method , as it is extended to other perspectives and possibilities . Students can access content, participate in discussion groups , solve situations, simulate pedagogical scenarios, develop skills important to their learning from anywhere and / or any moment, enjoying a meaningful experience of continuous, autonomous and intensive learning .

Understanding in this process the role of a mediator and an organizer of ideas so that you understand, accept and believe in the potential of hybrid education, in order to add values to the educational process in its various spheres , is essential . The teacher does not fail to have his level of pedagogical leadership to open space for technologies, but he needs to illuminate other paths so that those who need and / or want to learn , have contact with innovation and other relationships , in addition to physical contact and communication verbal. Thus, Carr (2010), stresses that the role of the teacher needs to be intrinsically linked to the evolution of society and to constantly open the range of opportunities to develop his teaching role.

Breaking concepts that are strongly active in human thought is challenging thus understand that the teacher had change s appraises is the role of transferring knowledge to learning facilitator, is a first step to accept, that in addition to reading and writing, currently the student body is developing competences and skills surpassed by the teaching and content areas. However, it is challenged by the modern educational process that is configured in the broader feeling that contemporary society has built. Hoffman (2016) clearly states that the change needs to be principiada, and should be the first teacher attitude, seeking renewal and adaptation in s document s teaching s.

Now in the virtual environment or in person, the envisaged advance teacher knowledge becomes necessari the , as well as a change holder professor posture of knowledge to mediator d learning, as above . With all this context debated about new methodologies, practices, possibilities, teaching becomes a metamorphosis of knowledge. The teacher becomes a mentor that leads the student to understand the reality and acquire the knowledge that interests him, making the teaching centered on the student , on his abilities and on what is captivated along the way, considering his experiences and consolidated learning.

This whole scenario, demonstrates the benefits of hybrid teaching , while tool able to engage and educate students so that, with autonomy and responsibility, show m -If able es to develop what is challenged. However, using what Silva (2017) says between the lines of your text, the idea requires er before all, a critical and active thinking by teachers, with the ultimate goal of infecting your audience and show Gossip will them to real ability to proceed with any task or competence. So it is that the educational world will be able to overcome any passive attitude in the process of teaching and learning, corrobor walk with more contemporary guidelines, creative, dialogic and especially open to cognitive interactions arising from the new technologies.

III. DIGITAL CULTURE AS AN EDUCATIONAL TREND L

To build a debate about digital culture, it is necessary to understand the concept of culture, and based on what Canclini (2005) reflects, it presents two spheres of easy understanding and meaning about the term. The first, part of the idea of the word used in everyday life, understood as a synonym for information, education and scholarship. This difference is based on the idealistic philosophy that has been built throughout history as the conclusion of customs, tastes, traditions. From another perspective, it goes through the conception of social sciences embracing the idea of culture as a scientific concept, relativizing as a result of ethnocentrism and admitting the image of culture as everything that man is able to create at any historical moment and especially in any social place. The author also mentions that the conceptualization of culture is like the symbolic value named the experiences and beliefs that man and society promote among themselves.

In other words, Barato and Crespo (2013) complement this idea, affirming the correspondence of culture to the set of social conditions that create, recreate, transform values and meanings. When characterizing Digital Culture, the way in which connectivity and the way of communicating between peers are linked is wide open. Heinsfeld and Pischetola (2017) also affirm in this line of reasoning, that through this connected culture, a restructuring of society took place, made possible by connectivity and that in this new hybrid environment, there is the extinction of the limits between what is venerated between the real and virtual, for the opportunity of increasingly broad and fast connections, enabling ever closer and more efficient relationships.

In order to explore the student potential, one of the paths that is being discussed is the relationship between digital culture and education, since, considering the world of possibilities and the range of opportunities offered by the virtual network, teachers and students would come into an increasingly closer link. and offered teaching and learning models that are in line with contemporary society that is immersed in such a context . In this sense, Modelski, Giraffa, Casartelli (2019) assures that digital culture as a pedagogical tool, goes beyond a mechanism that was already brought in old teaching formats and that through this global evolution, the subjects inserted in the context develop the ability to act in new situations and discover more practical and viable ways to consolidate their expected learning. Necessarily, the conjuncture of strategic methods defined for a group or in individual cases that come together for similar needs and / or affinities, can be replicated, as well as promoting identical results, but in another panorama.

According to Lopes and Melo (2014), digital technologies favored the construction of new ways to communicate, faster and with shorter words, use of icons, illustrations, to make the interpretation of that verbal relationship more effective; Thinking (simultaneously with a variable of open links), dealing with information and having the sanity to manage it, all of this became possible through the cell phone and / or computer that, with access to the internet network, dominated the whole scenario of civil society, it is worth remembering, that many call individuals born in the early 1980s, a society or analog generation. Even printing a slow speed for adaptation, it is clear that such slowness is even more intense in the educational scenario, the challenges are immense, from the offer of physical resources, as well as the absence and / or lag in the training process that also needs to be invested. to find a air successful implementation of the digital age within units and ducacionais.

Barato and Crespo (2013) are again used when they support the idea that in order to face all this discussion in relation to digital culture, it is essential to understand that it is not only a procedure based on technology, but it is also built on an action rational. That is, through mathematical and calculating processes of production and creation, as the human being has in his hands a new universe, updated and mainly unlimited, both in the physical and spatial sense, as there are no restrictions whatever the nature. It is about the empowerment and autonomy that is granted to them through these new educational trends , where they reflect on relevant results and mainly in an increasingly modern perspective, welcoming pedagogical and social needs and properly holding quality and easy access to contemplate all society, even considering economic and territorial aspects.

Giroto , Poker and Omote (2012) in their productions on pedagogical practices, emphasize the idea that, through globalized trends that may be directly facilitating the teaching and learning process, these technological supports become highly inclusive practices, which fosters the peculiarities, needs, desires on the part of the students and that in the teaching work and planning it is possible to measure and stop these paths for a more complete and effective development. Thus, the authors still point out that what the school institution knows and has in its hands is not completely satisfactory to carry out along with this innovation process, as it is essential that these school units have help to be qualified to embrace size challenge , b on how, have trained human resources and the basic structure to kick-start or continuously improve this performance.

Schiehl and Gasparini (2016) agrees with this idea when it portrays the constant need to transform the educational universe into motivating and totally intentional spaces and processes for complete learning, and in order to develop skills for individuals in this scenario, to be professional researchers, critics and decision-makers based on scientific knowledge, respecting the limitations of empiricism. The authors still show a distance between these technological educational proposals and the real situation of the classroom and that this gap exists not due to domain or resources such as hardware or software, but to have an view that these resources will solve or to satisfy certain difficulties, both from students and professionals themselves, which enable continuous improvement in the teaching and learning process. It's not about just hold these technology s, but the way how to use it s within the school environment.

In agreement with Andrade (2019), the instigation of the school in the face of the new model of society based on technologies and its advances, directs reinvention, a way of thinking about the increasingly active participation by students, who bring with them information, contexts and originality of the world "online", realizing that this constitution perspective of knowledge can not be paralyzed or merely a cast, which should not be limited n the concrete walls of the school. Much is said in higher education, about research and extension, but the gap in these aspects is notorious, as well as educational policies, which urgently need intuitive, visionary, innovative, creative discussions and leaders, as they are important parts in promoting practices and initiatives to succeed.

Although the author's scenario to happen a break in use and customs that are still strongly linked to the concept of education and its initiatives, it is essential to think n the students as active subjects and on the other hand reconsider school spaces without borders (represented through school gates) re-signifying physical and bodily distances, in which these educational technological trends, new methodologies and teaching methods, together with the idea of great innovative potential, unfold as devices for knowledge construction and mainly to consolidate skills and development of cognitive skills.

IV. MAIN CHALLENGES IN THE IMPLEMENTATION OF HYBRID EDUCATION AND THE MODELS USED

Through everything already discussed throughout this research, we realized that digital and technological instruments can directly collaborate in the teaching and learning process and that for an efficient use of Hybrid Teaching in the school context it is essential to think of a change that includes the provision of adequate infrastructure with their respective equipment, trained and qualified professionals to develop this process, curricular agreement with classroom practices, a special perspective for the evaluation aspect, illuminated by these paths is that the school institution will effectively print the practice of hybrid teaching. In this section, we will discuss the main provocations of this implementation, as well as present models and experiences of this way of doing education.

According to Castro (2015) about putting hybrid teaching into practice, there are no ready - made recipes, it is necessary to elaborate own ways of problematizing, challenging, instigating the student body with each component , perceiving their respective levels , and obviously, the target audience as members involved in that environment . Through this hybrid teaching model, feedback among social peers is the greatest sign of effective capacity for improving practices. It is the function of the teacher with school management, wanting to leave the world, the four walls of the classroom, and open space for the exchange of experiences in order to make them more apt innovations, new implementations as well as providing opportunities for themselves, professional improvement. And for the teacher to be ready for this implementation, management needs to have an investment perspective to corroborate this theory of change, even with slow steps.

Attention is paid to the need that emerges for complementary training for teachers to update themselves in the face of the modernization of pedagogical practices such as social transformations contemplating a more comprehensive education. With the clear intention of forgetting the idea of displaying content for a more complete performance, facilitating learning with the proper use of technologies. Kanashiro (2018) far beyond passing on content and knowledge, the teacher is dimensioned to create a closer relationship with his audience, establishing positive and effective connections and knowing the real situation of reality that are immersed to support his training with skills and abilities not only cognitive, but, make the student as protagonist, subject of a social environment and who has critical and relevant thoughts to support future decisions.

According to Viegas (2020), one of the discussions is the recurrence to the highest level of difficulty within this hybrid context, it is the personalization of the evaluation, as, according to the author, it strengthens her discourse of seeing, as a first step, the diagnosis to foster, understand and add value to teaching planning, and in this way, everything that the student already knows to succeed in the process is verified , and not just limit the action of evaluating at the end of the cycle. You have to tear the idea of evaluation only for metric and quantitative bias, but to build on the prospect qualitativ to . Thus, the integration and openness of digital technologies makes use of all these reflections, as well as strengthening the strategic ideas of students' organization in the classroom, in the classroom, in order to favor the conduct of referrals and personalization actions, by levels, such as example, always aiming at success in all stages and tasks that propose the model discussed in this study. Still on evaluation, the teaching work is also based on the practice of constantly evaluating its students, and that such practice, within the hybrid context, has the main objective of recognizing the interventions that need to be carried out at the right time. As previously mentioned and exemplifying the author's idea of the relevance of the diagnosis, it can be developed based on quiz or intentional dynamics that enable the teacher to glimpse this proficiency and everything that the student brings with him, be it his social, cultural experiences, customs, knowledge already acquired, so as from the initiatives to build this method, they can know the real role of each involved in this universe.

Mazur (2015) mentions that when active methodologies are contextualized, at first it is necessary to deconstruct the outdated idea that learning is a passive, mechanical and receptive attitude. In this way, placing the subjects involved in the educational process in the construction of this knowledge and significant learning, understanding that both the student and the educator, are seeking certain knowledge.

We resort to Moran (2017) when he addresses his approach on the systematization that configures the hybrid system , where it needs to be interconnected and integrated, that is, linking through various areas of knowledge (curricular components, specific fields of knowledge), to promote a humanist vision , with maximum breadth of knowledge, pedagogically sustainable and with creative application contextualized in different forms of knowledge. It is worth mentioning that, when reconfigured, it must contemplate three processes and leave them in balance: personalized learning, peer learning and learning mediated by more prepared people (teachers, advisors).

In personalized learning, it is when each one can follow their own paths, adapting and respecting their pace, expectation, style, situation and having autonomy to compose their curriculum, choosing activities and content that in their view is more pertinent, always with collaborations with their students. pairs, is total or partial customization . In Entre Peer learning , integration with the most diverse groups is contemplated in an interconnected manner. And in Mediated Learning by more experienced people, prepared is always reminding the figure of the mediator, exemplifying, it is the collaborative professionals, teachers, mentors, advisors, class leaders. Thus, we consider that all this theory is hybrid because it allows integration times, activities and spaces, overcoming the division between and virtual, but combining them and tra bal hando with optimization to deliver what each has to offer and whichever is more appropriate for the learning of each type of person.

Oliveira (201 9) suggest a more pronounced division of hybrid education into four models: Rotation, Flex, À la Carte and Enriched or Enhanced Virtual. The Rotation model decentralizes to four types: 1. Rotation by stations, where it is possible to modify the space and conduct the classes through the teacher, in smaller groups, allowing students to learn both virtual and collaboratively. 2. Rational Laboratory, students circulate in different spaces. The teacher can stay in the traditional room with a group, while the other will be performing some different task with the same line of knowledge, online. 3. Inverted Classroom, basically reverses roles, the study of theory and concepts, starts to be carried out at home, in the room the mediator plans an action that this knowledge will be shared. 4. Individual rotation, the student has a series of tasks to be added to their respective routines. The control is only of the student and he can define when he will be prepared for an evaluation process that will participate in it.

In the **Flex** model, virtual practice is the main method. But, students need to stick to the daily schedule at school units, with a flexible routine scheduled. Personalization is increased, as students have peculiarities in their routines and cannot necessarily be grouped by grade. In the \hat{A} la Carte model, the focus is on online education. And similar to the previous model, the student has a list of tasks that need real Custom Greeting ent, exist going to the presence of the tutor who helps direct the process. In the **Enhanced or Enriched Virtual** model, also happening online, the complement with the face-toface meetings is more intense and sees the accompaniment periodically with tutors.

V. FINAL CONSIDERATIONS

In line with the discourses and theories presented throughout the study, the relevance and capacity that Hybrid Teaching in fact results is clear, as it opens up a wide range of opportunities to improve the teaching and learning process, in order to meet the needs of current generation, providing with pedagogical intent innumerous didactic values that face contemporary challenges with great dynamism, flexibility, interaction, autonomy, innovation, for the current context and mainly to make a link for future generations and their new expectations.

This work presented a call for great reflections on the efficiency and effectiveness of such a process both for teaching and for educational institutions. The society faces technological modernization with great acceptance, and it is very visible, it is necessary to start a fight for the elaboration of policies that will guarantee a new organization that in fact meet the current demands and facilitate the development of more expressive skills, expanding to in addition to the intellectual ones, the cognitive ones, which, as mentioned in the development, are those that have the greatest effect on the assertiveness of effective decision making.

Importantly for implementation and configuration of the hybrid education in school environments, part of the connectivity with new technologies, including networks internet, allowing interweaving spaces available learning with the arrangement of the process s of teaching and learning, of course with adaptation and respect for the peculiarities of each context and situation. Another aspect that can be highlighted is that, according to the theories of great authors presented, the hybrid does not reproduce or resemble repetition activities, that is, using this teaching perspective, ideas of new transformations proliferate in the educational scope and extends to creation development paths, as well as research and extension.

Naivety cannot take over the thoughts of educational professionals, you cannot close your eyes to such a change in such a short time, because, parallel to all this context of a new script that can be followed, it fills your eyes with hope believing in a new direction for Education, but, it can be mentioned the great milestone, negatively speaking, of the Pandemic caused by COVID-19, where it destabilized the teaching units, mainly in elementary schools because until then, children and young people were prohibited of using the cell phone inside the classroom, and today, this is the main tool to reduce the effects on school bias and consolidate through new methodologies diverse learning.

Thus, debated about the light that the hybrid presents and the new modern context that is spreading every day, it is unquestionable the readaptation that education needs to be constituted. Increasing investments for financial stability by opening doors for physical and pedagogical reengineering on the part of our government officials is essential, but also alongside these resources, it is necessary to have the look of change that teachers and other employees have to accept, understand, believe and even then to infect their respective audiences for the much dreamed of change, to leave the discourse that education has changed and to be an agent of real change in order to prove a true basis in these statements.

For the implementation of hybrid education to happen, first of all, it is to break down the ingrained barriers of traditional education, not to forget it completely, but to measure its positive and negative aspects, and then to plan and unify for the hybrid proposal. It is known that it is not a quick change, and it will not happen overnight, but, it is necessary to start as soon as possible so that the new generation is not marked by the losses resulting from inertial methodologies to what is expected. Teachers who are critical and active is essential to mediate the proposals presented here, who in turn have in their hands the empowerment with students to follow steps towards autonomous positions, guided by critical sense and theoretical foundations.

Freire and Guimarães (2013) in an enchanting work on the practice of educating with the media, addresses the topic of transformative education through the technological possibilities immersed in society and comes up against the dialogue permeated by this study. The authors ask reflective questions for pedagogical methods, about whether the school uses ignorance, behaves as an adversary, or will be part of the same team as allies with technologies. In this sense, they emphasize that contemporary culture needs technological use, playing an increasingly important role for a sustainable, creative and critical education. All of this corroborates the precise attitudes that education needs to provide its full development.

And from such changes, one can dream of overcoming the passive and receiving attitudes that education mostly promotes in its teaching and learning process and meet the most dialogic and open proposals offered by new technologies. However, for the hybrid strand to be effective, it is necessary to be well planned to effectively contribute to current demands. Finally, the research highlights the benefits of hybrid education, as well as discussing its respective challenges. It also addresses topics to prosper the discourse and broaden the debate. In this way, contexts that are aligned with the discussions on the formation of implementation of hybrid education, expansion of new horizons pervaded by the new look of educational practice, always opening space for parallel or diverging opinions on the principles and beliefs of hybrid education.

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Neoplasia of Head and Neck: Perception of the Nursing team in the accommodation at the Cacon of the hospital Universitário Professor Alberto Antunes

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Abstract— Oncological pathologies of the head and neck are increasing worldwide. This scenario in the care of cancer patients presents great challenges and requires qualified professionals to deal with this demand. This study aims to understand the perception of the team of nurses regarding the reception of patients with head and neck cancer treated at CACON of a University Hospital. The methodology was based on a descriptive, exploratory research with a qualitative approach, where observation techniques and semi-structured interviews were used with 18 nurses who work in the service for data collection which were submitted to content analysis. The results demonstrated the complexity of the subject, the importance of humanization and comprehensive care. However, the care provided is still focused on the therapeutic part. It is expected that this study may contribute to the search for self-knowledge, and also that new strategies can be built in the curriculum process for the training of future nurses.

Keywords— Neoplasia, Nursing Oncology, Reception.

I. INTRODUTION

Cancer is a public health problem, worldwide, of great epidemiological relevance in terms of incidence and morbidity and mortality.

It is a chronic disease and represents, in the imagination of people, the symbol of the impossibility of cure, referring the human being to the confrontation with the finitude of life.(LUZ *et al.*, 2016)

In 2020, the number of new annual cases is estimated to be in order of 15 million. In Brazil, cancer mortality represents 13.7%, second only to diseases of the circulatory system whose percentage reached 27.9%. Deaths from external causes appear next with 12.4%.(AMADOR *et al.*,2011)

The nomenclature "Head and Neck Cancer" is related to malignant neoplasms of the upper airways and paranasal sinuses.(CASATI *et al.*, 2012).

Oncological pathologies of the head and neck are growing all over the world. According to (SILVEIRA *et al.*, 2012) the prevalence estimates a value of 900 thousand new cases diagnosed worldwide. Neck tumors have a high mortality and morbidity rate.

They can involve the oral cavity, pharynx, larynx, nasal cavity, paranasal sinuses, thyroid and salivary glands.(CAMPANA e GOIATO, 2013)Approximately 40% occur in the oral cavity, 15% in the pharynx, 25% in the larynx and 20% in the salivary and thyroid glands.

The incidence is higher in men than in women, in the proportion of 5: 1, over 40 years of age, the main risk factors being the consumption of tobacco and alcoholic beverages.(FERNANDES, BERGMAN e OLIVEIRA, 2013)

The Ministry of Health centralizes national data on the notification of malignancies at the Instituto Nacional do Cancer (INCA) at Rio de Janeiro.

The treatment of head and neck cancer can be by radiotherapy, chemotherapy and surgery, and can be isolated or combined with each other. Currently, surgery plays a very important role, because of it that it was possible recognize which type, the staging of the disease, and thus define prognosis and the main treatment.(FERNANDES, BERGMAN e OLIVEIRA, 2013)

The Centro Avançado de Alta Complexidade em Oncologia (CACON) is part of Programa de Expansão da Assistência Oncológica no País, launched by the Ministry in 2001, with the objective of changing the current model of assistance to cancer patients, is inserted at the Hospital Universitário Professor Alberto Antunes – HUPAA from the Northeast region of Brazil since 2006, and acts as a reference in the State for comprehensive care for cancer patients. It provides assistance on an outpatient basis, medical, nursing, nutritional, psychology and social services, emergency care, chemotherapy and radiotherapy.

The care for people undergoing cancer treatment is directly assisted by the nursing team, and they are responsible for comprehensive care for patients and their families.

The role of nurses in the hospital environment is faced with responsibilities towards these patients and their family, because they assistance care that ranges from reception, nursing consultation, systematization of assistance and family care, in addition to constantly dealing with situations of suffering and death, which are accentuated by the demands inherent to the service provided in the care of these patients, thus requiring technical competence, comprehensive care.(LUZ *et al.*, 2016)

Head and neck cancer is considered one of the main tumors that affect people in Brazil and worldwide. It is of great importance that nursing accompanies the development of this specialty, in order to improve the quality of the care provided.(PRIMO *et al.*,2016)

In Cacon of HUPAA, the statistics with epidemiological data for 2015 were 66 registered cases of head and neck cancer.

Perceiving the cancer patient brings different meanings, changes in values, beliefs and attitudes that demand appropriate and individualized interventions to minimize the threat to their physical and psychological integrity, which leads nurses and other professionals of their team to confront their own vulnerability. Assisting the cancer patient goes beyond a prescription for care: it involves monitoring his or her trajectory and that of his family, from diagnostic procedures, treatment, remission, rehabilitation, possibility of recurrence and the final stage of the disease, that is, experiencing moments of diagnosis at terminality. (SILVA e CRUZ, 2011)

Nursing care for cancer patients must be seen as full, encouraging, affectionate care and committed to helping adapt to new living conditions. (COSTA E SILVA, 2013)

In view of the above, the present study had the general aimto knowthe perception of the Nurses teamregarding the reception of patients with head and neck neoplasms treated at the Cacon of Hospital Universitário Professor Alberto Antunes.

There are great challenges that need to be faced by professionals who care for patients with head and neck cancer, since this demand is growing and nursing needs to qualify to improve the care provided to these patients in order to generate better assistance in the process healthdisease of cancer patients who come to the institution.

II. METHODS

This is a descriptive exploratory study with a qualitative approach, conducted in the Centro de Alta Complexidade em Oncologia, CACON, at Hospital Professor Universitário Alberto Antunes HUPAA/UFAL- located in the municipality of Maceió, Alagoas, Brazil, which serves the Sistema Único de Saúde (SUS). The study sample was composed by the team of nurses assigned to CACON of HUPAA, in their respective sectors: Chemotherapy, with 10 nurses; the Ambulatory, with 2; Emergency Service with 4; and Radiotherapy with 4 nurses. Data collection started after being evaluated bv the Research Ethics CommitteefromFederal University of Alagoas (UFAL), and approved according to Opinion 2.384.548, from November 2017 to February 2018, in the Oncology sector of the HUPAA. All volunteer participants were informed about the research, and they decided about their participation, as volunteers, by signing the Informed Consent Form. The information obtained was collected through semi-structured interviews and observations, being subsequently submitted to the content analysis process, which seeks to verify the units of analysis.Finally, the study's findings are reported and discussed in the light of the literature.

At first, an appointment was made personally with the participants for the most feasible day and time, and everyone demonstrated interest in participating in the research. The semi-structured interview addressed, in a first moment, five closed questions related to the professional category, age, time since graduation, place and time working at the Institution, time working in the sector, and also regarding the realization of other courses or specializations, and eleven open questions, which addressed the understanding of head and neck neoplasia, professional experience, patients' needs and the need to implement a care protocol in welcoming this type of patient.

In order to guarantee the spontaneity of the reports, reducing possible constraints or reporting experiences lived in the daily service, they were conducted in a closed environment, during the working hours. The transcripts were submitted to the reading and evaluation of each respondent, in order to guarantee the reliability of the collected data and subsequent elaboration of final summaries.

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The data from the results of the interviews were analyzed via content analysis by Laurence Bardin (2011).

III. RESULTS

The results obtained were collected from volunteer nurses who are part of the Centro de Alta Complexidade of Hospital Universitário Professor Alberto Antunes – HUPAA/ UFAL – Maceió-AL, through the interviews and observations made, which were analyzed via content analysis, following the author Laurence Bardin, and guaranteeing the confidentiality and anonymity of the participants, they were called "A" to "S".

The research sought to understand how the Reception is focused on the care provided by nurses working in the oncology service, to the patient with head and neck cancer treated at CACON, in order to minimize the emotional, physical, biological, psychological and social problems caused by cancer, thus focusing on humanized, holistic, individualized and welcoming assistance.

In total, 18 nurses were interviewed, assigned to the service of Chemotherapy, Radiotherapy, Ambulatory and Emergency Care within the Center of High Complexity in Oncology who were available and inclined to participate in the study.

The mapping of the interviewees profile, shown in Chart 1, reveals that only 01 is male. The age range varied between 27 and 62, with an average age of 38 years. All have different specializations, but only 07 have specialization in the area of oncology.Professional experience in the service is a relatively short time. With the exception of 03 respondents, the others work in the sector approximately under 3 years old.

After analyzing the interviewees observations and testimonies, it was analyze the interview with the participants voices considering the participants daily lives, their routine, their feelings in the face of the coping scenario during the care for these patients. For an overview of the interviews, they are presented in 10 categorization grids, according to the questions and reports of the investigated participants. As they respect ethical standards, their names are preserved due to reasons of confidentiality, which were called "A" to "S". A crossing was conducted between the observed data and the specific objectives proposed, thus reaching the scope of the investigated phenomenon. It is of great importance to know better the human being and the disease in order to be able to provide better care.

The knowledge about this pathology is recognized by most of the research participants in a superficial way, but they understand how it interferes in the patientsdaily lives, however, some still feel lay about the subject. Even without much knowledge about the specificity of the disease, it is understood how aggressive it is and how much it impairs its quality of life, as perceived in one of the reports:

> "[...]in general we observe that it is a very stigmatizing disease, because it is in evidence, it is something that is often difficult for you to hide, and so, it is related, like this, to issues, like, of life habits, that I can observe , right ... it's smoke, exposure to the sun, it's often hygiene itself, which is also related, so

some things can also be done in order to prevent this neoplasm. [...][sic]". (ParticipantERO)

The impact of treatment on patients with head and neck cancer is generally greater than in other types of tumors, due to its mutilating and disfiguring characteristics, as well as the functional changes left by it, which leave these individuals with reduced self-esteem. (MENEZES *et al.*, 2011)

There are several sequels caused by the treatment of this disease, as they involve the individuals physical, mental and functional domain. (ZANDONAI *et al.*, 2010)

Therefore, it is clear how much this group of patients deserves special attention in the care of nurses because they present their biopsychosocial factorsaltered, in general.

Oncology care, in general, is still a major challenge for nursing, and requires coping strategies from professionals.

Holistic care implies welcoming, establishing bonds and attitudes of interest, but health professionals are often unable to offer because they are unaware of coping strategies. (RECCO; 2005)

Often the professional faces these challenges of caring for patients with head and neck cancer in relation to their professional experience, and in the service it was noticed that the professionals did not receive any training to work in the specialized service, however, in interpreting the testimonies, they managed to perceive that the professional always wants to seek improvement to provide quality care.

This is noticed in some studies, when talking about training in Oncology. To Calil (2010, *apudAmador; et al*, 2011),in Nursing degrees, there is a big gap in subjects focused on the Oncology area.

In Nursing Graduation, one of the perceived obstacles is the role of nurses in the care of cancer patients, including the attention to the child at the beginning of the profession, creating a difficulty in comprehensive and humanized care. However, there is an individual search for knowledge by each professional. (AMADOR, 2011)

But even so, from the question raised about the need for training and updating for nurses within the studied scenario of oncology, specifically head and neck cancer, it was possible demonstrated in the analysis of the participants statementsthat in general, they were unanimous, revealing the importance and the need for improvement for qualified assistance.

For Salimena *et al.* (2013a), the offer of comprehensive and quality care is essential in the daily care of patients with cancer and each professional seeks to do what is within their reach to alleviate suffering.

The reports also demonstrated that it is not easy not to get emotionally involved, in view of the demands of technical assistance care experienced by the participants in their daily routine, together with patients with neoplasia, as shown in the excerpt of some statements:

> "[...]I feel somewhat fragile at times when faced with the suffering faced by people, the difficulties in different ways and not being able to change this reality. [...]".(ParticipantEPAJ)

> "[...]So it's a feeling of helplessness, given the magnitude this, of the problem itself. Most are already diagnosed locally advanced or well advanced and we end up focusing on palliative care exactly as the patient does not have a curative perspective".(ParticipantEQM

However, there are also many positive feelings, such as gratitude, because the little the team can do can demonstrate the recognition of the work provided, as shown in the excerpt below:

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"[...] I think I had the honor of working with them, I think I learn a lot more than i give them. I learn a life lesson... I learn to look at my life with different eyes, I learn not to complain about life, to be very grateful for everything I have [...]". (ParticipantEQG)

Even with the feelings expressed, it is possible to relate cancer to various negative aspects, such as pain, suffering, mutilation, among others, in which professionals often experience feelings of joy and satisfaction when the disease is cured, and also relieved when the patient dies, because he is freeing himself from suffering.

Nursing care goes beyond procedures and technical knowledge, requires responsibility, interaction and often, just being present.

According to Salimena *et al.* (2013b *apud* Gonzales, Beck and Denardin, 1999), the professional becomes aware and reflects on how he would like to be cared for putting himself in the others place, where it is perceived that involvement in care promotes empathy, and this is present in the day by day.

According Prearoet al.(2011), Florence Nigthingale defined and structured nursing as the art of caring for and assisting human beings, developing their activities in the promotion, prevention, maintenance and recovery of health.

In the context investigated, the care questioned in the interviews was to be seen in its broad sense of relationship with the other, but not all reports demonstrated this breadthaimed at the assistance provided more focused on the therapeutic part. The reports show, in general, that the nurse is still very focused on technical knowledge, not used to dealing with the psychosocial side, which is also demonstrated in Prearo (2011), and the need for nursing actions focused on the biological dimension.

Care in the most humanistic way should be prioritized and not just pathologies and technical procedures.

At the analysis of the study in relation to the complaints of the patients, it is noticed that a patient with neoplasia of the head and neck does not present only physical complaints, such as pain, but that the psychological aspect of it also interferes a lot in his quality of life, needing to be accompanied.

Early detection of cancer and specifically head and neck cancer is a determining factor in its prognosis.

The reports presented draw attention to the social dimensions involved in the health process, cancer disease, which still do not correspond to the expectations that are desired, thus interfering in the patients needs, which go beyond the organic needs but, emotional and social, as mentioned below:

> "[...]We find it very difficult to schedule appointments and exams. Financial difficulties and in the purchase of medicines, and transportation. They travel a lot here,

sometimes from the countryside and end up spending a lot, lack of family support. Often, they need hospitalization and there is no place for these patients [...]".(ParticipantEPAJ)

According to Silva; Cruz (2011), the flow of actions performed on cancer patients is still slow for the demand, with regard to the expansion of hospital beds, structuring of care, late diagnosis and delay in the start of treatment, which will limit the chances of healing of these patients.

Working with Oncology involves not only training, but also beliefs and individual experience of each professional, so that coping strategies are established, aiming at an adequate and effective assistance to minimize suffering.

According to Nicolussi *et al.* (2014, *apud* Saevarsdottir, 2010), the goal of cancer treatment is to prolong life and cure, but if it is not possible, it is of great importance to improve your quality of life.

User embracement is a relationship between the professional and the user that involves a technicalassistance action, through ethical, technical, humanitarian and citizenship parameters, facilitating the reorganization of services, improving the quality of assistance, where the user is the protagonist of the relationship. (COSTA, 2014)

When addressing the issue of how the care provided to patients with PCN is seen, the participants demonstrated to recognize the translation of the care, such as humanization, qualified listening, expanding the knowledge of clients.

The reception and nursing care are interconnected, since both involve the establishment of interpersonal relationships, with the objective of meeting the user's needs, making humanized assistance. The essence of the nurses work is the act of caring. (FERNANDES, 2017)

According to Guimarães *et al.* (2015), in specific care for cancer patients, it is important for nurses to be guided and updated on the latest advances in the treatment area, also highlighting the importance of systematizing care based on properly registered protocols.

The use of a care protocol in the daily work of nurses, in addition to providing the scientific support necessary for their practice, also facilitates the planning of care, unifies conducts according to the reality of a given service, making care safer and qualified. (LOURENZO, 2013)

A cancer patient, specifically Head and Neck Cancer, requires a proper care plan because of specific problems. In view of this scenario, it is of great value to use resources that facilitate the improvement of the quality of care provided to these clients, and one of these resources is the implementation of protocols to standardize care, thus planning cancer care. This was clearly visible in the testimonials acquired.

Regarding the observation, it was possible to verify that the volunteers were receptive and some anxious about the questions. However, they were all comfortably accommodated. Initially, a conversation was held to relax and later the questions regarding the interview about the Perception of the nursing team when welcoming people with head and neck cancer at CACON from Hospital Universitário Professor Alberto Antunes.

At the time of the interviews, it was possible to perceive the meanings of non-verbal language that showed awareness of the situation faced by patients and feelings of sadness, regret, of involvement with the studied context, but also of unease.

In some questions of the interview, it was possible to perceive the nurses anxieties associated with the difficulties faced by the non-guarantee of basic assistance offered by the system. On the other hand, expressions of satisfaction are perceived for being able to participate in this moment with this patient and for the individual service provided, thus contributing to the possible improvement of the patient.

It was noticed, in the expressions, that nurses experience different sensations, provoked by learning from day to day with the appearance of new clinical cases, motivating them to always improve their skills, and always willing and available to help.

In order to care for patients by connecting, welcoming, comprehensive care and excellence in careand according to the interview with CACON nurses, there was a need to create an Institutional Protocol in Oncology, since it is a of the specialties that have the dilemma of the daily struggle between life and death. With the care protocol for patients with head and neck cancer, it will be intended to standardize care, establish criteria, parameters for nursing diagnoses, treatment, control and monitoring, always based on scientific evidence, ensuring that they must be followed throughout the team and ensuring that all patients will have the same access. Knowing the nursing diagnoses and the interventions related to them, knowledge is built that leads us to develop an appropriate care plan, better patient care and organization of the nursing process.

IV. CONCLUSION

Given this study, there is a need to review institutional and educational policies in order to value the human relationship with the patient, as it has been shown that nurses are still not used to dealing with the biopsychosocial being, and are very focused on the do technical.

A well-prepared team of nurses is of great value, to act in a more humane way, contributing to the improvement of the quality of life of these patients with head and neck cancer, as it became clear, during the research, that these patients, during treatment, they develop functional complications, requiring early intervention by the team, in order to minimize damage and improve comprehensive care.

It is expected that this study will contribute to the search for self-knowledge, and the improvement of the theme "head and neck neoplasia" will bring results that benefit not only an improvement in the quality of care, but also the understanding for the construction of new strategies in the process curriculum for the training of future nurses.

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Effect of altering the reciprocation range and instrument speed on the shaping ability and working time of WOG NiTi instruments

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Abstract—Introduction: The purpose of this study was to investigate the effect of altering the reciprocation range and speed of the WaveOne Gold instrument on its shaping ability regarding canal centering ratio and preparation time. Methods: Sixty simulated resin canal blocks with a S-shaped canal were divided into 6 equal groups according to the reciprocation range and speed of the primary WaveOne Gold instrument (n=10): G1: 170 counterclockwise (CCW)–50 clockwise (CW)/ 150 rpm; G2: 170 CCW–50 CW/ 300 rpm; G3: 90 CCW-30 CW/ 150 rpm; G4: 90 CCW-30 CW/300 rpm, G5: 150 CCW-30 CW/150 rpm, and G6: 150 CCW-30 CW/300 rpm. Pre- and post-instrumentation images were superimposed, and centering ratios were calculated at 2, 5, and 9 mm from the apex. The time taken to complete canal preparation was compared and the incidence of instrument fracture was recorded. The mean/standard deviation values were analyzed using analysis of variance and the Tukey post hoc test. The significance level was set at P <.05. Results: Regarding preparation time, G2, G4 and G6 had the lowest mean for the preparation time, which was statistically significant in comparison with the other experimental groups (P < .05). Results for canal centering ratio showed that at 2, 5, and 9 mm from the apex there were no significant differences between all groups tested. Conclusions: Altering the reciprocation range did not significantly affect the shaping ability of WaveOne Gold primary instruments. Increasing the speed of WaveOne instruments resulted in faster preparation times.

Keywords—Root Canal Preparation, Materials, Endodontics, Techniques, Root Canal Therapy.

I. INTRODUCTION

Successful root canal treatment depends on effective debridement and shaping of the root canal system [1]. The purpose of mechanical instrumentation is to remove the infected soft and hard tissues from the root canal, to create access for the delivery of irrigating solutions and medicaments, and to create a sufficient taper for the subsequent placement of root filling materials [2], [3]. However, the complex anatomy of the root canal system and the inherent limitations of the enlarging instruments pose some challenges that can strongly affect the treatment outcomes [4], [5]. A new kinematics, reciprocating motion, has been proposed for NiTi instruments as an evolution of the balanced force technique [6]. It consists of a counterclockwise (cutting direction) and a clockwise motion (release of the instrument); the angle of the counter clockwise cutting direction is greater than the angle of the reverse direction. This kinematics subjects the instrument to lower stress values, rendering minimal distortion of the root canal shape and extended fatigue life. Moreover, shaping the root canal with a single instrument has been introduced to reduce the instrumentation time, cost, and cross-contamination risks [7], [8], [9]. Previous studies showed that canal shaping using single instruments with different kinematics did not compromise canal cleanliness and took less time to shape the canals compared with the traditional multi-instrument systems [2], [10].

An important determinant of the performance of reciprocating instruments, in terms of shaping ability and fatigue life, is the reciprocation range. WaveOne Gold files are designed with a reverse cutting helix, engage and cut dentine in a 150-degree counter-clockwise (CCW) direction and then, before the instrument has a chance to taper lock, disengages 30 degrees in a clockwise (CW) direction. The net file movement is a cutting cycle of 120 degrees and therefore after three cycles the file will have made a reverse rotation of 360 degrees [11]. Alterations in reciprocation range might affect the instrument's fatigue life and/or shaping ability inside the root canal [4].

Another factor that may influence root canal transportation is speed (rotations per minute [rpm]).Yared et al.demonstrated that the lower speed (150 rpm) did not result in any locked, deformed, or separated instrument [12]. However, Peters et al.found that increased rotational speed was associated with increased cutting efficiency [13]. In another study by Bardsley et al.it was found that instruments at 400 rpm generated less torque and force compared with 200 rpm [14].

To the best of our knowledge, there are no data in the literature related to the effect of different speed settings and CCW/CW angles for reciprocating motion on canal centering ratio and working time. Therefore, the aim of the present study was to evaluate centering ability and instrumentation time after artificial root canal preparation using different reciprocating ranges at 150 rpm and 300 rpm. The null hypothesis was that there would be no significant difference between different reciprocation ranges and instrument speed in terms of canal centering ratio and instrumentation times.

II. MATERIAL AND METHODS

Artificial Root Canal Instrumentation

Sixty simulated resin canal blocks with double curvature (S-shaped) root canals (Endo Training Bloc, 0.02 taper, 16-mm length; IM do Brasil, São Paulo, Brasil) were used. Instrumentation was performed by a single operator trained on the technique. The working length (WL) was set 1.0 mm short the apex of the simulated resin canal blocks. A glide path was created manually with #10 stainless steel K-files (Dentsply Maillefer, Ballaigues, Suíça). The blocks were then randomly divided into 6 experimental groups (n = 10 each) according to the reciprocation range and speed of the primary WaveOne Gold instrument used (n=10): G1: 170 counterclockwise (CCW)–50 clockwise (CW)/ 150 rpm; G2: 170 CCW–50 CW/ 300 rpm; G3: 90 CCW–30 CW/ 150 rpm; G4: 90 CCW–30 CW/300 rpm, G5: 150 CCW– 30 CW/150 rpm, and G6: 150 CCW–30 CW/300 rpm.Each block was fixed on a bench vice with vacuum suction cup.

The shaping procedure was performed with an inand-out motion, not exceeding an amplitude of 3–4 mm, with gentle apical pressure. After 3 motions, the instrument was removed from the root canal, and its flutes were cleaned with gauze. All instruments were operated using an electric motor with speed, torque, and reciprocation control (Dentflex Endodontic Motor - D Force 1000 Endo model, Dentflex Indústria e Comércio Ltda, Ribeirão Preto, Brasil). The torque was fixed at 2.8 Ncm. Irrigation with distilled water was performed between preparation of each canal third, with a total volume of 5 ml, using a 30-gauge needle (NaviTip; Ultradent, Indaiatuba, Brasil) that was inserted 3 mm short of the WL, and patency was maintained using size a #10 K-file.

Evaluation of Instrumentation

Images of the blocks before and after instrumentation were taken with a digital operative microscope at 16X magnification (661; Alliance, São Carlos, Brasil) coupled to a camera (EOS Rebel T6i; Canon, Manaus, Brazil).To determine the canal centering ratios at 2, 5, and 9 mm from the apex, pre- and postinstrumentation images were superimposed with image analyzing software (PaintShop Pro 2020; CorelDraw, Ottawa, Canada).The centering ratio was calculated by the following formula: (amount of resin removed from outer side) - (amount of resin removed from inner side)/postinstrumentation canal diameter at each measuring point [15]. Using this formula, a value of 0 indicated perfect centering, and positive and negative values indicated transportation to the outer and inner side, respectively.

Statistical Analysis

All data were tested for normality using the Shapiro Wilk test. All variables had a symmetric distribution. The mean \pm standard deviation values were analyzed using analysis of variance and the Tukey post hoc test. The significance level was set at P < .05.

III. RESULTS

Statistical analysis of the mean \pm standard deviation values showed that altering the reciprocation

range, the root canal level, and the interaction between them had no significant effect on canal centering ratio (Table 1 and Figure 1).

Regarding preparation time, G2, G4 and G6 had the lowest mean for the preparation time, which was statistically significant in comparison with the other experimental groups (P < .05). The ascending order of time in seconds was: group 2 <group 6 <group 4 <group 5 <group 3 <group 1 (Table 2).

Statistical analysis of the mean \pm standard deviation values for preparation time (seconds) are presented in Table 3. No file separation occurred during instrumentation of the specimens.

IV. DISCUSSION

In root canal shaping, from the aspect of the success of endodontic treatment, it is very important to maintain the original form of the canal as far as possible while the root canal is being gradually enlarged from the apical to the coronal region [3]. NiTi files are usually used, however, despite the advantages resulting from high flexibility, such as reduced transport and intracanal irregularities, they can fracture due to cyclic fatigue, especially in narrow and curved root canals.To prevent fracture in NiTi files caused by cyclic fatigue, single-file reciprocation motion systems are recommended [6], [7].

The present study assessed the effect of altering the reciprocation range and speed of the WOG instrument on its shaping ability regarding canal centering ratio at 2, 5, and 9 mm from the apex there and preparation time. Despite the absence of difference regarding the shaping ability, the null hypothesis was rejected, once there was a significative difference between the preparation time for the groups tested at 300 rpm.

Natural teeth and simulated resin canals are used to compare the shaping abilities of NiTi files. However, in studies using natural teeth, it is very difficult to maintain standardization because of the anatomic variations of the teeth. Peters et al. argued that when natural teeth are used, the anatomic variations of these teeth affect the results more than NiTi files [16]. In studies using S-shaped simulated canals, by easily comparing the pre- and postshaping images of roots via various computer programs, it is possible to compare the shaping abilities of NiTi files [17]. For this reason and considering these conditions, the S-shaped simulated canals were used to eliminate the anatomic variations that natural teeth have. The major limitation of the present study was the fact that the hardness of resin and the dentin is not the same [18], [19]. In the present study, no significant differences among the 150 or 300 rpm in the ability of the instrument to remain centered in the canal. A similar finding was found in the study by Yildiz et al.who found no significant differences among the WOG instruments tested at 750, 1300, or 2000 rpmin centering ratio at the three levels (3 mm, 5 mm, and 7 mm) [8]. Maki et al. evaluated how the speed of up-and-down motion could affect the canal centering ability of ProTaper Next rotary instrument, using simulated resin canal blocks with a J-shaped canal. Authors found that the highest up-and-down speed group showed the best centering ability, probably because the contact time of the PTN instruments to the outer canal wall was the shortest and thus the instruments removed the smallest amount of resin from the outer wall [19].

Faster preparation time allows the clinician to focus on the most important aspect of clinical endodontics, disinfection, thus fulfilling the mechanical and biological objectives of shaping canals. According to the results, using WaveOne Gold NiTi system at higher rotational speed resulted in faster canal preparation times. According to the study of Yildiz et al. WOG instruments used at 600 rpm was significantly faster than 300 rpm in root canal preparation [8].

A manual glide path was created before instrumentation; this is in agreement with Berutti et al. who reported that canal modifications are significantly reduced when a glide path is created before using reciprocating files [2].

Results of this study showed that altering the reciprocation range did not affect significantly the shaping ability and preparation time of WOG instruments. A possible explanation for this may be the fact that altering the difference between the counterclockwise and clockwise reciprocity angles, the cutting capacity of the parallelogram-shaped cross section is modified, keeping it more balanced and centered in the canal. This is in agreement with Saber & Sadat who investigated the effect of altering the reciprocation range and found no significant effect on canal transportation and the canal centering ratio. Authors also found a linear inverse relation between decreasing the reciprocation range and the time needed by the reciprocating file to reach the working length. Inconsistency in the results of different studies seems to be related to the differences in kinematics and speed used as well as to the design of the instrument [4].

The results of this study are disputable from a clinical aspect, and the shaping efficiencies on natural teeth may differ. However, these results are important for clinicians to have knowledge about the WOG NiTi files'

shaping efficiencies with security and to be capable of dealing with the anatomic difficulties, such as S-shaped root canal.

V. FIGURES AND TABLES

Table 1. Centralization ratio (means and standard deviations) of the sample groups and statistical analysis of ANOVA (Tukey)

Nível	G1	G2	G3	G4	G5	G6	(p)
2	-0.0646 (0.1174) ^a	0.0364 (0.0859)ª	0.2000 (0.1922)ª	-0.1795 (0.1502)ª	0.0114 (0.0493)ª	0.0597 (0.0844) ^a	0.0571
5	-0.0907 (0.0644) ^a	-0.0103 (0.0688)ª	0.2417 (0.0708)ª	-0.0813 (0.0991)ª	0.2169 (0.1161)ª	0.2033 (0.1852)ª	0.8674
9	-0.1331 (0.1123)*	-0.0399 (0.1154)*	0.1621 (0.2742)*	-0.1415 (0.1059)ª	-0.2142 (0.1474)*	-0.1746 (0.0848) ^a	0.1694

Same letters in the horizontal direction: no statistically significant differences.



Fig.1: Centralization ratio (means) of the sample groups

 Table 2.Arithmetic means and standard deviations of time
 (seconds) of the sample groups

Grupo 1	Grupo 2	Grupo 3	Grupo 4	Grupo 5	Grupo 6
196.90	143.20	178.20	149.60	175.10	146.00
(28.38)	(12.51)	(14.72)	(11.33)	(29.25)	(15.72)

 Table 3. ANOVA (Tukey) statistical analysis of the time
 (seconds) of the sample groups.

	Grupo 2	Grupo 3	Grupo 4	Grupo 5	Grupo 6
Grupo 1	<0.01*	>0.05	<0.01*	>0.05	<0.01*
Grupo 2		<0.01*	>0.05	<0.01*	>0.05
Grupo 3			<0.05*	>0.05	<0.01*
Grupo 4				>0.05	>0.05
Grupo 5					<0.05*

*: statistically significant differences.

VI. CONCLUSION

Within the limitations of this study, altering the reciprocation range did not affected neither the canal centering ability nor the working time of WaveOne Gold instruments. The high-speed groups showed faster preparation times.

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The authors deny any conflicts of interest related to this study.

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An Immense Review on Effects of Telecommunication Tower over Multistoried Building under Lateral Effects

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Abstract— As tower plays an important role for wireless communication network, the disappointment of such structure in hazardous situation will ultimately leads to loss of communication. In this research study, a review is taken with the theme of telecommunication tower over multistoried structure for different parts and situations of the entire world. Usually, for telecommunication persistence, the four-legged subsidiary tower are used extensively. In the last few ages there has been excessive growth in the communication industries outcome in the appropriate of huge amount of tower for stability of network and to increase the revelation area. The obtainability of terrestrial in city areas is very limited for sustaining the perfect connection of tower thus giving no substitute but to accept roof top towers. The review has been conducted to show the effects of telecommunication tower over multistoried building under lateral effects with different approaches along with different point of views.

Keywords— Seismic Analysis, Telecommunication Tower, Response Spectrum, Sloping Ground, Step Back, Step Back Set Back.

I. INTRODUCTION

In today's biosphere growth of cities and human colonies increasing day by day that is causing our agricultural lands and villages. To prevent unnecessary use of land high-rised buildings plays an important role. It reduces extra land use and cost. Therefore now a days towers are shifted upon buildings to save land from unnecessary construction. Tower companies are using building for towers they can use buildings as rental or permanent basis for towers.

The construction and safety of these towers are main issue for the engineers therefore to prevent it from earthquake and wind load analysis is required. The analysis can be done by using several software such as-

- 1. E- TABS
- 2. SAP 2000
- 3. STAAD PRO
- 4. CATIA
- 5. REVIT STRUCTURE

Modeling through these software helps to find strength of the structure against lateral and vertical loads. Analysis result shows the safety of the structure against lateral and vertical loads.



Fig. 1: Tower placed over multistoried building

It is healthy recognized that high-rise buildings act as equal important character in modern cities. First of all, tall structures can be excellently used to meet the necessities of contemporary civilization and resolve the problem of limitation of building site properties. On the other site, they are the indications of economic properties and civilization. These days, multistory building density increase higher and higher, with added floors which are more complex and separate plan elevation criteria, such as multi-tower structures.



Fig. 2: Tower placed over multistoried building in city

II. LITERATURE REVIEW

Nitin Bhosale et. al.

Mobile communication growth has increased from last three years. Therefore the need of communication towers and buildings is increased. The competition between mobile operators is also increased therefore the need of rooftop antenna has increased from last three years. The operators are adopting rooftop antennas now a day because it cost less than cost of land. In the present study, the comparison is shown in between ground tower members and rooftop tower at the same elevation.

M.A. Barkhordari, et. al.

Telecommunication towers are steel structure and their seismic response against seismic loads is different than concrete structure therefore an analysis is carried out against seismic loads on steel telecommunication towers in iran. This analysis is done on four legged telecommunication tower of height of 18 to 67 meters. The Dynamic, shear and vertical reaction of the tower are calculated.

Ghyslaine Mcclure, et. al.

In today's modern world telecommunication business at its top and the need of telecommunication rooftop towers increasing day by day because of increasing Teli-users. And they are obviously builted in dense populated areas therefore it safety against seismic loads, lateral loads, wind loads is more important. The study shows the time history analysis for maximum seismic base shear and also for the overturning moment of rooftop towers by showing correlation between them.

K. Jagan Mohan et. al.

Transmission towers consume about 28 to 42 percent of the transmission line cost. The requirement of electricity is increasing rapidly all over the world therefore to meet its demand economically development of light weight tower is in use.

In this paper, the effort is made to make cost effective transmission line by converting the shape and type of transmission line structures. By Using STAAD-PRO software analysis is carried on three towers. The wind load calculation is carried out and repeated again and again for the analysis and design of the towers.

S. R. Massah, et. al.

The telecommunication structures are basic structures now a day all over the world. Therefore it seems important to keep it safe from natural disasters like earthquake and heavy wind loads.

This paper shows the investigation of seismic reaction of four legged self-supporting towers. Total ten no. of telecommunication towers are studied in Iran under the seismic and wind effect with the help of Iranian seismic code of practice.

Suyash Malviya, et. al.

The usage of the complete preparation of the placing of the telecommunication towers which is supposed to be over a multistoried building, the researchers take care of it as per the provisions. The main theme in their work was that that they have not known if there will be telecommunication tower should be placed in future over roof. The telecommunication tower comes with the complete arrangement with its fixtures.

The load calculated to design a multistoried building is enough to resist itself under the effect of the earthquake. The main idea of their research was if additional load applied in the future will going to be a catastrophe to a multistoried building. In introduction, they tell and explain the same. They adopt the aims includes diverse output parameters such as the assessment of bending moments and shear in beam members, torsional moments and dynamic parameters for the same topic.

The various output parameters assessed for both X and Z direction on horizontal plane. Structure was assumed to be placed at seismic zone IV. The roof was supposed to have different tower positions, hence total 5 cases have selected as per positions. From Case A o Case E, position P1 to P5 have decided respectively. An efficient column head was

added in various comparable output tables for describing efficient column position.

By the help of different graphs, the data was described and in conclusion they proved each of the efficient case for each result.

Vafaei, et. al.

The design codes say wind load is the major lateral load except for some cases in the design of telecommunication towers. This study shows the seismic performance of total no. of 10 four-legged telecommunication towers. The investigation is done on towers whose height is in between 18 to 67 meters and the origin of investigation is country Iran.

Shailesh S. Goral et. al.

The telecommunication industry is the fastest growing industry in human society and therefore it catches more attention than any other industry. The earthquake and wind analysis plays an important role in telecommunication structure like towers. Natural hazards like earthquake and wind storms are the major issues for the safety of towers.

In this research the staad-pro software is used for the analysis of seismic and wind loads. The square shape plan and different bracing systems has been used in the design of these towers. Non linear dynamic method is used in the analysis of these towers.

Mohd. Arif Lahori, et. al.

The plain construction land is not available easily now a day's therefore it is shifted on hill sites. On hill sites it is not easy to construct on steep slopes and also it is not easy to maintain structure under seismic loads. The main aim of the paper is to study and analysis and comparison between buildings on plane ground and sloping ground.

Hemal J shah et. al.

The television towers are constructed for the purpose of transmitting signals from one place to another they also transmit the radio signals and telecommunication signals. Therefore their design and construction are most important under seismic zones.

This study presents seismic response of 4 towers of different height and different bracing system of towers. The SAP 2000 software is used to analyses these towers.

Ravi Mane et. al.

Coronavirus has affected several millions of people causing cardiovascular issues, and other health problems, which has caused the economy to slow down, increasing mortality rate.

Narendra Tak, et. al.

Researcher said that we can conclude that tower on building saves the extra land cost and if the analysis and modeling of the structure is accurate we can easily find out the safety of the structure against lateral loads and against sliding. The main aim of the paper is to study and analysis and comparison between buildings on plane ground and sloping ground with different angle.

Neeraj Patel et. al.

The possibilities of the usage of wall belt supported system in this work used in multistoried building the authors cope with it sincerely. As per review done, the various possibilities of the demand and supply of stability improvement system, the work compared the same.

The main criteria in this work were to show the lateral load handling capacity. With total 14 cases with the usage of RSA will be used under Zone V with zone factor 0.36 respectively, they secretly exposed in their upcoming work.

The main idea of their research was the Shear wall at corners with belt connecting over its periphery column members. They conclude that their main focus will be shear strip which was the modified part of the concrete wall system, after reviewing the various researchers and then outline of the proposed work were pointed out. If the height at which the shear strip behaves effective and out if the width and thickness were kept fixed will be their optimum case, they pointed out.

Mohd. Arif Lahori, et. al.

The construction of R.C. structures are commonly asymmetrical in shape on slope of mountains. The main aim of the study is to investigate, compare and earthquake analysis of the structure under five different configurations like stept back building 200, regular building, step back building 300 And the response spectrum method is used in it.

Narendra Tak, et. al.

Researcher conclude that the structures are fundamentally manufactured on a typical plain ground. These days due to lack of land area, construction has been done on a sloping ground. The mountainous areas are the majority exaggerated due to earthquake activity.

High damage experienced by the high rise structure in the mountainous region, as outcome causes harm and breaking up; hence reason of designing towards protection in opposition to natural disasters. The key point is to analyze the seismic task applied by Multi-Storied RC structure on a sloping ground with specific angle 29 degree.

The Multi-Storied building is taken at different position of tower of slope angle. The outcomes have been evaluated with the structure taken without slope and with sloping ground 29 degree angle having on plane ground. Thus the seismic analysis is the part of Dynamic analysis. There are two types of arrangements taken for the study along sloping ground .i.e. set back and step backset back. Hence G+10 RCC building is considered with different location of building with sloping ground with set back and step back condition for analyzing.

The analysis was carried by the Seismic Analysis Method. The whole process and the methods are carried out by IS-1893-2016. STAAD pro software is used to explore the Response Spectrum Method.

All the operations performed are the part of procedure which gives the result that the step back set back building is more suitable than other methods.

III. CONCLUSION AND OUTLINE OF THE PROPOSED WORK

After reading all of the researches, we conclude that tower on building saves the extra land cost and if the analysis and modeling of the structure is accurate, we can easily find out the safety of the structure against lateral loads and against sliding. Important point is to be designing the multistoried building with tower and its location over it and it has must needed to know before construction for extra load that will commence if there will a provision for telecommunication tower.

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Importance of Load Transferring Members under Seismic Effects: A Review

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Abstract— This review paper delivers about strength of choosing the load transferring porch location in important structures most of them has been analyzed with the help of analytical methods and analysis software's. It also defines the effects of seismic and non-seismic nature of high-rise structures. The key persistence of the research paper is to examine the significance of seismic waves on multistory building and high-rise structures with load transferring porch location over important building under seismic loading. This examination has also conducted for non-seismic area locations because the porch is a structure which is used for architectural appearance also porch is used to guard the entry from light and rain. The porch if can be useful to enhance the structural property, this review paper suggests the same.

Keywords—Hospital Building, Load Transferring Porch, Porch Location, Seismic Analysis.

I. INTRODUCTION

Porch is a component structure of any building which is an ancient engineering and now it has enhanced itself and several unpredictability of porch can be seen now-a-days. Some of them are provisional; some are endless subordinate of a structure and some can be used for numerous elegances as per architecture point of view. Porch authorizes the individuals to comfortably that remains in, previously exiting or entering the house or any other kind of structures. Most of them are of supported with supports while many of them rests on the column or any other vertical member which is used in the construction.

The earth is overflowing with high-rise structures and multistorey buildings so it is certainly substantial to make it inoffensive for entities and also to decrease its complete price therefore seismic analysis is actually significant and required for today's ecosphere. The novel finding and opinions are mounting hugely so that we can with no misfortune live our life without being fearful of hazards and tremor is one of them. Seismic loading is the main factor in any type of high-rise buildings and multistory building. It broadly affects the structural method of multistory buildings. When earthquake occurs, seismic waves started to begin into ground crust which mostly affects the civil structures like buildings, row houses, skyscrapers, dams, highways and Bridges.



Fig. 1: Various loads on Structures

II. TYPES OF PORCH

There are many types of provisions that are likely in the construction of the porch in the structure. We are citing some of them to practically visualize the same:-

- i. Arizona porch
- ii. Screened porch.
- iii. Sleeping porch.

iv. Rain porch.

v. Portico.

vi. Loggia porch

vii. Veranda style porch

viii. Lanai

ix. Sun porch

x. Stoop



Fig. 2: Seismic Response Building with Porch at Front End

It is healthy recognized that high-rise buildings act as equal important character in modern cities. First of all, tall structures can be excellently used to meet the necessities of contemporary civilization and resolve the problem of limitation of building site properties. On the other site, they are the indications of economic properties and civilization. These days, multistory building density increase higher and higher, with added floors which are more complex and separate plan elevation criteria, such as multi-tower structures.

III. LITERATURE REVIEW

Abrar Ahamed, Ankit Pal, Mayank Choudhary In this paper summarizes that it is really important to use analytical methods before construction of multistory buildings in seismic and non-seismic areas. By reviewing all the Papers we can easily understand the importance of analytical methods. We can easily calculate the effect of seismic loading by using the software's like Staad pro and E-tabs before construction of multistory buildings. Calculation and modeling is the main purpose of the conclusion **Abrar Ahamed, Ankit Pal, Mayank Choudhary** The building with porch subjected to seismic effects with seven different location the analytical results obtained for seven location multistoried building. There are several result shown in results the maximum displacement in location 7, maximum base shear in location 1, maximum axial force in location 6, maximum column shear force in location 1, beam shear force location 7, tensional force location 1. That means location 1 is very efficient cases for porch in building

T. Öztürk, Z. Öztür This paper summarizes the analysis of load carrying systems and its effects on multi-storey RCC buildings during seismic loads. It is so important to determine all possible earthquake loadings and behavior of reinforced concrete Because of it helps to design the structure system and also to resist seismic effects. seismic load effects is also an important factor in all type of normal buildings including skyscrapers.

Wensheng LU, Xilin LU The paper briefs about the tests of some scaled high-rise multi-tower structure models on the trembling table. By considering the effect of flexible transfer floor in a new analytic model is shown. The test result considers the theoretical dynamic behavior comparison. The combination floors between towers at top levels, and the stiffness of foundation role to structural dynamic behavior is also described in this paper. Many suggestions and theoretical guidelines are also accomplished.

Ravi Manne, Snigdha Kantheti Air pollution has reduced by 20% to 30% during the covid period because of lockdown in several countries and in India air pollution has reduced by 30%. This will improve the health of people who got health issues from air pollution there by reducing mortality.

Pushkar Rathod, Rahul Chandrashekar The paper states that the Seismic analysis plays an important role in any type of structure. it is very important to consider seismic analysis in high earthquake prone areas. During an earthquake the high lateral movement of earth's crust the structure can be designed with the help of seismic analysis. By using ETABS any type of basic or a highly advanced structure can be evaluated which maybe under static or dynamic conditions. ETABS is a main tool for analysis and designs, which can design simple 2D frames to modern skyscrapers therefore it is the one of the best software for building structures.

P. P. Chandurkar, Dr. P. S. Pajgade The paper state that In the design of building structural walls, shear walls plays an important role as major earthquake resisting members during seismic loadings. The properties of these seismic shear walls is very important factor in the buildings therefore, it is very significant to calculate the seismic response of the walls suitably. In this paper determination of shear wall location in multi-storey building is observed. It has been considered with the help of 4 different models.

N R Shwetha , Naveen, Pampanna Moolimani, S Naveenkumar, Mahesh Sajjan, C H Veeresh This paper includes design and estimation with the analysis of multi storey building under seismic load, Dead load and live load. The design of beams, columns and footings is carried out under seismic loads. The software has been adopted is E Tabs because of its new features of data sharing and analysis and design. Completion of the analysis, design and estimation of a multi-storey building is the main aim of the paper. kani's method is being used to verify the results obtained through E tabs software. The fitness of structure is calculated by using the analysis result. E tab software is used for analysis.

Viktor Castlenrist, Stefan Svensson: This paper summarizes the methodology which is based on idealized calculation models and idealized finite element models, especially focused on the dynamical properties, natural frequencies and accelerations of the building. In recent years it has been seen that in society, there has been vast changes like related to economics, urbanization, and architectural changes has become the greater interest for the construction of high-rise buildings. Up to that time Construction of skyscrapers has been limited in Sweden. The challenges are faced during designing and construction of high-rise buildings.

IV. CONCLUSION

After evaluating all the papers with each and every point of view, it is really important to use analytical methods previously constructed high-rise structures. Like hospital building, where life is more important, it is necessary to take and analyses the same structure with Importance factor 1.5 at a particular seismic zone with and without porch. By reviewing all the research Papers, we can effortlessly recognize the importance of analytical methods with the importance of load transferring member. We can simply compute the result of seismic loading for porch with building by the help of using the analysis software before construction of the important buildings. Calculation and modeling is the key resolution of the supposition.

V. FUTURE SCOPE

- 1. None of the papers have mentioned structural stability when new members added to it.
- Condition should satisfy for seismic loading as per IS 1893:2016
- 3. None of the researches have mentioned the location of porch that is responsible for structural integrity as per civil engineering point of view.
- 4. Some of the papers have conducted dynamic analysis as per response factor method.
- 5. Only some researches have concluded various cases based on location of porch and none of them concluded its efficient location with load bearing porch.

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Agroecology and family farming: A perspective of sustainability in the brazilian Semiarid region

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Abstract—The research focuses on discussing the dynamics between agroecology and family farming in the Brazilian semiarid region. Family plays a significant part in the production of food on the Brazilian territory, contributing to its socioeconomic development, as it generates jobs, contributes to the local economy and diversifies production while contributing to lessen environmental impacts. Therefore, this article aims to analyze the agroecological discourse and practical strategies used in family farming and its role in the socioeconomic development of the Brazilian Semiarid region, by means of a systematic literature review. The works retained center on the following themes: public policies, land management and territoriality, cultivated varieties, and the issues surrounding water usage.

Keywords—Family farming. Agroecology. Brazilian Semiarid Region. Sustainability.

I. INTRODUCTION

The present article aims to address the questions of agroecology and family farming in recent decades as Brazilian agriculture is being modernized through important technological innovation and globalization, resulting in an evolution of economic, environmental, political and social aspects. In view of these changes, we now have large concentrations of land on the part of a few landowners and on the other hand we have a high number of farming families that survive on small rural plots [1].

A survey [2] carried out in more than 5 million rural properties in Brazil, shows that 77% of agricultural establishments in the country were classified as family farming (AF). Family farming has a significant place in the production of Brazilian food, in perrennial crops, the segment accounts for 48% of the value of coffee and banana production; in temporary crops, they are responsible for 80% of the production value of cassava, 69% of pineapple and 42% of beans. According to the survey, family farming employed more than 10 million people in September 2017, which represents 67% of the total number of people employed in agriculture [2].

These data show the relevance of family farming to the Brazilian territory, especially the Brazilian semiarid region.

This level of activity, in addition to contributing to the local economy, generates jobs, diversifies production and contributes to actions that help reduce its impact on the environment. In this sense, this article aims to analyze the agroecological discussions and strategies used in family farming and its role in the socioeconomic development of the Brazilian Semiarid region, based on a systematic literature review.

The theme proposed here: agroecology and sustainability, was chosen due to the authors' shared interest. Two guiding questions (QN) were adopted as strategy: which agro-ecological topics are most commonly brought up as socioeconomic development strategies for the Brazilian semi-arid region? Which strategies are being adopted in the semi-arid Brazilian region by family farms for local development in the agroecological sphere?

II. THEORETICAL FRAMEWORK 2.1 AGROECOLOGY

The oldest concept of the word agroecology concerns to the agroecological zones, which is the territorial demarcation where exploitation area of a particular culture is possible given the edaphoclimatic characteristics necessary for its development [3]. For [4] the term "agroecology" appeared in the 1930s with objetive to design the application of the methods of ecology to the study of agricultural crops.

For [5], agroecology seeks to integrate knowledge, in order to establish new strategies for rural development and new designs for more sustainable farming, thus, its elements can be grouped in three dimensions: ecological and agronomic technique; socioeconomic, cultural and sociopolitical.

Ecological and agronomic technique aspects are where ecology as a science must be taken as a reference as it describes the inner workings of important environmental systems, and in which the parameters of the technology used in agronomy are inserted, this being an aspect that ties the sustainable character and of nature with consistent productivity. Socioeconomic and cultural aspects consider differences among peoples, without discrimination while bringing economic growth to the population involved. Finally, socio-political aspects consider that one must obey a consistent network of justifications and social actions that can help indicate the political path to be followed by political rulers [5].

Thus, when searching among the different definitions for the term "agroecology", from its origin to the present times, themes arise such as the ecological management of soils, the diversification of agricultural production systems, the rescue and conservation of creole seeds and locally adapted breeds of animals, in dialogue with the resistance struggles of the peasant communities, the production and consumption of food [6].

In this perspective [7], it can be said that agroecology offers essential steps to achieve sustainability and preserving natural resources, as they have a proposal to guarantee food security, family income and market access while maintaining the quality of natural resources. Thus, it provides sustainability through the rebalancing and conservation of biodiversity, water, soil and its nutrients and other living beings, resulting in an increase in the productive capacity of the territory, without degrading the resources that exist there [7].

Thus, agroecology emerges as a possible possibility for family farming, which seeks, above all, conditions for maintaining the activity and the social group through a sustainable development project [5].

2.1 FAMILY AGRICULTURE

Family farming is practiced by small rural producers, traditional peoples and communities, settlers by way of land reform, foresters, aquaculturists, extractivists and fishermen. They are responsible for the production of maize, cassava root, dairy cattle, beef cattle, sheep, goats, vegetables, beans, cane, rice, pigs, poultry, coffee, wheat, castor, fruit and vegetables in Brazilian territory. The management of the property is shared by the family and the agricultural production activity is the main source of income, since the land is their place of work and home [8].

Over the past decade, Brazilian family farming plays a key role in food production for domestic consumption. With the approval of Law 11.326, which provided the legal framework for family farming, the segment managed to guarantee recognition, social and economic importance through the expansion of public policies such as credit (PRONAF); Technical Assistance and Rural Extension (ATER); commercialization, through the Food Acquisition Program (PAA) and the National School Feeding Program (PNAE); agricultural insurance and equality for women [9].

It is worth mentioning that both the Food Acquisition Program (PAA), in 2003, and the reformulation of the National School Feeding Program (PNAE), with Law No. 11,947, of 2009, has helped through their programs to create strategies were food security, nutrition and combating hunger were improved by seeking to establish a connection with production and consumption through the institutional purchase of food from family farming [9].

Family farming is essential for employment and becomes the main ally for the most sustainable practices, as it has the same desires evidenced by a large part of non-rural society. Thus, it is essential that farming families choose a production systems that guarantee economic, social, political and environmental satisfaction in Brazil for the whole family [1].

III. METHODOLOGY

The The present theme, agroecology and sustainability, was addressed due to the mutual interest of the authors, adopting as a methodological strategy a systematic review of the literature. An exploratory quantitative approach was used as it allows for the familiarization of the problem by building hypotheses, limiting the recording of the observed facts without interference [10]. Furthermore, as for the procedures, the research is classified as bibliographiy based on materials already elaborated and having its sources as an instrument type [10].

Considering the purpose of this article, to analyze the agroecological discussions and strategies used in family farming for the socioeconomic development of the Brazilian semiarid region. Two QN's were launched which motivated the development of the research. A QN1 - What agroecological discussions are currently brought up as socioeconomic development strategies for the Brazilian semiarid region? QN2 - Based on the agroecological dimensions, what strategies have family farming in the Brazilian semiarid region used for its local development?

Two criteria were used to carry out the work: for conducting the research, the process of conducting independent searches was used, and the second one, the identification of the findings to obtain rigor and reliability in the search [11]. Through the agreement of both researchers in conducting independent searches, the elaboration of a research protocol started, even if they are initially studied in a generic way.

Articles were mainly obtained through use of the portal of journals of the Coordination for the Improvement of Higher Education Personnel (CAPES), using as research descriptors: "agroecology", "family agriculture" and "semiarid". Afterwards, the following refinements for research were used: firstly, a search for only articles, secondly, the timeframe cut of the last 5 years and peerreviewed articles.

The articles obtained in this search, went through other refinement processes, to be included and compose the discussion of this work. Thus, the following were included: articles published in magazines with at least Qualis B2; those whose research region was the Brazilian semiarid region; as to their theme, those could provide results for the Guiding Questions (QN) exposed here and registered in the research protocol. In addition to these selection processes mentioned, articles of methodological strategy for bibliographic review were excluded, thus reaching a plausible number for the systematic study of the theme that included its most important aspects and its updated textualizations.

In addition, the related data were submitted to a preparation process, in order to identify a priori whether the

chosen documents were in accordance with the theme to be reviewed, and then submit it to the analysis of its content. After this stage, the data were submitted to the process of unitarization, through an exploratory reading of all content and adoption of a coding procedure, classification and categorization procedure. Thus, once the data obtained, all systematically aggregated in units, it was possible to carry out the description step, exalting the pertinent characteristics of the content versed in the text, and then, through careful interpretation, to explore the meanings expressed in the literature object of investigation and review.

Through this research it was found that there were no articles that worked on this topic, within a systematic review, much less in the cited region, it shows how important and relevance this work is.

IV. RESULTS AND DISCUSSIONS

Table 1 presents a research flowchart, with its refinement processes. At the end, 14 articles were selected to compose the discussion of this bibliographic review, as shown below.

For a better understanding and analysis of the 14 selected articles, an organization was carried out according to the central theme of its contents, as shown in Table 2. In short, the analyzed articles focused their research on public policies; land use and territorial reality; cultivation and planting of varieties in family farming; water issue and water use.



Table 1. Flowchart Flowchart of research, refinement process and internal criteria



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Nº	Title of Article	Authors	Year of publication	Qualis	Thematic
1	The Transformation of "Agroecological Ideas" into Public Policy Instruments: dynamics of contestation and institutionalization of new ideas in policies for family farming.	Schmitt.	2016	B1	Public policies
2	Public policies for Rural Development in Brazil: the dilemma between productive inclusion and social assistance.	Cazella et al.	2016	B1	Public policies
3	Diagnosis of land use and conservation in an agrarian reform region in the semiarid region.	Carvalho et al.	2017	B2	Land management /Territoriality

International Journal of Advanced Engineering Research and Science (IJAERS) <u>https://dx.doi.org/10.22161/ijaers.712.20</u>

4	Soil management and conservation practices: Perception of farmers in the semi-arid region of Pernambuco.	Lima et al.	2016	B2	Land management /Territoriality
5	Chemical attributes of traditional agriculture and Caatinga managed at different depths in an Inceptisol.	Neto et al.	2017	B1	Land management /Territoriality
6	The semi-arid, A relationship of society and nature in a dynamic of social organization of space.	Teixeira.	2015	A2	Land management /Territoriality
7	Territorial reality of family units in the Brazilian semiarid.	Vidal et al.	2016	A1	Land management /Territoriality
8	Agronomic evaluation of cowpea varieties under rainfed cultivation in the municipality of Coremas-PB.	Santos et al.	2015	B2	Cultivated varieties
9	Evaluation of creole varieties of corn for organic production in the semi-arid potiguar region	Araújo Junior et al.	2015	B2	Cultivated varieties
10	Production of chili pepper under organic fertilization and irrigation with treated wastewater.	Silva et al.	2019	B1	Cultivated varieties
11	Production tanks for improving the quality of life in the semiarid region of the state of Pernambuco.	Ferreira et al.	2015	B2	Water issue / Water use
12	Efficient use of rainwater stored in a cistern for vegetable production in the semiarid region.	Ferreira et al.	2016	B2	Water issue / Water use
13	Food and nutritional security of semi-arid farm families benefiting from rainwater collection equipment in Brazil.	Fagundes et al.	2020	A1	Water issue / Water use
14	Measuring the invisible: analysis of the Sustainable Development Goals in populations exposed to drought.	Sena et al.	2015	B1	Water issue / Water use

Source: prepared by the authors (2020)

4.1PUBLIC POLICY

From the 14 articles selected to compose this research, 2 of them dealt with issues related to public policies. Returning to the definition of [5], agroecology integrates different knowledge, and among its dimensions are sociopolitics. However, it was observed from the reading of the articles that, the discussion about the implementation and application of public policies aimed at strengthening family agriculture, extended to all of Brazil, there was no specific direction for the Brazilian semiarid.

Article number 1 brings a reflection made by [6] about the recent dynamics of institutionalization of agroecological ideas in public policy instruments, considering their relationship with the policies for strengthening family farming. Coming to the conclusion, that the process of affirming "agroecological ideas" in public arenas in Brazil was slow and marked by advances and setbacks and did not come to constitute itself as a force-idea capable of decisively influencing the Program National Strengthening of Family Agriculture (PRONAF).

Some of the public policies for rural development in Brazil are addressed in article number 2 of [12], where an analysis of policies of a productive and assistance nature is carried out, such as: agrarian reform actions, the National Program for Strengthening Family Agriculture (PRONAF), the Food Acquisition Program (PAA), the National School Feeding Program (PNAE), the rural social security system and the income transfer from the Bolsa Família Program (PBF), used as a research base by the agricultural census of 2006 which, although old, was the most recent database on the Brazilian agrarian structure, taking as reference the number of beneficiaries.

In general terms, the results obtained by [12] demonstrate that, despite the advances achieved in the last

25 years in the design of specific public policies for Brazilian family farming, three aspects stand out in this process: the separation of policies of a productive nature and of character assistance, the difficulties of expanding the public contemplated by policies aimed at promoting agricultural production and the lack of socio-environmental counterparts for those who benefit from public subsidies.

4.2EARTH MANAGEMENT AND TERRITORIALITY

Leaving the scope of public policies and entering the context of land management and territoriality. from the 14 selected articles, 5 of them deal with this broad theme, which according to [6], nowadays, among the themes that arise when discussing agroecology, is the ecological management of soils. The authors focus attention on the territorial reality of family units in the Brazilian semiarid region and, from a plant production perspective, the issue of sustainable soil management.

Thus, [13] used family units in Ceará as the object of study, to visualize this territorial issue and, they observed that, as the members of a rural family manage to increase their income, their territory is strengthened and their sustainability increased, because the extra income is invested in infrastructure and in the improvement of available areas and production, even those that have no relevant influence on total production.

In the family units analyzed, according to the aforementioned authors, the work perceived as a factor of production is present, being the main responsible for the economic dynamics of small rural production, with aspects related to land, which in mostsometimes limits greater production. It was also observed that in these family units, family work is predominant and wage earners appear only as an assistant in periods of greatest need for labor. Vegetable production is the main source of income for these farming families who concentrate their activities on the cultivation of corn and beans, and on the specific management of small ruminants.

In this perspective of plant production, researchers tried to highlight the practices of management and use of land by family farmers. Bearing in mind that in the Brazilian semiarid region, an aggravation in soil degradation with the lack of rain in the region is perceived, related to its intrinsic characteristics, associated with the farmers' lack of knowledge of the problem, in the desire to get the most out of their crops. land due to economic and social limitations. Representing a challenge for the implementation of sustainable practices for the use and management of soil and water [14].

In view of this, a diagnosis of soil management and conservation practices, carried out by farmers in a

settlement located in the Semi-arid region of Ceará, revealed that, even in the case of family farming, there are still inadequate conventional practices that degrade the soil, leaving unproductive land, such as the process of planting and sowing crops in the settlement a little more than half of the families prefer to follow the direction of the slope of the land to line up the plantations, this long-term practice can contribute to the erosion process of the soil generating environmental damage [15].

Still on soil management and conservation practices, [14] carried out a diagnosis in the municipality of Pesqueira Pernambuco, making it noticeable, on the part of researchers, that the vast majority of farmers are unaware of the concepts of soil management and conservation, despite, they carry out sustainable management practices, revealing the need to support these farmers, due to the importance of this theme.

4.3CULTIVATED VARIETIES

Another issue that drew the attention of the researchers who authored the articles selected for this research was the varieties planted by family farmers in order to draw attention to the use of traditional seeds, which are the creole varieties, due to their genetic, environmental, social and economic, totaling 3 articles related to this theme.

Taking into account that the populations of Creole varieties are important because they are a source of genetic variability and the use of these varieties also presents several advantages related to the sustainability of production, such as resistance to diseases, pests and climatic imbalances, and may have the seeds stored for the crops. subsequent harvests, reducing the cost of production [16].

In this follow-up, [16] carried out a study with the creole varieties obtained in rural communities in the state of Rio Grande do Norte and evaluated characteristics related to the growth and production of corn grains in an organic production system, comparing the results in relation to cultivar hybrid, the results showed that Creole varieties presented results similar to the values observed in the hybrid culture for the characteristics of growth and grain production. This type of research rescues local varieties of corn and provides farmers with more accessible options for genetic material for cultivation.

Along with this type of work carried out by Araújo [16], an evaluation was made of the productivity of certain varieties grown by small producers, in view of the problem of the low yield of some crops, justified by the use of low technology and varieties not adapted to production conditions.

This is the case of research by [17], who evaluated the productivity of cowpea varieties (*Vigna unguiculata L*.

Walp.) Under rainfed cultivation in the municipality of Coremas-PB. Tests were carried out with four varieties of evergreen cowpea (*BRS Marataoã*), purple (*Phaseolus vulgaris*), cow's rib (*Vigna unguiculata*) and garanjão, where the cow rib variety showed the highest yield. This type of research contributes to the development of family farming, as it guides farmers in relation to the best varieties for cultivation, taking into account local conditions.

4.4WATER ISSUE/WATER USE

So far, some causes influencing the production of family farming have been discussed, such as public policies, land use and management and cultivated varieties. Now the discussion will be focused on the use of water, considering that the semiarid requires particular attention, given the irregularity of rainfall that occurs in the region, 4 out of 14 articles were found discussing about this same theme.

Discussions in this regard are focused on the use of the sidewalk cistern of the Uma Terra e Duas Águas Program - P1 + 2, a project for Living with the Semiarid Region, which ensures access to land and water for the rural population, both for family consumption and animals, as well as for food production, teaching them to take care of the land in a sustainable way.

Considering that the cistern ensures an improvement in the diet of rural families, as it allows the insertion of fruits and vegetables in the diet, [18] carried out a survey of the current situation regarding the use of production cisterns and their real contributions in improving the quality of life of rural families in the São Francisco Valley micro-region, in the State of Pernambuco.

They noted that the implementation of P1 + 2 cisterns is an important tool for improving families' diet, however, there is a need for better technical monitoring as to the rational and efficient use of water in the cistern. For presenting this result, [19] built flower beds for vegetable production, in order to define the best water/production ratio, reaching a condition of application of a blade of 4 mm dia-1 sufficient to provide daily consumption of 33,71 grams of vegetables in a family's diet. As observed in the other articles, this research benefits the rural producer of family farming, giving support in controlling the use of water in their agricultural production.

V. CONCLUSION

This bibliographic review, which deals with the dynamics of agroecology and family farming in the Brazilian semiarid region, will serve as a basis for other researchers who wish to explore this theme, to reflect on the progress and direction of the published works. As, for example, the reflection in relation to the publication dates, which reveals that most of the articles were published in 2015 and 2016, signaling the need for more current studies.

In addition, going back to the guiding questions that drove the realization of this work, it was noticed that the discussions raised in relation to agroecology and family farming, are driving the socioeconomic development of the Brazilian semiarid. Since, in each theme that was highlighted, there is a possibility of further development.

Whether in the scope of public policies, with the purpose of diagnosing, or how these policies connect with producers and how they are developed, we can visualize possibilities for improvement. Furthermore, in the study of soil management, we can highlight unsustainable management practices, so that, through diagnosis, outlining a plan for changing practices becomes achievable. Also, within the scope of agroecological practices, in which the study of the production conditions of seeds of Creole varieties or other cultivars, it will support the producer for a more sustainable production, including in the management of water during production.

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Systematization of Nursing Care for Pediatric Users with Congenital Vascular Disease: Experience Report

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Abstract— Objective: to report the experience of applying Nursing Care Systematization to pediatric users with Congenital Vascular Disease. Methods: This is a descriptive study, like an experience report. The sample selection followed the non-probabilistic criterion, where the participant was included in the study for convenience. Nursing Care Systematization was applied to a minor who was admitted to the Metropolitan Hospital in the city of Belem/PA - Brazil. The precautions were taken care by nurse and governess stage, along with academics from the 9th span the of the Bachelor of Nursing course at a private Higher Education Institution. He carried out the monitoring of the child span the 02/10/2020 to 04/03/2020. In order to construct the present report, six moments were obeyed: in the first moment, the trainees' history of the child was known, in the second moment, the Nursing Problems were listed, in the third moment, the Affected patterns, the fourth time, scored to the Diagnostic the Nursing as the North American Nursing Diagnosis International (NANDA-I), the fifth time, outlined if the expected results, Finally, the sixth time - the Nursing Prescriptions. Results: Patient remains hospitalized, under the care of the team, stable, bandaging the operating room every 4 days, waiting to perform an embolization action that is still in the process of releasing material. Conclusion: The application of the Nursing Assistance Systematization enabled a unique and specific planning to meet the user's demands, through the nursing problems encountered, giving quality to the development of care and user satisfaction.

Keywords— Nursing, Nursing Care, Chid, cardiovascular disease, Child Health.

I. INTRODUCTION

The use of the Systematization of Nursing Assistance (SAE) by professional nurses is essential to improve the management of care and super air the present weaknesses and s in institutions health, in addition to r a methodology that contributes to one better process management, as it allows quality assistance through systematic care^[1].

Nursing professionals use SAE as an instrument to provide care, because in addition to being regulated in Brazil, it confers quality in care management and an organized and structured planning to deal with the demands of users^[2].

However, the care and management practice nurses permeates through а complex process to be r and Alizada, given the intuit the to promote, maintain or restore a person's quality of life, family and community is influenced of the service organization health by the various ways in which professionals perform their assistance and thus, weaken the line of care and full implementation of SAE^[3].

In this scenario, SAE is used as a specific nursing action and it is essential for strengthening health care for the user. The nursing process (NP) is then a scientific method designed to improve care for the human being in an integral way^[4].

The statistical index of death in babies with congenital heart disease corresponds to 24% due to birth defects every year. The Confederate diseases rem instability in the first days of life for newborns (NB), but DIAGNOSTIC the and prompt treatment are essential to avoid serious problems with hemodynamics and injuries to other organs, as well d and confer a good prognosis and reduce morbidity and mortality rates^[5].

The nursing care developed for the child with congenital cardiac malformation must be performed, in view of a well-structured and imminent care plan, in view of the aggravating condition that the disease confers on the children, due to rapid clinical deterioration, heart failure and crises hypoxia^[6].

This research is justified because of the large role d nursing to help the family in the prevention of disease, the relief sentiment the suffering as well as to protect and promote the best quality of health. And nursing team also promotes health conditions more compatible with life without major regrets preserving the growth and development the cardiac child^[7].

Thus, the objective of this study is to report the experience of applying Nursing Care Systematization to pediatric users with Congenital Vascular Disease.

II. METHODS

This is a descriptive study, like an experience report. The sample selection followed the non-probabilistic criterion, where the participant was included in the study for convenience. SAE was applied to a minor who was admitted to the Metropolitan Hospital in the city of Belem / PA / Brazil, in the care of vascular surgery due to the suspicion of Hemangioma, long-standing left foot ulcer and severe anemia, probably due to the loss blood. According to information collected by the parent, the minor undergoes treatment and follow-up at the Hospital Santa Casa de Misericordia in the city of Belem / PA, Brazil, has a history of showing active bleeding in the left foot, with improvement after compressible dressing.

Applied to SAE for assistance and preceptor nurse stage, along with academics from the 9th span the course of Bachelor of Nursing of an education institution who were experiencing stage oversees the in that hospital. He carried out the monitoring of the child in the Edo Period the from 10.02.2020 to 04.03.2020.

To construct the present report, it was necessary to obey six specific moments to better detail the experience. In the first moment, the trainees' history of the minor was known, presented by the assisting nurse and internship preceptor. The students had the opportunity to pass r the first nursing visit with the user, realized walk the care nursing already prescribed for the customer as well as set new goals and contribute to the SAE less.

Then in the second moment, listed to the nursing problems (PE) found during the passage m of view and listed for SAE, with intuit the offer a service suitable with resoluteness and that meets user demands.

It held in THIRD date, the proper preparation of Affected Standards (PA), in a systematic way to manage the best possible care to the user, as well as act in u ma li n ha care full and resolute.

Were applied on the fourth time, the Diagnostic the Nursing (DE) DE as the North American Nursing Diagnosis International (NANDA-I). To continue in smaller nursing process, the fifth time, outlined to the Expected Results (ER) according to each problem encountered during the care of the bedside.

Finally, in the sixth moment, the necessary interventions and Persistent Nursing and Nursing Prescriptions (PE) were scored.

III. RESULTS

Please be informed that during the stay in the stage of setting and monitoring the users were held to the relevant care, in order to promote the process of teaching and learning of the students, but above all, offer satisfaction to user through nursing care. The SAE of the minor is then reported:

DESCRIPTIVE HISTORY

Minor (A .PSSB), 10 years old, weighs approximately 50 kilos, female, admitted to the Metropolitan Hospital of Urgency and Emergency on 01/06/2020 from UPA Marituba, under the care of the vascular surgery team due to the suspicion in hemangioma, ULC was on the left foot longstanding and severe anemia, probably due to blood loss . Its parent reported that the youngest has had a vascular malformation since birth. She started with a red spot on her left foot and was diagnosed with Hemangioma. After the age of 5 he started to develop a blister in his limb and from the age of 7 that blister broke and developed an ulcer, but when he broke it, he triggered hemorrhage in the difficult place to stop, with improvement after a compressive dressing. As the worsening of the clinical picture, the lowest one stopped studying in the 2nd grade. Family medical history: Hypertension and Diabetes mellitus. Allergic to Ibuprofen. Complementary exams were performed: Magnetic Resonance Imaging (Porto Diaspresented at admission), Angiotomography (Metropolitan) and Angiography (Hospital das Clinicas). After medical evaluation, she was diagnosed with arteriovenous malformation (AVM) and left foot ulcer. He underwent antibiotic therapy with Ceftriaxone and Clindamycin (D10) and followed by drug treatment with propanolol 40 mg (VO), tramadol 50 mg (EV), dipyrone (EV), deltramethrin (TO) and ketoprofen 100 mg (EV). Complains of moderate pain (5-6 according to pain scale) in the left foot and lumbar region when trying to move around in bed or ambular, but on the day the dressing is performed, the pain is more intense (9-10 - as pain scale) and with that it presents irritability and aggressiveness, that is, there is a variation in your mood (SCI). Impaired physical mobility, makes use of a wheelchair. Her dressings are performed in the operating room for 4/4 days, where she is submitted to spinal anesthesia and sedation. Vital Signs: normotensive (120x80mmHg), normothermic (36.2°C), nomocardio (82 bpm), eupneic (18rpm) and SPO² 96%. On general physical examination: pale, damp scalp and the presence of pediculosis, with no signs of edema and phlebitis, with deviation of the spine in the lumbar region and a compressive dressing on the left foot. Chest: symmetrical. Pulmonary auscultation: presence of breath sounds and absence of adventitious

sounds. Auscultation heart: normocardio with presence of heart sounds phonetically normal in 2 times (BCNF). Abdomen: painless on palpation. Abdominal auscultation: hydro-air noises present. Performs their personal hygiene, but has a deficit of self-care, guidance is provided. Tolerates oral diet offered. Physiological functions of elimination: present and spontaneous.

FIRST NURSING EVOLUTION

Date: 11/02/2020 to 16hs. Minor conscious and oriented in time and space, verbalizes, breathing in ambient air, restricted to the bed. Vital signs: normotensive (120x80 mmHg), normothermic (36.2°C), eupneic (18rpm), normocardio (82 bpm), satisfactory peripheral perfusion (SPO² 98%). Maintains AVP in MSE (10/02/20) salinized. On physical examination: wet, leathery skin with the presence of pediculosis, clean and complete external ear cavity, isochoric pupils, pale, full oral cavity with the presence of dirt, incomplete dental arch, and a tongue with a rough finish. Absences of infarcted ganglia. Thorax: symmetrical. It has a deviation in the spine in the lumbar region. Pulmonary auscultation: presence of breath sounds and absence of adventitious sounds. Auscultation heart: normocardio with presence of heart sounds phonetically normal in 2 times (BCNF). Abdomen: painless on palpation. Abdominal auscultation: hydro-air noises present. He keeps a compressive dressing on his left foot, performed in the operating room on 02/10/2020 and with a schedule for exchange on 02/14/2020. Tolerates oral diet offered. Physiological functions of elimination: present and spontaneous. Waiting for an angiography report of the left lower limb. It is still under observation by the nursing team.

SECOND EVOLUTION OF NURSING

Date: 02/18/2020 at 3pm. Minor conscious and oriented in time and space, verbalizes, breathing in ambient air, restricted to the bed. Vital signs: normotensive (100x60 mmHg), normothermic (36.4°C), eupneic (20rpm), normocardio (99 bpm), satisfactory peripheral perfusion (SPO² 96%). Maintains AVP in MSE (18/02/20) salinized. On physical examination: scalp clean and with the presence of pediculosis, external ear cavity whole and clean, isochoric pupils, pale, oral cavity integrates with the presence of dirt, incomplete dental arch, savory tongue. Absences of infracted ganglia. Chest: symmetrical. It has a deviation in the spine in the lumbar region. Pulmonary auscultation: presence of breath sounds and absence of adventitious sounds. Auscultation heart: normocardio Abdomen: painless on palpation. Abdominal auscultation: hydro-air noises present. He keeps a compressive dressing on his left foot, performed in the operating room on

02/14/2020 and is in preparation to perform a dressing change today. Maintains zero oral diet. Physiological functions of elimination: present and spontaneous. Awaits authorization to release material to perform embolization at the Hospital de Clinicas Gaspar Vianna Foundation. Follows in observing the care of the staff of Nurse.

IV. DISCUSSION

For each nursing problem encountered, a Nursing Diagnosis was applied, proceeding with the classification of the affected pattern, as well as the SAE and proceeding with the Expected Result and the appropriate nursing interventions act. Thus, there is the following Assistance Plan:

1°PE: Restriction to the bed. PA: Physical mobility. DE: Impaired physical mobility. RE: with the suport wheelchair, the patient will circulate in areas permitted clinical pediatric to 2 times a day; remain performing their personal hygiene and physiological functions with the help of the bath chair. IE: Stimulate leaving the bed with the aid of a wheelchair twice a day, (according to the clinical picture) - for 30 minutes to 1 hour. 10: 00h and 15: 00h. Perform physiotherapy in bed - Morning.

2nd EP: Restricted to the bed. PA: Physical mobility. DE: Risk of falling; ER: falls do not occur during your stay in the hospital. IE: Attention - Maintain high gradations whenever manipulated; guide a companion to assist her whenever the child leaves the bed.

3rd EP: Invasive Device. PA: Peripheral Venous Access (AVP). DE: Risk of infection. RE: Do not develop an infectious condition during your stay in the hospital. IE: Attention - Salinize the AVP before and after administration of medications with 0.9% saline. • Perform an AVP change every 96 hours; keep cover clean and clean - Morning (after spray bath).

4th EP: Pressure injury (LPP) in the Left Lower Limb (MIE). PA: Left foot injury. DE: Impaired skin integrity characterized by an LEM injury, related to bed restraint. ER: The lesion regressed as a result of vascular treatment; do not develop LPP while in hospital. IE: Prepare the patient for 4/4 days to perform dressing in BC - Morning; cover the dressing before spraying it to keep it dry -Morning; forwards patient to perform dressing in the surgical block of 4/4 days - Afternoon; moisturize MIE and bony extremities with effusion to prevent LPP -Morning, Afternoon and Night.

5th EP: Inadequate hygiene. PA: Self-care deficit. DE: Self-care deficit, characterized by the presence of dirt, related to poor hygiene. ER: guide the patient and the companion on how to perform and adequate hygiene at the time of the sprinkler bath - Morning; perform physical examination after spray bath - Morning.

The patient remains hospitalized, under the care of the team, stable, bandaging the operating room every 4 days, waiting to undergo embolization, which is still in the process of releasing material.

V. CONCLUSION

Research has gaps in knowledge in relation to the selected theme to be a rare case, hindering the development of actions by health professionals, in particular to apply the systematization of care in nursing.

The application of the Nursing Care Systematization enabled a unique and specific planning to meet the user's demands, through the nursing problems encountered, giving quality to the development of care and user satisfaction.

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Characteristics of Ocular Findings of Patients with Coronavirus Disease

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Abstract— The outbreak of COVID-19 spread rapidly to several countries, leading the World Health Organization to declare a pandemic situation. The correlation of this pathology with ocular structures has been discussed as a possible gateway to SARS-CoV-2. Given the urgency of information related to the control of COVID-19, this article aims to evaluate and expose the main ophthalmological manifestations resulting from viral infection by COVID-19. Methodology: This article proposes a review study regarding the current pandemic scenario. To this end, a search was carried out in the primary databases: LILACS, BIREME, PubMed in Portuguese and English, for articles based on current literature. The choice had taken place at random, obviously, following a line of reasoning of the authors involved. Discussion: A sequence of cases demonstrated the presence of SARS-CoV in the tear film by polymerase chain reaction with reverse transcription (RT-PCR). Considering that SARS-CoV and SARS-CoV-2 are part of the same family of coronaviruses, and share genetic similarities, it is plausible that the same is observed in COVID-19. During COVID-19 infection, conjunctiva inflammation is the most frequent ophthalmologic manifestation. The most commonly reported ocular manifestations so far are conjunctival hyperemia and watery discharge. Conclusion: Although there is still no well-established evidence, recent studies suggest that tears may be direct sources of ocular transmission of COVID-19. Also, reports of ocular manifestations in patients infected with SARS-COV-2 are very scarce, making further research related to the frequency of these events necessary.

Keywords— COVID-19; Ophthalmology; Conjunctivitis; Ocular manifestations; Retinopathy.

I. INTRODUCTION

An outbreak of highly infectious pneumonia caused by a new coronavirus (SARS-CoV-2) emerged in December 2019 in the city of Wuhan, China. ⁽¹⁾ The spread of the infection to other countries and continents, and the difficulty in controlling it, prompted the World Health Organization (WHO) to declare a pandemic situation

quickly. ⁽²⁾ The clinical conditions presented by patients infected with such pathology vary from asymptomatic individuals to severe conditions that culminate in death.

Coronaviruses are characterized as enveloped, capped, and polyadenylated RNA viruses. ⁽³⁾ The virus is believed to live in animals but can infect humans through the zoonotic transmission. ⁽⁴⁾ The human coronaviruses are

mainly disseminated by aerosols or droplets released when infected individuals cough, speak loudly or sneeze. Direct contact with contaminated fomites is also a route of human transmission of SARS-CoV-2. ^(5,6,7,8,9)

Several systemic manifestations of COVID-19 have been reported, notably: fever, dry cough, dyspnea and bilateral ground-glass opacity in computed tomography scans. ^(10,11,12) In addition to these, gastrointestinal changes and eye disorders have also been reported. The most frequent ocular manifestations evidenced are conjunctival hyperemia and watery secretion. ^(13,14)

The correlation between COVID-19 and ocular structures has been widely discussed as a possible gateway for the virus. ⁽⁵⁾ Even though the respiratory complications resulting from viral infection are well documented, the information regarding the ophthalmological impairment generated by the pathogen is still not very clear. Thus, the present article aims to assess and expose, through a bibliographic review, the main ophthalmological manifestations resulting from the viral infection by COVID-19 (FIGURE 1)



Fig.1: Ophthalmological manifestations resulting from the viral infection by COVID-19

II. METHODOLOGY

This article proposes a review study regarding the current pandemic scenario. To this end, a search was carried out in the primary databases: LILACS, BIREME, PubMed in Portuguese and English, for articles based on current literature. The choice had taken place at random, obviously, following a line of reasoning from the authors involved. The keywords searched were: COVID-19, ophthalmology, conjunctivitis, ocular manifestations.

III. DISCUSSION

In 2003, for the first time, a sequence of cases demonstrated the presence of SARS-CoV in the tear film by polymerase chain reaction with reverse transcription (RT-PCR). A study carried out with 36 patients diagnosed with SARS, found that three patients had samples of tears with positive results for SARS-CoV, through the conjunctival swab route. Considering that SARS-CoV and SARS-CoV-2 are part of the same family of coronaviruses, and share genetic similarities, it is plausible that the same is observed in COVID-19.^(15,16)

The main receptor for SARS-CoV-2 in the human body is the Angiotensin-Converting Enzyme (ACE2) receptor. ⁽¹⁷⁾ In vitro study showed the expression of these receptors in cells of the conjunctiva and cornea, as well as the effective binding of SARS-COV-2 S240 proteins with the ACE2 receptor on cells. ⁽¹⁸⁾ Given the high vascularization of the conjunctiva and the expression of ACE2 on the surface of endothelial cells, the possibility of the ocular manifestation of COVID-19 being a transient local vasculitis cannot be excluded. ^(19,20,21) Beyond that, ACE2 receptors were observed in aqueous humor, which indicates that this may be the target of contamination by COVID-19. ⁽¹⁷⁾

Conjunctiva's inflammation is the most frequent ophthalmological manifestation of COVID-19 infection ⁽¹⁷⁾. Thus, conjunctival hyperemia and watery secretion are commonly reported ocular manifestations. ⁽⁵⁾ Nevertheless, some studies suggest the possibility of other eye diseases such as uveitis, vitritis, or retinal vasculitis by SARS-CoV-2 due to the presence of receptors of the Renin-Angiotensin-Aldosterone System in the ocular tissues. ^(22,23,24)

A study recently published by The Lancet exposed retinal changes in 12 adult patients, where nine tested positive for COVID-19; these were examined 11 to 33 days after the onset of symptoms. The diagnostic test used was RT-PCR and antibody testing. All patients reported asthenia, fever, and dyspnea, and 11 of these had anosmia. As a result, it can be seen that all patients had hyperreflective lesions to the point of ganglion cells and the internal plexiform layer, with a more robust presence in the papillomacular bundle of both eyes. ⁽²⁴⁾

In a systematic review, 252 patients infected with COVID-19 were analyzed, among which 32% demonstrated ocular conjunctivitis. ⁽²⁾ Three of these patients had conjunctivitis and positive ocular swab RT-PCR, eight had positive ocular swab RT-PCR without conjunctivitis, and fourteen had conjunctivitis during negative ocular swab RT-PCR. ^(25,26) The authors related

the inconsistency in the result of low viral load in conjunctival secretion, contamination of the sample, and damage to genetic material. Still, they suggest that conjunctival swab RT-PCR should not be proposed as a standard diagnostic technique for COVID-19. ⁽²⁶⁾

At the moment, there are still few studies that demonstrate eye changes in SARS-CoV-2; those that are currently published are from China and report just a few cases. A survey carried out in Hubei province, China, with 38 COVID-19 patients, found ocular symptoms in 12 of Symptoms included epiphora, them. conjunctival hyperemia, exacerbated eye discharge, and chemosis. Of these patients, one third had a severe form of COVID-19. Patients who develop eye symptoms are more likely to have leukocitosis and higher neutrophil counts, in addition to higher levels of procalcitonin, lactate dehydrogenase and C-reactive protein (CRP), when compared to patients who do not have ophthalmological disorders. (27)

Although there is still no well-established evidence, recent studies also suggest that tears may be a direct source of ocular transmission of COVID-19 and the target of infectious material. Considering that tears have a viral load, it is likely that contact with the eye may favor the inoculation of the virus. Therefore, it is worth noting that ophthalmologists point out that professionals working as a front line should be alert to conjunctivitis, mainly when associated with respiratory symptoms or fever, as they can predict SARV-CoV-2 infection. ⁽²⁷⁾

IV. CONCLUSION

It is clear that ophthalmological changes are associated with SARS-CoV-2 infection. This fact can be explained by the presence of ACE2 receptors in ocular tissues. Furthermore, the scarcity of studies on the pathophysiological mechanisms, as well as evidence of visual dysfunctions for SARS-CoV-2, are not decisive to confirm ocular transmissibility. Thus, further studies are needed in order to clarify the occurrence, or not, of ocular transmission.

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The contribution of the arrival of 5G in the consumption of mobile data

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Abstract— Mobile systems currently have several applications aimed at data transmission. Over the years, where several technologies have been developed - known as generations, that have enabled the traffic of information. Therefore, the objective of the work was to verify the contribution of the 5G system, in comparison to other generations, indicating its main benefits, in addition to the information about IoT. For this, the methodology used was a bibliographic reviewthrough an exploratory research based on information about the new 5G technology, in order to deepen the knowledge on the topic related to the other subjects included in this work. The results showed that telecommunications companies play an important role in the provision of 5G technology, since the availability of services depends on the investments that will be applied in the telecommunications sector. Among the services that 5G allows is support for Internet of Things applications (Internet of Things or IoT). Currently, IoT applications are operating on previous technologies, which are still in operation (2G, 3G and 4G), so 5G will make the internet of things much more efficient and effective. Each device and network created based on the IoT will use only what is necessary and when necessary. It is concluded that The 5G system and Internet of Things (IoT) will offer the ability to capture, store and move data from devices on a large scale and supply databased decision making, the5G and the Internet of Things (IoT) will offer the ability to capture, store and move data from devices on a large scale and power data-based decision making.

Keywords—Comparison, Generations, Benefits.

I. INTRODUCTION

The use of cell phones to access the internet has grown in Brazil. The devices are the main means of accessing the network in the country, used by almost all Brazilians. The information is from the National Continuous Household Sample Survey - Information and Communication Technology (PNAD Continuous TIC) 2018, released by the Brazilian Institute of Geography and Statistics (IBGE) [1].

Since the appearance of the cell phone, there has been a significant change in the way of communication. Mobile systems currently have several applications aimed at data transmission. Over the years, where several technologies have been developed - known as generations, that have enabled the traffic of information [2].

The implementation of 5G networks also has difficulties, such as the great growth of users by area,

problems in transmission by base station and cell coverage, lack of maintenance at stations causing problems in sending signals, in addition to bureaucratic difficulties for installation. new stations [3].

The 5G standard is a mix of network levels of different sizes. ensuring intelligent connection transmission, accessed by а large number of interconnected devices. It has a greater capacity, due to the improvement of architecture and the presence of advanced physical communication [3].

Anatel published three acts (3151, 3152 and 3153) that update the minimum technical requirements for the adoption, exploration and use of 5G technology in Brazil. In practice, this means that in order for cell phones and internet access stations, such as modems and equipment connected to the IoT, to be certified and marketed,

belonging to 5G, they must meet the established parameters [4].

Based on this information, the study aims to verify the contribution of the 5G system, compared to other generations, indicating its main benefits, in addition to the information on IoT.

II. MATERIALS AND METHODS

The methodology used was a bibliographic review through an exploratory research based on information about the new 5G technology, in order to deepen the knowledge on the topic related to the other subjects included in this study.

Data collection of this information took place from academic websites, scientific articles, bibliographic productions such as: dissertations and theses, and on government websites that discuss content about 5G technology and the benefits of IoT.

Criteria for the inclusion of texts published between 2000 and 2020 (preference of recent publications) were used, where only keywords were considered. Thus, 12 articles were analyzed and, by exclusion, reduced to 10. The exclusion criteria were given by duplicity, inaccessible editorials, where only 6 articles effectively corresponded to the proposed objective.

The results of the research will be presented qualitatively, from the collection of information from primary sources.

III. RESULTS AND DISCUSSION

5G technology for mobile systems is being increasingly discussed in Brazil. In some countries, this technology is already being implemented (USA, United Kingdom, South Korea, China, etc.), which causes great expectations in the consumer market regarding its effective operation in our country. The reasons for the long-awaited process are due to some characteristics of the system, when compared to the current 4G system: explained, in general terms, by data transmission 10 times faster, latency 10 times lower, 10 to 100 times more connected devices and lower battery consumption [5].

Telecommunications companies play an important role in the provision of 5G technology, since the availability of services depends on the investments that will be applied in the telecommunications sector. In Brazil, this is an aspect that must be evaluated from a deeper analysis, as it depends on several factors such as regulations, investments, scientific studies, etc. [15]. Among the services that 5G allows is support for Internet of Things applications (Internet of Things or IoT). Currently, IoT applications are operating on previous technologies, which are still in operation (2G, 3G and 4G) [5].

With the advent of the 5G network, it becomes possible to operate equipment and devices more efficiently, especially in certain cases where, some services could be affected [7].

The implementation of the 5G system provides numerous challenges, and for the objectives to be achieved, a drastic change in the design of the cellular telephone network architecture is necessary [8], since it is a systemic technology project capable of choosing the technological structure that best meets the requested request [9].

5G, unlike 4G and all other previous generations of cellular mobile communications systems, depends not only on large towers to cover a macro cell of tens of km2 each, but also needs to have hundreds or thousands of small cells, available in city spaces [10].

5G technology is expected to increase internet data consumption on cell phones. According to the study [11], called "Mobility Report", which provides forecasts about the mobile connection. The average internet spend, on the smartphone, will be almost four times higher than the average of 2018, which should total 21 GB per month, in 2024.

Based on this information, it is observed that this technology will not only be a tool to transmit more data in less time, but will provide numerous benefits for the use and recognition of IoT, requiring the support of the interaction of millions of devices [12].

[12] further mentions that main players describe that 5G is not only a necessity, but also a big bet for the future, and that in constant evolution, it is a pillar of transformation in the world, when it is known and used, given mainly for its capacity connection and congruence with the IoT concept, impacting different sectors [13].

[14] It indicates that the 5G system, fifth generation of mobile telephony, is a new technology of data transport in networks involving mobile devices.

Many characteristics will be observed when there is a standardization of the basic premises defined for the 5G (Table 1).

Table 1: Characteristics of the 5G Internet from thestandardization of operating premises.

Characteristics	description
velocity	The 5G will achieve 100 times the speed available for LTE and 10 times the technology presented by LTE-Advanced.
Low latency	The decrease in latency in 5G will allow the entry of different services inherent to previous technologies.
High density	The 5G will have the capacity to support a large number of connected devices at the same time, even tolerating densities of up to 100 devices per m2.
Efficiency	This technology is expected to exceed the energy efficiency of 4G by 90%.

Source: Adapted [11].

In December 2017, the 3GPP (3rd Generation Partnership Project) approved the specifications of the 5G New Radio (NR), which deals with a 5G technology (the first officially approved standard), which cannot act autonomously, but which is supported higher than LTE, the current technology.

The connection made with 5G, still in 2020, by the companies: Vodafone and Huawei, from Barcelona to Madrid, was the first in the world to be carried out according to the NR standard [12] and also mentions that the main advances regarding the previous technologies are:

- a. A real-time operational: where to use 5G is to speak faster, especially with regard to response time, high availability, low latency and jitter. Latency and jitter, are two concepts that go together, since both refer to delays: the first is generalized to all networks, while the second is an effect of data networks not connection oriented and based on packet switching. The latency should be less than 150 milliseconds and the jitter should be below 100 milliseconds to suit the sensitivity of the human ear in real time communications (such as VoIP).
- b. Critical infrastructure: although up to the present moment, the dimensioning of 3G and 4G networks have been conditioned by problems in the transport network with 5G, this dimensioning will be a base of experience offered to the user with high reliability and coverage.

- c. Very high capacity networks: it will be worked with high quality coverage and the technology will support multispectral services for the maximum use of this capacity.
- d. Virtualized infrastructure: the networks will be defined by software (SDN) and functions (NFV), where the networks will be oriented in the cloud, which will allow the use of new and better scales, in addition to obtaining cost efficiency and flexibility, which were not yet feasible.
- e. IoT and M2M: 5G will be able to support millions of connected devices by sending information periodically. The "all connected" can be a reality.

[15] The investments made by telecommunications operators, which were previously directed to people, may change by directly inferring new applications linked to the IoT.

[12] 5G will be easy to implement as opposed to 4G, described by features such as:

- a. The fifth generation technology will allow 90% energy savings per service provided.
- b. 5G will allow simultaneous connection on 100 billion devices.
- c. The frequencies used will be much higher, with the new technology being able to reach from 6GHz to 100GHz.

The 5G system will make the internet of things much more efficient and effective. Each device and network, created based on the IoT, will use only what is necessary and when necessary [15].

[16] suggests that in this technology there will not only be a big increase in connection speed, but it will also enable a significant increase in the number of simultaneous connections, the long-awaited decrease in data control latency, a reduction in power consumption and making the connection available in a much larger area, focusing on spaces where there is no mobile internet, even allowing the connection of 7 trillion devices.

[17] describes that 5G networks work through adio waves, as well as the mobile networks of previous generations. However, thespectrumcovered by the fifth generation of mobile broadband is significantly higher than the previous ones, spreading between 600 and 700 MHz, 26 and 28 Ghz and 38 and 42 GHz.

The 5G network antennas will be coupled to the existing antennas, which will be adapted to work in parallel with the new connection infrastructure. In

addition, smaller antennas with a range of a few meters, such as domestic ones, may be installed to repeat the signal from local devices, which will then be redirected to a central station. Whereas, replicating antennas, installed on poles or in tall buildings, will be able to cover distances up to 250 m [17].

The 5G network will allow service providers and operators to create new platforms to assist the operation of the next generation of applications, in addition to developing new business models. Video streaming and IoT-based applications are the current killer applications that, combined with the capabilities of virtual and augmented reality, will create opportunities in various sectors [8].

[8] Cites that most mobile operators worldwide indicate that enhanced mobile broadband (eMBB) will be the main proposition in the first 5G implementations, with massive, ultra-reliable low latency IoT communications gaining scale at a later stage.

Access through wireless technology has had major evolutions related to performance and efficiency, with the first generation (1G) fulfilling its function with the basic mobile voice service, while the second generation (2G) introduced greater service capacity and coverage , followed by the third generation (3G), which incorporated high-speed data search and the fourth generation (4G), which provides access to various telecommunications services combined with high mobility applications and data rates. Thus, it is clear that the fifth generation (5G) promises to be technologically more intelligent, interconnecting the whole world [18] (Table 2).

Table 2 Shows the comparison of generations.

Generations	Comparisons
1G	They brought mobility to analog voice services.
2G	Digital cellular voice services and basic data services (SMS, GPRS) - as well as roaming services on all networks
3 G	They brought a better mobile internet experience, however, with limited success to trigger the massive adoption of data services
4 G	IP-based services (Voice and Data), a fast broadband internet experience, with unified network protocols and architectures.
~	1 5 1 4 3

Source: Adapted [13].

The number of Internet of Things (IoT) connections will increase more than three times in the world, between

2017 and 2025, reaching 25 billion [15] and still presents that IoT can be considered as the future evaluation of the Internet that performs M2M learning (Machine to Machine), providing connectivity for everyone and everything.

IV. CONCLUSION

The 5G system and Internet of Things (IoT) will offer the ability to capture, store and move data from devices on a large scale and fuel data-based decision making.

Given this, 5G technology is a new standard for mobile devices that will bring both quantitative and qualitative changes in the way people use these devices, allowing for new features and a significant increase in the number and speed of connections.

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Solar Panel: A Sustainable Development Alternative for Industries

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Abstract— The energy system worldwide is seeking alternatives based on non-renewable sources that impact on the environment, new measures are therefore essential, such as renewable sources, which generate less environmental impact implementation of solar panels is characterized by as an alternative to conventional energy systems and polluting as a means of generating clean energy renewable and also with the advantage of enabling production of energy at the place of consumption itself. The objective of this study is to show the benefits related to the deployment of solar panels as a contribution to its role in sustainable development in industries. Thus, the appropriate incentives for spreading the use of distributed solar energy distributed among the actors becomes a major strategy for the industrial sector. In addition, the spread of major environmental innovations and ecological can bring economic benefits by stimulating industries to become more efficient in this area promote significant changes in the environmental, economic and social fields.

Keywords— Solar Panel; Industries; Renewable Sources.

I. INTRODUCTION

Industries, in the current scenario, show strong technological growth, This is happening at an everincreasing pace, the trend in energy consumption is increasing, since electric power is necessary for the vast majority of industrial activities.

The implementation of renewable energy sources as well as of storage systems reduce the amount of energy produced at low cost which is not properly harnessed [1].

Sustainable Development has brought a new approach to the relationship between mankind and the environment, promoting technological progress developed in an industrial process with various environmental impacts, where many industries aim to improve processes in this area. This is the idea of developing educational work, and consequently progress to mitigate environmental impacts.

Brazil, undergoing technological changes seeking to optimize the country's economy and the production of energy generated presents positive projections in alternative technologies, as that obtained through solar incidence, for the purpose of generating electricity using a solar power generation system grid-connected photovoltaic [2].

The energy system worldwide has been searching for alternatives based on non-renewable sources that impact on the environment, therefore initiatives that promote the advancement of renewable sources with minimum environmental impact.

Thus, the implementation of solar panels is characterized as an alternative to conventional energy systems and pollutants as a clean energy generation mode, renewable and also with the advantage of enabling energy production at the place of consumption itself. Solar panels are therefore instruments that contribute to the generation of energy generating less impact and reducing excessive spending for environmental and social purposes.

This study aims to characterize the beneficial impacts related to the implementation of solar panels, as a direct contribution to sustainable development in industries.

II. METODOLOGY

The methodology applied in this study was based on a bibliographic survey conducted for thematic related data collection in order to demonstrate the importance of installing solar panels, identifying its benefits, particularly with regard to mitigation of environmental and social impact and as an alternative source for industries.

Later, an explanation of the technology will be highlighted and the benefits for using solar panels, in addition to types of photovoltaic modules that can be deployed.

The study also provides a brief analysis of solar energy and the ability to improve and use this type of energy. In general, because we are situated in a high percentage area of solar irradiation, becomes the focus to understand on the subject, to enjoy and become one of the largest consumers and developers of renewable resource.

III. RESULTS AND DISCUSSION

Electric energy is fundamental to human beings, as an indispensable resource for everyday activities, resulting in comfort and even the development of new technologies and the advancement of mankind; but that overload, directly linked to the demographic increase, also brought problems related to the depletion of resources used to produce such energy, as well as impacts on the environment, often irreversible.

The sun's energy be used through the photovoltaic effect to produce electricity, converting the sun's energy into electrical energy, thus generating a clean and renewable energy source that causes less impact on the environment [3]

The increase in the number of people and technological development development have had a great need to produce electricity to meet demand.

Currently, there are several sources that can be used, either by hydroelectric plants, nuclear power stations and even by coal [4], however, some of them have contributed to the increase of pollution in the world and with it great impact on the environment and on different resources. This requires incentives for the use of clean and safer sources, as is the case with solar energy, with solar photovoltaic systems, reliable and a possible alternative energy source and sustainable in industries, in their productive environment.

In the industrial sector there is the juxtaposition of new technologies, because each project that reduces or minimizes should be studied and applied as a means of environmental benefit and also, economically, from the cost of the photovoltaic modules, reduction of taxes and the rising price of oil, which should be considered for the implementation of a project where solar energy is used as an alternative and advantageous source of energy [5].

The conversion of solar energy into electricity takes place directly, in a clean, silent process carried out at the place of consumption. This, combined with technological development, makes the production of electricity through photovoltaic generators and solar energy is a technical and economic reality that is widespread in the main industries.

The use of photovoltaic systems has several advantagesnot restricted to economic ones. In this power generation system, the consumer and also the producer of the energy, being most of the time in most cases, the sole owner is responsible for the whole process. Another advantage is that the energy source is free of charge and available for virtually infinite term (renewable energy source), since energy from the sun is available everywhere.

Limitation of energy supply in isolated locations is overcome, as it is, as said earlier, a resource available anywhere in the country. There is also the local generation, which contributes to environmental preservation, since the impacts are extremely low, i.e. clean energy [6].

With regard to the economy, the evolution of electricity production, by the solar energy boards, makes their installation, in the industrial environment and administrative, be practical and meet demand especially with regard to the use of equipment machinery, among others.

Currently, with the available technological applications, electric power generation from solar radiation is obtained by the photovoltaic effect. Thus, public policy actions are needed to exploit this energy source, considering the productive densification, generating a significant technological and clean dependence.

Seeking new alternatives, for the use of renewable energy, photovoltaic systems are in increasing use. With it, has been exploring new materials and conducting research for the advancement of photovoltaic [7].

Solar energy, on the other hand, does not need to be extracted, refined and neither transported to the place of generation, as it uses solar cells, which are responsible for generating energy [8]. This process is simplest, no emission of gaseous pollutants or noise with minimal need for maintenance. The relentless pursuit of development and of economic growth unquestionably entails unlimited and uninterrupted demand for electricity. The current world energy scenario shows signs of depletion of natural resources geared to energy generation. The increasing use of various equipment that demands electricity has two effects, being them, the increase in electricity consumption and the increase in the industrial production process. This development cycle, therefore, increases the emission of socalled greenhouse gases [9].

Growing environmental concern and global climate impacts has been generating a reflection on sustainable development around the world, committing to in-depth studies on alternative sources of renewable energy that can be incorporated into the brazilian electric matrix, mainly in industries.

In general, industries are quite intensive in energy consumption. In addition, the modern lifestyle itself is directly related to an increase in energy use [10].

The cost of implementing an isolated solar system may even drop sharply as its economic potential is to reduce electrical activity and the solar equipment has approximately 30 years of useful life value [11]. By aggregating taxes, environmental and social costs, photovoltaic solar energy will become economically competitive in the near future.

Solar panels, or modules, are the main components of the photovoltaic system energy generation. These are formed by a set of associated photovoltaic cells, electrically, in series and/or parallel, depending on the voltages and/or currents determined in design. All these modules are called photovoltaic generator and constitute the first part of the system, are responsible for the process of capturing solar irradiation and its transformation into electrical energy [11].

The industries are expanding significantly, affecting the world somehow; with this, the use of the solar source for electricity generation has as energy source. However, the energy not used in a satisfactory way. In this way, provide the appropriate incentives for the spread of solar energy use distributed among the actors becomes a major strategy for the industrial sector. In addition, the dissemination of major environmental and ecological innovations can bring economic benefits by stimulating brazilian industries to become more efficient in this area.

To understand the applications and benefits of a solar panel its production efficiency needs to be analysed. Efficiency is one of the characteristics of evaluating the quality of a photovoltaic module. However, it needs to be seen in a global context, considering the other variables involved, being defined by the relationship between the amount of electric power which is produced at the point of maximum power (W) and the amount of solar energy reaching the module $(W/m^2 x m^2)$ [13].

Industrial policy in a context of renewable energy policy, can generate relatively high costs, and there are still many obstacles to this condition. The question of value, shows the advantageous financing conditions, being a central element in the expansion of electricity generation mainly in large industries, given the broad and historic involvement of new public policies. Thus, in the absence of careful adaptation, the conditions for the financing of new renewable sources can have a strong impact on technological choice, considering other renewable sources.

IV. CONCLUSION

The impacts of energy use on the environment, its production and consumption, deserve a relevant analysis, either because of the huge environmental impacts caused energy used in industries and use of environmental resources.

The production of electricity by solar radiation conversion is a promising technology today, clean and renewable for electricity production, offering exemplary conditions for the use of this photovoltaic technology to reduce dependence on electric power from industries.

The deployment of solar panels helps to reduce gas emissions, and in Brazil, for example, could be used in most industries, for not using any fuel, where solar energy does not contribute to the price increase and problems in the recovery and transport of fuel or in the storage of radioactive.

There is an increasing need for the use of clean and renewable energy sources, a measure to reduce gas emissions, enabling an increase in the local energy matrix, which have proved capable of promoting significant changes in the social and environmental fields.

Therefore, the challenge is still to make available and prioritise resources to develop technologies to enable alternative energy sources in a timely manner so that industries can recover and there is no collapse between industrial growth and the availability of a clean environment.

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Physicochemical characterization of six yam (*Dioscorea* spp) species

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Abstract— Yam is a crop with economic and social significance for the Brazilian Northeastern region. The objective of the present work was to analyze the physicochemical characters of six yam species in order to verify variations in chemical composition within the species (inter and intra-species) germplasm. The experimental was performed under a completely randomized design with six treatments and three replicates. Contents of lipids, humidity, ashes, proteins, starch, reducing sugars and the content of total sugars were evaluated. Regarding physical measures, weight of tubers with peel (kg) and weight of tubers without peel (g), tuber length (cm), longitudinal and transversal diameter (cm), longitudinal and transversal thickness (cm) were determined. The results were submitted to analysis of variance (ANOVA), F test and means were compared by the Tukey test (p<0.05) using the statistical software R. High significant statistical difference (p < 0.05) was observed for all physicochemical characteristics analyzed. Yam species designated as 'Jiboia' showed the highest tuber weight (76.96), higher pulp weight (76.26), higher tuber length (74.76) and higher longitudinal diameter (67.76). The species Dioscorea rotundata was also prominent showing higher contents of ashes (1.40), starch (85.20), lipids (1.23) and protein (2.14) and the species D. trifida showed the lowest contents of lipids (0.59), protein (1.07) and reducing sugars (1.06). Results in the present study evidenced inter-specific and intra-specific variations in chemical composition of yam germplams.

Keywords— Variability, nutrient contents, yam tubers.

I. INTRODUCTION

In addition to its excellent nutritional and energetic qualities, Yam (Dioscorea spp.), has an accessible price in the market and its tubers have been of great importance in Brazilian nourishing, yam can also be considered as a raw material source for the food industry [14]. For millions of people around the world it constitutes a food with accessible prices and it has been widely used as raw material in a food production chain with benefits for farmers and consumers [6]. Yam has nearly 600 species, with the most important being those originated from tropical regions in Asia and West Africa, which produce edible tubers: D. cayennensis, D. rotundata and D. esculenta originated from Africa; D. alata originated from Asia [13], [18], [17]. These species are preserved by small traditional farmers [8].

Due to its nutritional value and astringent some *Dioscorea* species have been used against malnutrition and to treat various diseases, such as diabetes and to help reducing cholesterol.

Despite the species *Dioscorea spp.* having high nutritional value, research regarding this tuber are still scarce and consequently their nutritional properties are unknown [9]. The objective of this study was to perform physicochemical analyses in order to identify if there are variations in the chemical composition of yam access at intra- and infra-species level.

II. MATERIAL AND METHODS

Physicochemical analyses were performed at the Laboratory of Food Sciences and Technology from Embrapa Yam and Fruit Culture, in Cruz das Almas, Bahia-Brazil. Yam tubers were firstly visually inspected and evaluated regarding their sanity, physical integrity, size and form. Then, tubers were washed in tap water and then weighed in semi analytic balance, peeled and mechanically sliced.

Physical measurements consisted in: weight of tuber with peel (kg) and weight of tubers without peel (g) obtained using a digital balance (Ramuza®, model DCR-

15 Bat); tuber length (cm), longitudinal and transversal diameter (cm), longitudinal and transversal thickness (cm) using a ruler graduated in mm and a digital caliper (Ford®); then tubers were cut in halves and the longitudinal and transversal thickness was evaluated, as well as the weight of the tuber without peel. After peeled and measured, tubers were cut in smaller pieces obtaining a sample of 600 g for each species for chemical analysis.



Fig.1: Weighting of yam tubers (1); measuring length of tubers (2); measuring tuber diameter (3)



Fig.2: Cutting tubers (1); weighting tubers without peel (2); measuring tuber thickness (3)

Chemical analyses included the content of ashes, lipids, humidity, protein, starch, reducing sugars and contents of total sugars, obtained according the recommendations from [9]. The experimental design chosen was completely randomized with six treatments and three replicates. Results were submitted to analysis of variance (ANOVA), F test and means compared by the Tukey test (p<0.05). The statistical software R® was used to perform all data analysis [15].

III. RESULTS AND DISCUSSION

Mean values from the physical analysis of yam tubers are showed in Table 1. Yam tubers form the species denominated 'Jiboia' showed higher tuber weight (76.96), higher pulp weight (76.26), higher tuber length (74.76) and higher longitudinal diameter (67.76). 'Da Costa' yam showed higher transversal diameter (63.76), transversal thickness (71.50) and longitudinal thickness (72.30). Yam species called 'Iambu' showed the lowest values for tuber weight (8.46), pulp weight (8.00), tuber length (8.66), transversal diameter (14.60), transversal thickness (14.66) and longitudinal thickness (14.53).

Table 1.Values of tuber weight, pulp weight, tuber length, longitudinal diameter, transversal diameter, transversal thickness
and longitudinal thickness of six yam species.

Yam species	Tuber weight	Pulp weight	Tuber length	Longitudinal diameter	Transversal diameter	Transversal thickness	Longitudinal thickness
Jiboia	76.96 a	76.26 a	74.76 a	67.76 a	56.73 ab	65.40 ab	69.96 ab
Da Costa	66.66 b	67.66 b	74.83 a	70.60 a	63.76 a	71.50 a	72.30 a
São Tomé	52.36 c	54.53 c	44.10 b	63.46 a	51.60 abc	60.03 b	61.73 b
Roxo	46.00 c	42.63 d	48.30 b	32.30 b	46.16 bc	43.03 c	23.50 c
Fígado	22.53 d	23.90 e	22.33 c	12.60 c	40.13 c	18.36 d	30.96 c
Iambu	8.46 e	8.00 f	8.66 d	26.26 b	14.60 d	14.66 d	14.53 d

Means followed by the same letter do not differ statistically by the Tukey test at 5% probability.

'Da Costa' and 'Roxo' yam species showed the highest content of ashes. The lowest contents of ashes were observed in 'São Tomé' and 'Iambu' (Table 2). Contents of ashes were considered within the expected values, as previously reported [10], when the total content of ashes varied from 0.05 to 1.76. In a similar manner [12] observed an average of 0.90, while [3] in a study characterizing *Dioscorea alata* as food product, registered values varying from 3.83 to 6.49 for the content of ashes.

'Da Costa' yam showed the higher content of lipids and the lowest content was verified in 'Iambu' species (Table 2). The values for lipid contents observed in the present study are similar to those observed by [7], while studying the composition of nutrients in *D. bulbifera* with a lipid contents varying from 0.11 to 0.3. The majority of tubers showed low contents of ashes, lipids and proteins; and predominance of high values for total carbohydrates' contents in the form of starch, therefore, being considered energetic foods [5].

'Da Costa' yam showed the highest protein content, while the lowest protein content was observed in the species 'Iambu'(Table 2). These results are similar to [2], when studying Indonesia yam with protein contents varying from 1.2 to 1.8. On the other hand, [15] observed values from 4.03 to 6.52 in Ghana yams. Low protein concentrations may be justified due to the gathering starch during tuber development.

Yam form the species *D. alata*has high contents of starch and has been part of the Southeast Asia and African diets in addition to Chinese traditional medicine due to its anti-inflammatory properties. Starch is an edible polymer derived from vegetals an one of the most important ingredients to prepare several meals [1]. Our results are in agreement with [11] who emphasize the contents of starch in tubers from within the same species or from different species may diverge due to the differences in the activity of enzymes participating in starch biosynthesis. The lowest starch content was observed in the species*D. trifida* (Table 2).

Yam species *D. rotundata*showed higher contents of reducing sugars and total sugars, with the lowest contents of reducing sugars registered in the species *D. trifida* (Table 2).

Yam						Reducing	
species	Ashes	Lipids	Moisture	Proteins	Starches	sugar	Total sugar
Da Costa	1.40 a	1.23a	76.16 a	2.14 a	85.2 a	2.47 a	12.34 a
Roxo	1.39 a	0.93 b	75.44 b	1.91 b	78 b	2.04 b	9.32 b
Jiboia	1.23 b	0.83 c	72.59 c	1.45 c	63 c	1.42 c	7.40 c
Fígado	1.21 bc	0.71 d	66.00 d	1.38 cd	60 c	1.16 d	6.62 d
São Tomé	1.16 bc	0.70 d	65.40 e	1.33 d	60.02 c	1.14 d	5.91 d
Iambu	1.08 c	0.59 e	65.11 e	1.07 e	43. 0d	1.06 e	5.90 d

Table 2. Mean values for contents of ashes, lipids, proteins, starch, reducing sugars and total sugars in six yam species.

*Means followed by the same letter do not differ statistically by the Tukey test at 5% probability.

A significant effect was observed for contents of ashes, lipids, proteins, reducing sugars, total sugars and humidity, as shown in Table 3. The coefficient of variation was of 4.32% for contents of ashes, 3.09% for lipids contents, 2.20% for protein contents, 2.58% for starch

contents, 1.60% for contents of reducing sugars, 3.53 for

total sugar contents and 0.16% for humidity.

					SM			
VS	LD						Reducing	Total
		Ashes	Lipids	Humidity	Proteins	Starch	sugars	sugars
Treatme	ent 5	0.68**	0.72**	81.49**	0.73**	673.36**	0.67**	18.23**
Residu	e 12	0.29	0.67	0.13	0.16	2.79	0.61	0.83
Total	17							
CV(%))	4.32	3.09	0.16	2.2	2.58	1.6	3.53
VS	(Variation	source),	LD	(Liberty	degree	es), SN	I (Squa	are me

 Table 3. Analysis of variance (ANOVA) obtained for physicochemical characterization of different yam (Dioscorea spp.)

 species, analyzing the contents of ashes, lipids, proteins, starch, reducing sugars, total sugars and humidity.

** and * = significant at 1 and 5%, respectively, by the F test, ^{ns}non-significant.

IV. CONCLUSIONS

We have verified the importance of studying the chemical composition of tubers in order to contribute to the understanding and knowledge of nutritional properties of yam species that have been neglected.

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Implementation of Industry 4.0 and Robots in Production Processes of the Metal Industry

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Abstract— We are witnessing major changes in all industries. Due to the application of new technological discoveries, new business methods are emerging, with the transformation of production systems, and a new form of consumption, delivery and transport. The course of development in the field of production in the world is directed towards Industry 4.0, which aims for production based on smart production processes. This requires the introduction of new technologies such as: robotics, Internet of Things (IoT), 3D printing, smart sensors, Radio Frequency Identification (RFID), etc. The application of the first-generation industrial robots introduced rigid automation of production processes. The major deficiencies of the first-generation robots are that they were fenced and took up a lot of production space. The development of robotics technology and other new technologies in Industry 4.0, so the application of robots in the automation of production processes, with the support of information technology, leads to 'smart automation', i.e. 'smart factor''. The paper presents the implementation of industrial robots and Industry 4.0 in the production processes of the metal industry, as well as the possibility of increasing productivity, reducing time, and increasing the quality of production for the analysis.

Keywords—Industry 4.0, robot, automation, production process, metal industry.

I. INTRODUCTION

There are many changes taking place on the world industrial and digital scene that we call Industry 4.0, or the Fourth industrial revolution. It represents the vision of the advanced industrial production based on CPS - Cyber-Physical-Systems, and new technologies, which primarily include Robotics & Automation, Internet of Things, Cloud Computing, 3D Printing, Intelligent Sensors, RFID -Radio Frequency Identification, etc. The goal of Industry 4.0 is to implement innovations from these technologies in all segments of society, especially in the production processes of all industries. The metal industry and its production processes represent a very important segment of industrial production. The direction of development of this segment is based on flexible automation leading to intelligent production processes. The implementation of Industry 4.0 in the production processes of the metalworking industry is motivated by technical and economic reasons, such as: increased productivity,

flexibility in the production process, increased quality of finished products, reduced production costs, etc. The implementation of Industry 4.0 in the production processes of the metal industry is inconceivable without the implementation of industrial and service robots in the production process itself. Their implementation has technological and economic justification, as shown in [1-12,14,18]. The implementation of robots in the production processes of the metal industry provides a number of advantages, some of which are:

- Increased flexibility of the production process,
- Increased accuracy in the production process which gives better product quality,
- Increased productivity of the production process,
- Increased safety at work in inadequate working conditions,
- Reduced production and maintenance costs,
- Reduced participation of workers in the production process,

• Reduced workforce in performing heavy and repetitive jobs.

This represents only a small part of the advantages, which are very significant in the conditions of larger capacity production, as evident in the metal industry.

The introduction of the paper should explain the nature of the problem, previous work, purpose, and the contribution of the paper. The contents of each section may be provided to understand easily about the paper.

II. METHODS

Theoretical analysis of Industry 4.0 and statistics on the application of industrial robots were used, obtained from the International Federation of Robotics (IFR), the European Economic Commission (UNECE) and the Organization for Economic Co-operation and Development (OECD) [1,3,4,26-30].

III. EXPERIMENTAL

The reference [19] provides the conclusion that the trend of application of innovations from the mentioned technologies of Industry 4.0 is continuously increasing in the world. The first place in the implementation and application of innovations from Industry 4.0 is held by the automotive industry. The reason for such order is a great global competition in the world, because all companies invest heavily in research, development and implementation of Industry 4.0 core technologies in order to remain competitive in the global market [3,6,25].

3.1 The Fourth industrial revolution - Industry 4.0 and its concept in production processes

The world has changed from the first industrial revolution with the invention of the steam engine in 1784, the second industrial revolution with the discovery of electricity and the third industrial revolution using IT systems and the Internet in 1969, to the fourth industrial revolution - Industry 4.0, due to the latest innovations from new technologies such as Robotics & Automation, Internet of Things, Cloud Computing, 3D Printing, Intelligent Sensors, RFID – Radio Frequency Identification, and their implementation in all segments of society, including production processes [3,13,15,16,17]. When it comes to production processes, and especially production processes in the metalworking industry, the difference between the third and fourth industrial revolution is shown in Fig. 1.



Fig. 1. Advantages of Industry 4.0 over the Third industrial revolution

As Fig. 1 shows, the third industrial revolution was recognizable by automated repetition, physical labor, and production automation. Here we must note that during the third industrial revolution, the automation of production processes was performed with first-generation industrial robots, whose workspace had to be separated by fences from the workers for their safety, thus creating rigid automation. Similar to the third industrial revolution, Industry 4.0 also uses automated repetition, intellectual work, and automatic design. Development, progress and implementation of basic technologies of Industry 4.0, such as: Robotics & Automation, Internet of Things, Cloud Computing, 3D Printing, Intelligent Sensors, RFID -Radio Frequency Identification, lead to the secondgeneration industrial robots, i.e. collaborative robots. They are implemented in production processes, and create flexible automation which is an advantage over the third industrial revolution. Invention of large number of technologies innovations in digital and their implementation in production processes through the use of computer hardware, software and networks is becoming more sophisticated and intelligent, resulting in their transformation, thus affecting society in all segments of life, including the global economy [1,3,6,19-22]. Industry 4.0, like any industrial revolution, creates an increase in knowledge in the world through the implementation of innovations from these new technologies, by using advanced software, as shown in Fig. 2.



Fig. 2. Advantages of Industry 4.0 in the automation of production processes in the metal industry

In today's world, advanced machines with standard software are used in all production processes, including the metalworking industry. The Fourth industrial revolution is using advanced software for typical machines, as shown in Fig. 2. Advanced innovations and their implementation cause many advances in technology and processes, such as innovations in the basic technologies of Industry 4.0 [3]. As an illustration, Fig. 3 shows the number of patent applications in 2016 in five countries: China, USA, Japan, Korea, and Germany.

The analysis of the trend of patent-innovation applications from Industry 4.0 in 2016 shows that robotic technology is in the first place with 26 % of the total number of applied patents-innovations, which is to be expected because Industry 4.0 wants to achieve flexible automation, i.e. smart manufacturing processes that cannot be accomplished without industrial and service robots. Fig. 3b, shows the trend of patent-innovation applications in robotics in five countries: Republic of Korea, USA, Germany, Japan, and China. In terms of applied patentsinnovations in robotics, the first place is held by China. However, we must keep in mind that this represents a large number of low-quality innovations, the reason being that government policy rewards the registration of innovations regardless of their quality and implementation.



a – *percentage of total patent applications*



b-broj prijavljeni patenata iz robotike



The basic industries of the Industry 4.0 are based on innovations that are much faster and more widely implemented in the production processes of the automotive industry. The reason for such position is the impact of the global market, because for the company to survive in the market it must constantly modernize and innovate production processes, i.e. implement Industry 4.0. This especially refers to the metal industry which is the foundation of the automotive industry. In addition to the automotive industry, the metal industry with the linear mode of the production process is also shifting to the network production process, as shown in Fig. 4. In this process, the machine communicates with the M2M machine, the machines are serviced by collaborative robots, and the transport is arranged with service robots for logistics. The implementation includes completely smart solutions for local transport with the application of mobile robots for logistics. In the fourth industrial revolution or Industry 4.0, the second-generation industrial robots and service robots for logistics are implemented in the production processes of the metal industry [3,21-25].



a – Classic manufacturing process



b – Manufacturing process in Industry 4.0

Fig. 4. The linear production process is transformed into the network production process in Industry 4.0

The linear production process is switched to a network production process because machines communicate with each other, and the communication is provided by basic Industry 4.0 technologies. The production processes in the metal industry now have many advantages, of which some are:

- When complete automation is complex, we are able to partially automate the execution of tasks. In other words, we have the possibility of different levels of automation.
- We can turn rigid automation into flexible automation.
- It is characterized by simple and manageable tasks for handling.
- Due to the division of operations between workers and robots, we have improved performance.
- The role of industrial and service robots in Industry 4.0 is the most important, because it connects the factory of real life with virtual reality, which opens greater prospects for application in global production.
- We can significantly improve non-ergonomic workstations with the help of collaborative robots, where we must keep in mind that worker safety is an absolute prerequisite.
- Reducing the product life cycle and increasing product diversity, require flexible automation, which will result in increased use of collaborative robots.

From the above mentioned, we can see that the concept of production processes in all industries, including the metal industry, is to implement second-generation industrial robots, collaborative robots, and service robots for logistics, to move from a linear production process to a network production process, to provide machine-tomachine communication, and to implement a large number of smart sensors. This enables online monitoring of the production process, online decision-making, permanent maintenance, fast changing serial production, etc. With the implementation of Industry 4.0, the production process in the metal industry goes in the direction of smart production process.

3.2 Implementation of industrial robots in production processes in the world

In order to get a real image of the implementation of industrial robots, it is necessary to make an analysis of the implementation of industrial robots in the world in the last ten years, and expected predictions of implementation in the coming period. The analysis was conducted based on statistical data on the implementation of industrial and service robots, provided by the International Federation of Robotics (IFR), The United Nations Economic Commission for Europe (UNECE) and the Organization for Economic Co-operation and Development (OECD). The trend of implementation of industrial robots in the world is shown in Fig. 5,[3,6,26-30].

The trend of implementation of industrial robots in the world is growing annually, as shown in Fig. 5.a), so that in 2019 a total of amount of 421.000 robot units were implemented.





b-total

Fig. 5. Annual and overall trend of implementation of industrial robots in the world in the period 2008-2019 and estimated implementation by 2020

It is noticeable that in the period of five years from 2009-2014, the increase in implementation was 268%, while in the next five years the trend of implementation decreased slightly and amounted to about 90.5%. In ten years, in the period 2009- 2019, the implementation increased by 602%. This leads to the conclusion that the automation of production processes has accelerated, and Industry 4.0 has the credit for that. By analyzing the implementation of robots by continents, we see that Asia/Australia holds the first place, followed by Europe and America. Africa as a continent has not been considered because implementation is insignificant compared to these three continents. We can conclude that the implementation in Asia/Australia takes place as per exponential function, whereas the implementation in Europe and America is linear. In the next three years, it is estimated that the implementation of robots in the world will increase, so that in 2020, the use of about 582.000 robot units is expected. Regarding the total number of implemented robots in the world, Fig. 5.b), we see that the trend of implementation is exponential and continuously

increasing. In the period 2009-2019, the increase was about 172 %, which leads us to the conclusion that production processes in the world are increasingly modernized and automated. The trend will continue in the future, so it is expected that in 2020 the total implementation of industrial robots will be around 4 million units.



Fig. 6: Implementation of industrial robots in the top ten countries in the world in 2018

The analysis of the implementation of industrial robots in the top ten countries in the world in 2018, according to the number of implementations, has shown that most countries are from Asia: Taiwan, Republic of Korea, Japan and China. The highest implementation is recorded in China with about 154.000 industrial robot units, which confirms the fact that China is implementing its technological development strategy called "Made in China 2025", which aims to position China as the most technologically advanced country in the world by 2025. In order to get the real image of the implementation of industrial robots in the world, it is necessary to make an analysis of the implementation of industrial robots per 10.000 workers employed in production processes. The statistical data were taken from and shown in Fig. 7, [13,26]. The density of industrial robots represents the number of multi-purpose industrial robots per 10.000 employees. In other words, it is the number of robots in relation to the number of employees in the manufacturing industry, which presents a measure of economic size, and allows us to compare average between countries. Here we must note that unique sources, such as the OECD statistical database, rely on local data sources. These data are often revised (employment data available only with a time distance of at least one year).



Fig. 7. Trend of installing industrial robots per 10.000 workers in production processes in the world in 2018

The density of robots in 2018 is shown in Fig. 8, only for those countries in the world that have a density greater than 95. Based on Fig. 7, it is suggested that in 2018 the average density of industrial robots in the world is 99 robot units per 10.000 employees in production processes. The density of industrial robots is the highest in Europe and equals 114 industrial robot units, followed by America with a density of industrial robots that amounts to 99 and Asia with a density of industrial robots of 91. Since Asia has the highest rate of implementation of industrial robots, as shown in Fig. 5 and Fig. 6, we can conclude that Asia will very quickly reach America's density of industrial robots per 10.000 employees in production processes.

3.3 Implementation of industrial robots in the production processes of the metal industry

The implementation of industrial and service robots in the production processes of the metal industry aims to increase productivity, reduce costs and achieve better product quality. Their implementation will achieve exactly what Industry 4.0 advocates, which is a higher degree of automation with satisfactory flexibility and greater production with economic justification, whether it is existing production processes or the introduction of new production processes. The metal industry covers all production and service processes, from the production of parts to assembly into semi-finished or finished products. Industrial and service robots in the metal industry are used in many tasks in the production process, including transport of materials before and after processing, process operations, assembly processes of subsets/sets/finished products, control processes (inter operative control and control of final products), etc. The implementation of fundamental technology of Industry 4.0 in the production processes of the metal industry, especially secondgeneration industrial robots and service robots for logistics, leads to greater flexibility and efficiency in production processes. The analysis of the implementation

of industrial robots in the metal industry was performed based on statistical data of the International Federation of Robotics (IFR), the United Nations Economic Commission for Europe (UNECE) and the Organization for Economic Cooperation and Development (OECD), as shown in Fig. 8 and Fig. 9,[6.26-30].



Fig. 8. Implementation of industrial robots in production processes in the world in the period 2011-2019 at the total and annual level, and estimates of implementation by 2022

The trend of implementation of industrial robots in the production processes of all industries in the world has a slightly growing trend on an annual basis, and is conducted linearly. In 2011, 23.050 robot units were implemented. In 2015 implementation increased to 25.800 robot units, and in 2019 the implementation amounted to 42.300 robot units. It is estimated that in the coming years, the trend of the implementation of industrial robots in production processes in the world will continue to grow. The overall trend of robot implementation in production processes in the world is growing, so that, in just eight years, from 123.750 robot units in 2011, the implementation amounted to about 332.200 robot units in 2019, which is an increase of about 170 %. In the coming years, the implementation of industrial robots in production processes in the world is expected to increase, and in 2020 the implementation of about 425.000 robot units is expected. This kind of trend of implementation of industrial robots is due to the fact that companies are introducing Industry 4.0 into their production processes, which would be unthinkable without the introduction of industrial robots. The highest number of implemented robots is recorded in the production processes of the automotive industry, and the largest part is in the welding of bodies, production of engines and various elements necessary in the automotive industry. In order to depict the real situation of the implementation of industrial robots in the production processes of the metal industry, we have conducted an analysis, as shown in Fig. 9.



Fig. 9. Annual implementation of industrial robots in the production processes of all industries and the metal industry in the world in the period 2011-2019 and estimates of application until 2022

The trend of implementation of industrial robots in production processes in the metal industry has a growing tendency. 9.890 robot units were implemented in 2011, and in just four years the amount increased to 17.099 robot units, which is an increase of about 73%. In the next four years, the implementation increased to 21.150 robot units in 2019, which is an increase of 24%. The total increase in the implementation of industrial robots in the processes of the metal industry for the period 2011-2019 was 114%, which is very good. In the coming years, the implementation of industrial robots is expected to increase, so that in 2022 the implementation of about 24.300 robot units is expected. Of the total number of industrial robots implemented in production processes in the world on an annual basis, almost one half is implemented in the production processes of the metal industry, which can be seenin Fig.9. In addition to industrial robots, service robots for logistics are also implemented in the production processes of the metal industry, which are used for transport of materials, transport of semi-finished products from machine to machine, transport of finished products and transport of finished products in the warehouse during commissioning. In order to see their role and implementation, Fig. 10. shows the trend of their implementation.

The development of new technologies that form the foundation of Industry 4.0 has had a significant impact on the development of service robots for logistics. Many companies have developed different designs of service robots for logistics that are implemented in all production processes in the world, most of it in the production processes of the metalworking industry [15,17,20-25].



Fig. 10. Annual implementation of service robots for logistics in production processes in the world for the period 2011-2019 and estimates of implementation until 2023

Based on Fig. 10, we see that the trend of implementation of service robots for logistics is exponential, so that from the 1.218 robot units implemented in 2011, there was an increase to about 75.000 units of service robots for logistics, which is an increase of 6,050%. It is predicted that such high implementation of service robots for logistics will continue, and in 2023 the implementation of about 259.000 units of service robots for logistics is expected. This shows us that the implementation of Industry 4.0 is widely implemented in production processes in the world, including the production processes of the metal industry. The goal is to make production processes smart-intelligent without employees performing difficult and tedious tasks. The employees will be replaced by second-generation industrial robots and service robots.

IV. DISCUSSION

Robotic technology is the core technology of Industry 4.0, as evidenced by the number of patent applications in robotics 26% in 2016 worldwide Fig. 3. The trend of implementation of industrial robots in the world is growing Fig. 5.- Fig.7., and the lead by 2022 is that the implementation of robots will be a growing trend. In the metal industry is also a growing trend Fig. 8. and Fig. 9., and the reason is the implementation of industrial robots in the service of CNC machines, as well as the implementation of service robots for logistics in production processes in the metal industry. With the implementation of Industry 4.0, the trend of robot implementation in the metal industry will be growing. With the development of robotic technology in implementation are second-generation industrial robotscollaborative robots and service robots for logistics that are fully intelligent, and the implementation trend is much increased Fig. 10.

V. CONCLUSION

In order to survive in the global market, the aim of every company must be to reduce costs and at the same time increase productivity and quality of the final product, which can be achieved by implementing the basic technologies of Industry 4.0, primarily robotic technology and implementation of second-generation robots collaborative robots and service robots for logistics. When designing any metal processing procedure in the metalworking industry, it is necessary to take care that this process is organized with as little human participation in operational tasks. The development of the metal industry in the world includes the implementation of Industry 4.0, because any deviation or slowdown in development reduces market competitiveness and inevitably leads to delay. The trend of implementation of industrial robots and professional service robots in the production processes of all industries is growing and it will continue in the years to come, as is shown in this paper. The decision to introduce robots in all segments of production processes of the metal industry would present one of the conditions for achieving greater efficiency in the work of industrial processes. The use of robots is no longer limited to industrial robots with specific requirements of a safe working environment, because the achieved robot-human interaction has created conditions for their joint work using collaborative robots, which will result in their increased implementation. The development and improvement of new technologies is expected in the coming years, as well as robotic technology and its implementation in the production processes of all industries, especially in the metal industry, which aims to make production processes smartintelligent. The ultimate goal is to reach smart-intelligent factories.

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Development of high School Biological Module based on Pictorial Riddle inquiry in Human Motion System

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Abstract— Global changes in the development of knowledge and technology, especially those related to the education system in schools, require a change in teacher attitudes in implementing classroom learning. Therefore, teachers are required to continue to innovate in developing learning models that can improve students' attitudes, skills and knowledge. This learning model is expected not only to prepare students as a generation who only follows the times, but also to prepare them as a generation that is critical, creative, and innovative in developing their potential in the future. However, in general, the level of creativity and critical thinking of students is still low. Some of the causes for dull student creativity and critical thinking are the low mastery of basic concepts. Thus, in this study, learning improvements will be carried out through the use of biology modules based on the pictorial riddle inquiry method to increase student retention as a support for the learning process. Therefore, it is necessary to improve learning biology, especially on the subject of human motion systems in the form of using biology modules based on the pictorial riddle inquiry method as a medium and / or a student learning resource. From this explanation, it is hoped that metacognition skills can be useful in increasing critical thinking, conceptual understanding, and student creativity.

Keywords— *the pictorial riddle inquiry method, biology modules.*

I. INTRODUCTION

Module development is needed to be able to meet student needs, namely modules that are in accordance with the characteristics or social environment of students. Therefore, teachers are required to continue to innovate to develop learning models that can improve students' attitudes, skills and knowledge. This learning model is expected not only to prepare students as a generation who only follows the times, but also to prepare them as a generation that is critical, creative, and innovative in developing their potential in the future. However, in general, the level of creativity and critical thinking of students is still low. Some of the causes for dull student creativity and critical thinking are the low mastery of basic concepts. Another cause of bluntness in students' creativity, critical thinking, and conceptual understanding is low metacognition skills.

This statement is also supported by the results of an interview with a Biology teacher at a high school in Jember, related to the material module of human motion systems used in schools that have not fully carried out the inquiry steps, even in some high school schools the textbooks provided by the government have not met the quota of students. so that the system used alternately when learning activities in Biology subjects, in the process of learning activities are also not supported by other modules or modules that support inquiry learning activities so that students are less stimulated to create inquiry learning.

Inquiry pictorial riddles is a learning method that uses pictures, demonstrations or real situations so that it can stimulate students to think more critically about the problems presented in the form of pictorial puzzles. Pictorial riddles motivate students to issue ideas, think critically and intuitively, and form and develop selfconcepts in students, besides that the material will last longer in memory because the material is presented using images and events that actually occur in everyday life. For these reasons, the pictorial riddle inquiry is in accordance with the demands of the 2013 curriculum described above. Based on the aforementioned background, a study was compiled with the title "Development of a Biology Module Based on Pictorial Riddle Inquiry on Metacognition Skills and Student Retention in SMA / MA Material for Motion Systems in Humans.

Based on the background above, the following problems can be formulated:

- a. How is the validity of the Pictorial Riddle Inquiry-Based Biology Module on Metacognition Skills and Student Retention in SMA / MA Material for Motion Systems in Humans?
- b. What is the practicality of the Pictorial Riddle Inquiry-Based Biology Module on Metacognition Skills and Student Retention in SMA / MA Material for Motion Systems in Humans?

c. How effective is the Pictorial Riddle Inquiry-Based Biology Module on Metacognition Skills and Student Retention in SMA / MA Material for Motion Systems in Humans?

II. METHODOLOGY

This type of research is development research, namely a type of research that develops a new product or enhances an existing product. The product in question is a Biology module based on the Pictorial Riddle inquiry method on the material of motion systems in humans in high school is a type of development research (Research and Development), this product is then tested for practicality and effectiveness on students. The process leads to the development of the module through the 4-D model proposed by Thiagarajan et al., (1974), namely (define, design, develop and disseminate) as shown in Figure 3.1 below:

• Define•	Field study observations Defines the pictorial riddle biology module study
Design	Theoritical studies for the pictorial riddle biology module Biology pictorial riddle module format selection Prototipe I module biologi <i>pictorial riddle</i>
Develop •••••	Expert and user validation Prototipe II modul biologi <i>pictorial riddle</i> Prototipe III modul biologi <i>pictorial riddle</i> modul biologi <i>pictorial riddle</i> valid, practically
Disseminate	Test the level of validity, practicality and effectiveness in other schools with different student quality standards

III. RESULT

Research on the Development of Biology Module in High School Based on Pictorial Riddle Inquiry in Human Motion Systems is a type of research and development, and produces products that are valid, practical, and effective. This research was conducted at MA Al-Qodiri Gumukmas based on a 4-D development design (Thiagarajan et al., 1974: 9). The results of this development include 1) the results of the define stage, namely a questionnaire on teacher needs, a questionnaire on student needs and materials; 2) the results of the design stage, namely the initial prototype of the developed module; 3) the results of the development stage, namely expert validation, small group trial results and large scale trial results (class scale); and 4) the results of the disseminate stage, namely the results of class scale trials at MA Al-Qodiri Gumukmas and MA Ibnu Kholdun Puger.



Fig 4.4 Histogram Skore N-Gain Uji Coba II di MA Al-Qodiri Gumukmas

The Disseminate stage (dissemination) is carried out in other schools with the aim of testing the effectiveness and practicality of using the developed Pictorial Riddle Inquiry Module, the assessment process is by giving student response questionnaires, pre-test and post-test questions. This dissemination also aims to get criticism, suggestions, and ratings, as a basis for improving the final product development, so that it is ready for adoption by users. This distribution stage is only carried out on a limited scale, namely carried out at two schools that have the same Biology material character but have different student characters, the first school is at MA Al Qodiri Gumukmas, the second school at MA Ibnu Kholdun Puger. The results of the dissemination trial were in the form of student response questionnaires, pretest and posttest results.

IV. DISCUSSION

Module Based On Inquiry Pictorial Riddle Material Motion Systems in humans consists of three different subject matter. Material 1 contains "The frame as an active motion system", Material 2 "Muscles as an active motion system", Material 3 "Disorders of the movement system", The three module materials are arranged with the 5M approach step which is presented in full starting from (observing, asking try, reason and communicate) Activities that aim to analyze, try, reason and conclude are important parts of teaching and learning activities because students carry out the process of finding facts or concepts that are being studied (Gok, 2010). Module Based on Inquiry Pictorial Riddle Material for Motion Systems in humans has gone through the validation and testing stages of small and large groups (class scale), the preparation of modules is arranged on the basis of field needs and is designed

based on appropriate supporting references and directions from the supervisor, this module adopts the 4-D development (Thiagarajan et. al., 1974) in its development process.

V. CONCLUSION

Based on the results of research, data processing analysis, and research discussion, it can be concluded that the use of pictorial ridle inquiry-based biology modules on human motion systems material can improve student outcomes. This is evidenced by the percentage of students' conceptual understanding after using a pictorial inquiry-based module on the material of motion systems in humans of N-Gain 0.74 with a high category.

Suggestions that can be given for further research are 1) Development of a High School Biology Module Based on Pictorial Riddle Inquiry in Human Motion Systems. it will be more effective if the spirit of each student in the class has high learning motivation. 2) Before the Pictorial Riddle Inquiry Based Module Material for Human Motion Systems is distributed to students, the teacher first reads the instructions for using the module so that students understand if the module is an independent teaching material that trains students' independence in understanding the subject matter. 3) In the testing step, there are tools and materials that must be prepared by students, tools and materials for the practicum so that they are notified at the previous meeting. 4) For further researchers, it is hoped that they can make a Pictorial Riddled Inquiry Based Module with broader material and

pay attention to the content of the material applied in the steps of the approach.

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Effect of Barite Concentrations on Oil Based Drilling Mud Density and Rheology

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Abstract— Drilling fluid is an essential element to the drilling process as most drilling challenges can be traced to the condition of the drilling mud used. Density and rheology are among the basic properties of drilling fluid usually defined by a well program and closely monitored during drilling operation. The sustainability of the density of drilling fluid is a key factor that needs deliberate monitoring to ensure that its density is higher than the formation density, so as to avert unexpected complications. Hence this research was aimed at investigating the effect of barite concentration on oil base drilling fluid density and rheology. Formulations and testing procedures were conducted in accordance with American Petroleum Institute (API) specifications. Experimental results showed that the increase of drilling mud is a direct function of increase in concentration of barite. It was also observed that when the barite concentration was 0%, the plastic viscosity decreased as the temperature increased meaning that the drilling mud sagged whereas an increase in barite concentration to 10% revealed an opposite relationship, the plastic viscosity increased as the temperature increased. The yield point at 0% barite concentration gave the least yield point; this signifies that the barite concentration aids in the carrying capacity of the drilling mud. It was also observed that the barite concentration can be used to make the fluid more pseudo-plastic in nature. The consistency index (K) increases as the barite concentration is increased, which indicated that the fluid becomes more viscous when barite concentration is increased. Therefore, results have showed that concentration of barite affect the density of drilling mud as well as rheological properties.

Keywords—Density, Plastic Viscosity, Barite, Consistency Index, Pseudo-plastic.

I. INTRODUCTION

Hydrocarbon recovery requires constant research and new ways of improvement of drilling based mud concentrating more effort towards researches that will enhance drilling optimization. One of the ways of enhancing drilling operation is through having good knowledge and application of drilling fluid (mud). Drilling fluid is an essential element to the drilling process as most drilling challenges can be traced to the condition of the drilling mud used. Premium is usually place on the selection of drilling fluid during drilling operations because the success of completion of oil and gas wells as well as production of hydrocarbon from reservoir depends to a considerable extent on the properties of the drilling fluids. Selective designing of the drilling fluids holds a strong place of concern in achieving economic project results in the oilfields and should be strongly emphasized, so as to achieve shortening of the non-productive time during operations hence, reaching the target depths (pay zones) in good time. In fact, without drilling mud and their additives, corporations would find it difficult if not impossible to drill for oil and gas and we would hardly have any of the fuels and lubricants considered essential for modern industrial civilization. Davies and Kingston (1992) stated that mud additives contribute to the specific functions and properties to the drilling fluid especially in case of weighting properties, which in turn attains multiple roles in the wellbore. Drilling fluid is simply defined as heterogeneous mixture of either water or oil and chemicals referred to as additives; it is an influential component in the drilling process, which brings about varied functions into play. Drilling fluids are multifunctional mixture which primary objective is to remove the rock cuttings from the borehole during drilling of the well.In addition, during drilling activities, drilling mud is usually used to prolong bits life, minimize fluid loss, and control well pressure and lots more. Drilling mud should be able to impose sufficient hydrostatic pressure, normally in the range of 250psi to 450psi higher than the formation pressure. Failure to produce the expected hydrostatic pressure will initiate the influx of formation fluid - a phenomenon known as kick, which may lead to blowout. According to Blacket al., (1985) and Juhari and Isham(1998), blowout will only occur if well kick could not be controlled/killed in a relatively short period. In modern drilling practices it is necessary to identify operations that could make drilling cost reduction possible (Bilgesu, 1997). Drilling fluid offer a complex array of interrelated properties; five basic properties are usually defined by the well program and are closely monitored during drilling. They are - Rheology, Density, Fluid loss, Solid content and Chemical properties. For any type of drilling fluid, all five properties may to some extent, be manipulated using additive, however, the resulting chemical properties of a fluid depends largely on the types of mud chosen, and this choice rest on the types of well, the nature of the formation to be drill and the environmental circumstances of the well (Baker Hughes 2011). To ensure proper functionality, an appropriate drilling fluid is to be designed and selected. Understanding the factors affecting the working of the drilling fluid is very much critical. The drilling fluid is related with most of the drilling problems. If the drilling fluid does not perform the above mentioned functions and according to the expectations of the bore hole conditions, then situations might arise leading to abandoning of the well. Since the additives and chemicals used are expensive, it is to be kept in mind that the drilling fluid be maintained in a good condition and at a lowest possible cost.

The sustainability of the density of drilling fluid is a key factor that needs deliberate monitoring to ensure that its density is higher than the formation density, so as to avert unexpected complications. To achieve effective balance pressure, the mud should be design light to prevent lost circulation if the formation pressure is low. In trying to enhance the properties of drilling fluid through the addition of additives, critical analysis of the impact of the different conditions. The mud density is considered in relation to the hydrostatic pressure (HP) imposed on the hole. At a given depth, large mud density results in large pressure. When this pressure in the bottom hole is examined, in the face of the formation pressure acting on opposite direction to it, the net effect is called Differential Pressure, - that is the difference between the HP and the Formation Pore Pressure. It is this Differential Pressure that affects drilling rate when mud density is considered. High Differential Pressure opposes cuttings removal thus causing regrinding of drill cuttings and retardation of Penetration Rate. It also leads to the strengthening of the rock and causes Chip- Hold – Down (Onyia1991). Mud weight is calculated by sum of weights over sum of volumes. It is increased by adding solid materials and decreased by adding water, oil or aerating the fluid (Baker Hughes 1991; Gatlin 1960) thus, many mud properties vary with its solids content.

Akgun (2002a and b) stated that the selection of mud weight is a challenge one faces during drilling operations. Penetration rate is decreased by increasing plastic viscosity, solid content and mud weight. Furthermore, the increase of barite in the drilling fluids has a bad effect on other 85 well completions and logging processes. For example, it tends to attenuate the intensity of the emitted gamma rays from the different geological formations, especially those enriched by shale and clay minerals. This tends to give low counted rate of the gamma rays and hence erroneous estimate of some important reservoir properties, such as shale volume, effective porosity, and fluid saturations, will arise (Schlumberger, 1986, 1991 and 1995; Lashinand Abd El-Naby, 2014; Lashin, et al. 2011, 2016). Therefore, it is necessary to select the proper mud density, which have the best functions of drilling operations, and achieve minimum non-productive time during drilling and completion of oil and gas well.

Rheological properties are basis for all analysis of well bore hydraulics and to assess the functionality of the mud system. Rheological characteristics of drilling mud also include yield point and gel strength. It is critical to control and maintain rheological properties as failure to do so can result in huge financial and time loss, and in extreme cases, it could result in the abandonment of the well (Darley and Gray, 1988). Physical and chemical properties of the drilling fluids largely depend on the type of solids in the mud. These solids are categorized as either active or inactive solids. The active solids are those that react with water phase and the dissolved chemicals. On the other hand, the *inactive* solids are those that do not react with the water and chemical to a significant degree (Azar and Samuel, 2007). Some examples of the inactive solids include - Barite and Hematite, these are added to drilling fluids as weighing agents. Examples of inactive fluids include - clays, polymers and other chemicals, which are

viscosity enhancers. There are three different types of drilling fluid namely; Oil-Based Mud or Non-Aqueous Muds; Water Based Muds and Gaseous Drilling Fluid.

Inability to control and maintain rheological properties of drilling fluid can result in unexpected complication during well drilling and completion operations; density being one of the key rheological properties of drilling fluid is controlled with barite. Therefore, this research is aimed at investigating the effect of barite concentration on oil based drilling fluid density and rheology.

II. MATERIALS AND METHODS

This study was achieved with the aid of the following experimental materials and apparatus such as: measuring cylinder, Hamilton beach mixer, mud cup, 6-speed viscometer (35 Model), thermometer, weighing balance, continuous medium, viscosifier,primary emulsifier, secondary emulsifier, alkalinity agent, salinity source, fluid loss control and weight agent of 4.0 specific gravity (barite)

2.1 Formulation of Oil Based Drilling Mud

The formulation of oil based drilling mud and experiment were conducted in accordance with the American Petroleum Institute (API) specification.210.00ml of continuous mediumwas introduced into a Hamilton beach mixer cup and allowed to stir for a minute and 15.00 grams of viscosifier was added and was stirred for 5 minutes. Thereafter, 12.00 ml of primary and secondary emulsifiers were added intermitted and allow to stirfor 5 minutes respectively; 2 grams of alkalinity agent was added and allow to stir for 5 minutes; 20.00 ml of salinity source was added was added was stir for 5 minutes; 5.00 grams of fluid loss control was introduced and allow to stir for 5 minutes and finally 74.00 grams of weight agent was added and the mixture mixed vigorously for 1 hour for homogenous mixture.The cement slurry was ready for analysis. Mudweight was taken and transferred to a consistometer for different temperatures regulations at 120 °F, 150 °F and 190 °F while 80 °F was taken without a consistometer at room temperature. After each regulations, the slurry was transferred to the rheometer were rheological readings were taken and recorded.

2.2 Rheological Properties Determination

- i. About 150ml of the cement slurry was transferred into the rheometer cup and stirred for 10 seconds and heated to a working temperature (80).
- ii. The motor was started by placing the switch in a high-speed position. Readings were taken at 600RPM. The gear of the motor was changed while the motor was running to try for other speeds (300, 200, 100, 60, 30, 6, and 3 RPM).
- iii. Step 2 was repeated at 120, 150, and 190.
- iv. Readings were taken to determine: Plastic viscosity (cP), Yield point (lb/100ft2), Gel strength (lb/100ft2).

2.3 Results and Discussion

In order to investigate the effect of barite concentrations on density and rheology, oil based drilling fluid was formulated. The results for these experiments are tabulated in tables 4.1 to 4.3, followed by the graphical representations and discussed below.

RPM	80°F	120 ⁰ F	160 ⁰ F	190ºF
600	49	45	39	21
300	36	30	27	19
200	28	22	18	13
100	23	18	16	11
6	19	15	13	9
3	14	12	12	7
PV	13	15	12	2
YP	23	15	15	17
10Secs	11	9	7	4
10Mins	13	10	10	7
Mud weight, ppg	8.37	-	-	-

Table 1: Rheology and Density @ 0% Barite Concentration

RPM	80°F	120°F	160°F	190 ⁰ F			
600	102	96	91	85			
300	91	81	69	53			
200	84	76	66	46			
100	57	41	37	30			
6	20	18	15	11			
3	17	14	11	9			
PV	11	15	22	32			
YP	80	66	47	21			
10Secs	15	11	10	7			
10Mins	17	12	12	10			
Mud weight, ppg	8.5	-	-	-			

Table 2: Rheology and Density @ 10% Barite Concentration

Table 3: Rheology and Density @ 20% Barite Concentration

RPM	80°F	120 ⁰ F	160°F	190°F
600	151	142	126	93
300	101	97	91	64
200	95	91	88	60
100	71	62	60	49
6	26	21	18	14
3	19	17	15	12
PV	50	45	35	29
YP	51	52	56	35
10Secs	22	19	16	14
10Mins	25	24	22	17
Mud weight, ppg	9.2	-	-	-



Fig.1: Barite Concentration (%) against the Density of the mud (ppg)



Fig.2: Temperature (°F) against Plastic Viscosity (cP) for different Barite Concentration



Fig.3: Temperature (°F) against Yield Point (lb/100ft²) for different Barite Concentration



Fig.4: Temperature (°F) against 10 sec Gel Strength (lb/100ft²) for different Barite Concentration



Fig. 5: Temperature (°F) against 10 minute Gel Strength (lb/100ft²) for different Barite Concentration

From Figure 1, it was observed that the barite concentration had a positive effect on the density of the mud. Thus the increase in barite concentration caused corresponding increase in the mud density. Figure 2 showed the effect of temperature on the plastic viscosity at various barite concentrations. It was observed that when the barite concentration was 0%, the plastic viscosity decrease as the temperature increased. Increase in barite concentration to 10% revealed an opposite relationship, the plastic viscosity increased as the temperature increased. Further increase in barite concentration to 20% showed similar pattern as when the barite concentration was 0% but higher plastic viscosity was observed at 20% compared to 0%. It was observed that the barite concentration tends to increase the plastic viscosity of the fluid at higher barite concentration. It was also observed that at temperature above 170°F the plastic viscosity for barite concentration of 10% and 20% were relatively close. Figure 3 showed the effect of temperature on yield point at various barite concentrations. The graph revealed that at 0% barite concentration, as the temperature increased the yield point of the fluid decreased. This pattern was also observed when barite concentration was 10% and 20%. The yield

point at 0% barite concentration gave the least yield point; this signifies that the barite concentration increases the yield point of the fluid. It was observed that at lower temperature the yield Point of the fluid for the different barite concentrations differed significantly, but at temperature of 190°F, the yield point for the different barite concentration were relatively close. Figure 4 showed the effect of temperature on the gel strength of the fluid at different barite concentration. There was a clear relationship between the three variables, it was observed that increase in temperature of the fluid tend to reduce the gel strength of the fluid and increase in the barite concentration tend to increase the gel strength of the fluid. The lowest gel strength was observed when the barite concentration was at 0% while the highest gel strength was observed when the barite concentration was at 20%. The gel strength of the fluid can be reduced by increasing the temperature of the fluid and reducing the temperature of barite concentration. Similar trend was also observed in Figure 5, which showed the relationship between temperature and 10 minute gel strength at different barite concentration.



Fig.6: A graph of shear rate against shear stress for different temperature for 0% Barite Concentration



Fig.7: A graph of shear rate against shear stress for different temperature for 10% Barite Concentration



Fig.8: A graph of shear rate against shear stress for different temperature for 20% Barite Concentration

Figures 6 to 8 showed graphs of the shear stress against the shear rate for various barite concentrations. The fluid exhibited a pseudo-plastic behaviour for all barite concentrations. This was confirmed in Table 4, as the flow index (n) was less than 1. Comparison of the Bingham plastic model and Herschel Bulkley model showed that the latter gave a better fit. The R² and RMSE error showed that the fluid exhibit a pseudo-plastic nature more than a Bingham plastic nature because of the higher R² values and lower RMSE error. It was also observed that the fluid becomes more pseudo-plastic when the amount of barite concentration was increased in the fluid. This was confirmed by the flow index (n) as shown in Table 4. It was observed that at 10% barite concentration the flow index decreased by more than 60% making the fluid more pseudo-plastic. This shows that the barite concentration can be used to make the fluid more pseudo-plastic in nature. The consistency index (K) increases as the barite concentration is increased, this indicated that the fluid becomes more viscous when barite concentration is increased.

Model	0% Barite Concentration			10% Barite Concentration			20% Barite Concentration					
Parameter	80ºF	120ºF	160ºF	190ºF	80°F	120ºF	160ºF	190ºF	80 ⁰ F	120ºF	160ºF	190ºF
Bingham Plastic												
Ту	17.01	12.89	11.70	8.65	33.22	26.31	21.38	13.82	34.80	30.62	29.83	22.59
М	0.03	0.03	0.03	0.01	0.08	0.08	0.08	0.07	0.12	0.12	0.11	0.08
R ²	0.97	0.99	0.98	0.89	0.77	0.82	0.87	0.97	0.92	0.92	0.87	0.88
RMSE	1.84	1.16	1.40	1.69	16.16	13.43	10.50	4.51	13.16	12.73	14.34	9.85
	Pseudo-Plastic											
K	0.11	0.02	0.01	0.19	31.96	8.76	4.81	0.69	4.99	4.66	9.45	6.34
N	0.83	1.05	1.11	0.63	0.21	0.35	0.42	0.68	0.48	0.48	0.38	0.38
R ²	0.98	0.99	0.98	0.93	0.98	0.96	0.98	1.00	0.99	0.99	0.99	0.99
RMSE	1.56	1.13	1.32	1.34	4.32	6.15	4.22	1.37	3.99	3.27	3.41	2.87

Table $4 \cdot$	Rheology	Model	Parameter
<i>1 ubie</i> 4.	Kneology	mouer	<i>urumeter</i>

III. CONCLUSION AND RECOMMENDATION

3.1 Conclusion

Experimental investigation was conducted in the laboratory using API specified procedure for determining density and rheological properties of drilling fluid.

From the result of this study, the following observations were made;

- When barite concentration increased, the density of the mud also increased.
- When the barite concentration was 0%, the plastic viscosity decrease as the temperature increased; while an increase in barite concentration to 10% revealed an opposite relationship, the plastic viscosity increased as the temperature increased.
- The yield point at 0% barite concentration gave the least yield point; this signifies that the barite concentration increases the yield point of the fluid.

- The barite concentration can be used to make the fluid more pseudo-plastic in nature.
- The consistency index (K) increases as the barite concentration is increased, which indicated that the fluid becomes more viscous when barite concentration increases.

3.2 Recommendation

Since concentration of barite strongly affects density and rheology of drilling fluids, close monitoring must be adhered during drilling operation.

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CO2 Capture and Storage: Property Rights overview in Brazil

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Abstract— Carbon Dioxide Capture and Storage (CCS) emergesas one of the possible alternatives for managing and reducing greenhouse gas emissions and consequently maintaining the temperature increase on the planet within acceptable limits. Along these lines, the definition of property rights and legal implications arising from it is understood as relevant. The present work aims to analyze how the legislation in force in Brazil treats the ownership rights of CO2 in the context of CCS activities, especially in the storage phase. The methodology is based on the literature review and the deduction of legislation, in addition, the qualitative method is adopted. The results show that at the current level of Brazilian legislation, the delimitation of the property rights under study will take place through political decisions, later, to be insculpiated in norms.

Keywords—CO2, CCS, public choices, property rights.

I. INTRODUCTION

Given the increasingly clear evidence of climate change around the world, arising from human interference and the widespread use of fossil fuels, technologyknown asCarbon DioxideCapture and Storage or Capture Carbon and Storage (CCS)has been gaining relative space asone of the possible alternatives for managing and reducing greenhouse gas emissions and consequently maintaining the Earth's temperature rise within acceptable limits.*Capture Carbon and Storage*

CCS involves capturing CO2 from a stationary source and injecting into a suitable storage location. Among the storage possibilities, more and more attention is being paid to the use of geological formations. Potential geologicalreservoirs, for example, include oil and gas fields.

In this context, in the consideration of the cost ofgeological storage, the delimitation of property rights plays an important role. For these costs, the amount of acquisition of the geological property rights of the reservoir and the value of storage through the ownership of the injected CO2 shall be stipulated. Determining property interests will also have implications for short- and longterm liability forecasts.

The present work aims to analyze how the current legislation defines the ownership rights of CO2 in the

scope of CcS activities, especially in the storage phase, where there is injection in geological formations on a permanent basis. To this end, the first part presents the general delimitations of property rights in the Brazilian legal system, and then briefly exposes the trajectory of the differentiation of the general property of the soil of the property of certain resourcesfoundin the subsoil and, finally, to deal specifically with the ownership of CO2.

II. GENERAL DEFINITIONS OF PROPERTY RIGHTS IN BRAZIL

The legalissuerelated to property rights is a subject widely explored by Brazilian doctrine. Starting from the concept of property found in the legal literature, Pontes de Miranda writes that "in a very amplíssimo sense, property is the domain or any property right" (1955, p. 9). Jà Caio Mário da Silva Pereira explains that this definition "changes to the taste of economic, political, social and religious injunctions", being "admitted the survival of private property as essential to the characterization of the capitalist regime" and that it is the "real right par excellence, standard subjective right, or fundamental right" (2006, pp. 81-89). For his part, Carlos Roberto Gonçalves states that "the right to property is the most important and most complete of real rights" (2013, p. 225) and Maria Helena Diniz, who are "turning all real rights around them over other people's things" (2013, p. 132).

Turning our eyes to thedeterminationsenshrined in the Brazilianlaw, Article 524 of the Brazilian Civil Code, "the law guaranteesthe owner the right to use, enjoy and dispose of his assets"to, throughout Title II of his Book II, to detail the theme property. It is worth noting that there is no clear normative conceptualization of this legal institute, which is defined by the doctrine by this characterization – the right to use, enjoy and dispose of the thing, and to claim it from those who unjustly detain it (PEREIRA, 2006, p. 91). Let us move on to the analysis of such attributes.

First the right to use, that is, *the ius utendi*, according to Caio Mário da Silva Pereira (2006, p. 93):

It consists of the ability to put the thing at the service of the holder, without modification in its substance. The owner employs it for his own benefit, or the third-party. It's good for you. But of course you can also stop using it by guarding it or keeping it inert. Use is not only to extract beneficial effect, but also to have the thing in condition to serve.

On the other hand, the right to enjoy (*or ius fruendi*)"is essentially realized with the perception of the fruits, whether the ones that naturally come from the thing, as well as the civil fruits" (PEREIRA, 2006, p. 94). Maria Helena Diniz adds that "the owner of the principal will be the accessory" (2013, p. 135).

The third attribute is the right to dispose, i.e. *iusabutendi*, thus defined as::

It is the most vivid dominial expression, by the greatest looseness it mirrors. Whoever has the thing is more head than he uses it or enjoys it (...) involves the material disposition that streaks by destruction such as legal, that is, the power to alienate in any title – donation, sale exchange; it means still consuming the thing, transforming it, changing it; it also means destroying it, but only when it does not imply antisocial procedure (...) It also involves the power to record it of burden or to submit it to the service of others. (PEREIRA, 2006, pp. 94-95).

There is also the right to take back the thing: *the king vindicatio*, since "the right to property is thus endowed with a specific guardianship, founded on the right of sequel, this power to pursue the thing ond andwants it to befound" (GONÇALVES, 2013, p. 231). Whenclaiming, the owner seeks his property from the hands of other

people, takes it back from the one who owns it, but does not ownit, owns it.

There are also four other characteristics of property systematized in the doctrine, as Maria Helena Diniz(2013, pp. 136-137) quotes: exclusivity, fullness, perpetuity, and elasticity. Then, when dealing with the object of the property, the author states that it will be "everything that is not excluded fromit by law" (DINIZ, 2013, p. 138). It is these exclusions, or "restrictions on the right to property", that we will now analyze.

Following the absolutist tradition departing from Roman law on which the classical doctrine on property is based, Pontes de Miranda (1955, p. 16) states that "property is absolute right and has,by even, *ergaomnes* effectiveness".The author himself, however, later deals with his restrictions: "The domain is not limitable. The law itself establishes limitations. It's not even irrestringible. The law contains rules of restriction and legal business may restrict it" (PONTESDE MIRANDA,1955, p. 18).

A form of delimitation of the right to property in the Brazilian legal system is provided for in Article 5, item XXIII of the Constitution of the Republic and in art. 1.228 of the Civil Code, addressing the existence of the social function of property as a limitation of the dominial power. According to Caio Mário da Silva Pereira (2006, p. 85), the assumption of such positiveity is that the goods are "given to men not so that they extract the maximum benefit and well-being with sacrifice of others, however, so that they use them to the extent that they can fulfill their social function", since "it guarantees public order to each one the use of their goods, in the normal misters for which they are intended. But in any circumstance, the social overlapswith the individual" (PEREIRA, 2006, p. 87). Therefore, the whole basic attribute of the right to property - to use, to enjoy, to dispose of - "must be done ... within the legal limits and according to the social function of property" (GONÇALVES, 2013, p. 230).

There is also, in our Constitution, special concern about the social function of rural property ownership, which provides for "a complex of measures aimed at promoting the better distribution of land, in order to meet the principles of social justice and increased productivity" (PEREIRA, 2006, p. 104). In addition to the issue of social justice, Gustavo Elias Kallás Rezek (2011, p. 123)states that also due to the relevance itself of agriculture to humanity "the land can no longer be considered itself non propriety asset".

In classical Private Law, the owner of the soilpossessed *all* that is above it to the heavens, and all that is beneath it, even hell (usque ad inferos and usque ad coelos), there

being no limitation inthis sense. At the time, at most there was the perception that "others can use it as long as it is such a depth or at such a time that the owner has no interest in prohibiting it" (PONTES DE MIRANDA, 1955, p. 79), which, in some way, persists to this day in the form that "the extension of airspace and subsoil is limited by the usefulness that the owner can provide" (GONÇALVES, 2013, p. 247).

III. DIFFERENTIATION OF LAND OWNERSHIP RIGHTS AND RESOURCES FOUND IN THE BRAZILIAN UNDERGROUND

With the historical growth of the economic and geopolitical relevance of ores and hydrocarbons (which are in underground lands) the absolutist principle of property has undergone transformations and, today, has gained quite different contours in the different legal systems of the globe. In the Brazilian case, the property continues to cover the corresponding subsoil and surface; such property, however, does not include deposits, mines and other mineral resources, as positive in Articles 1,229 and 1,230 of the Brazilian Civil Code. *In verbis*:

Art. 1,229. The ownership of the soil covers that of the corresponding airspace and subsoil, in height and depth useful to its exercise, and the owner may not be owes activities that are carried out, by third parties, at such height or depth, which has no legitimate interest in preventing them.

Art. 1,230. Land ownership does not cover deposits, mines and other mineral resources, hydraulic energy potentials, archaeological monuments and other assets referred to by special laws.

As noted, Art. 1230, transcribed above, creates a material restriction on the right of ownership of the subsoil.

On the other hand, there is the model followed by the United States of America and Canada, where, according to Hirdan Katarina de Medeiros Costa and Carolina Arlota (2017, p. 209): "Each state adopts specific laws and, in general, enshrines the rule of common law, which determines that the landowner is also the owner of the subsoil and hydrocarbons contained therein."

The pronounced Federalism of the USA makes it not mentioned the issue in the Federal Constitution and allows each Member State to delimit its own oil extraction standards.TheU.S., however, is an exception to the global tendency of state governments and companies to detain the mineral resources of their territory (MEDEIROS COSTA; ARLOTA, 2017, p. 205).

In Brazil, the norm best to define the legal relationship between state and mineral resources is the Constitution, as Fernando Facury Scaff (2014, p. 23) explains:

> The Federal Constitution of 1988 establishes that mineral resources, petroleum and hydraulic energy potentials are union assets (art. 20, VIII and IX), and the legislative competence (art. 22, IVe XIII) may be privately federal,[1] but there may be common competence in this matter (Art. 23, XI). It also establishes that the legal regime for the exploitation of mineral resources and the potential for hydroelectric power will be that of authorization or concession (art. 176), with a monopoly of the Union in the exploitation of oil activity (art. 176) and in research, mining and other activities related to nuclear ores. and its derivatives (art. 21, XXIII and art. 177).

It is worth noting that, in addition to the property itself, the Federal Constitution determines, in its art. 177, that the research and mining of hydrocarbons and natural gas are a monopoly of the Union, according to Hirdan Katarina Medeiros Costa and Carolina Arlota (2017, p. 215) well explain:

> (...) the regime of monopoly of oil and natural gas provided for in Art. 177 of the Constitution is aimed at the protection of national security. This protection justifies the state's performance as an economic agent. Thus, in addition to leaving open mechanism of direct intervention, it provides through a systematic interpretation the commitment of the Public Power to establish policies with a view to making effective social rights constant throughout the constitution. (...) it can be said that the constituent legislator raised the attempt of a model of social welfare and an interventionist State.

It is important to emphasize that the 1990s brought great changes in the economic order of Brazil and, with this, some normative inclusions that allow, under certain legally established conditions, the Union to hire private companies in carrying out those monopolized activities.

But it has not always been this: if we historically divide the various policies of oil exploration in Brazil, we will perceive three very different phases. The first, irrigalist, lasted throughout the colonial and imperial periods and the Crown – before, Lusitanian and then Brazilian – was responsible for exploiting the mineral resources, from the precious metals of the eighteenth century to the oil of the late nineteenth century; there were also, at the end of this phase, cases of concessions of mineral and oil exploration to foreigners in very specific geographical spaces and under very detailed conditions (MEDEIROS COSTA; ARLOTA, 2017, p. 210).

The phase of accession or land, present in the First Republic, was marked by the state absorption of *the principles of laissez faire*, leaving entirely up to the private mining of ores, also granting concessions to foreigners (MEDEIROS COSTA; ARLOTA, 2017, p. 210). Here, there was no perception of oil as a national strategic instrument – even because of the absence of the discovery of large deposits.

But it was in the late 1930s, from vargas' provisional government to the Estado Novo, that the dominial phase of exploration came. The Varguista interventionism led to the creation of the National Petroleum Council and the National Department of Mineral Production, which, driven by the discoveries of new hydrocarbon reserves and the strong Venezuelan and Mexicannationalism, limited the possibility of exploitation to Brazilians (MEDEIROS COSTA; ARLOTA, 2017, p. 213).

Meanwhile, conflicts between countries that had natural reserves and foreign companies that had very disproportionate contractual advantages over the former were seen in international law. To measure them, the United Nations resolutions – especially that of no. 1,803, 1962 – "were emphatic in reinforcing the principle of the sovereignty of states over their natural resources" (TORQUATO-FERNANDES, 2013, p. 14). It declares that standard:

> 1. The right of peoples and nations to permanent sovereignty over their wealth and natural resources shall be exercised in the interests of the national development and well-being of the people of the respective State;

> 2. The exploitation, development and disposition of such resources, as well as the importation of foreign capital to effect them, shall comply with the rules and conditions that these peoples and nations freely deem necessary or desirable to authorize, allowor prohibit such activities (UNITED NATIONS, 1962).

Returning to the positive rights on the subsoil in Brazil, in addition to the Constitution (in its art. 20) and the Civil Code, it also corroborates in the same sense art. 1 of the Minas Code when determining that:

It is for the Union to manage mineral resources, the mineral production industry and the distribution, trade, and consumption of mineral products", as well as the Forest Code, which in item VIII of Article 3 defines it as "public utility:

(...)

b) infrastructure works for concessions and public transport services, road system, including the one necessary for urban land parceling approved by the municipalities, sanitation, as well as mining, except, in the latter case, the extraction of sand, clay, clay and gravel.

Thus, it must be understood that, in Brazil, the property of the, subsoil, by itself, is, not of the Union, but only the pre-determinated natural resources, as exposed.So, we have to:

> This rule [the Constitution] does not declare that the entire subterranean subterranean system is of the Union. (...) the criterion is that mineral resources and hydraulic energy potentials, when used for exploration and use, will stand out from the property and belong to the Union, whether in the soil or underground. Porting, are (public) goods of the Union (...) (SCAFF, 2015, p. 59).

Turning once again to minerals and hydrocarbons, it is necessary to understand that such goods are not only scarce, but exudeable – that is, they are non-renewable natural resources. The legislative decision to include water energy in this area, therefore, is a political choice – taking into account the energy relevance of hydroelectric plants to Brazil – since hydro power is a renewable natural disuse (SCAFF, 2014, pp. 38-43).

IV. CAPTURED CO2 PROPERTY

In the legal literature on property rights there are few references related to the definitions of property of what is permanently inserted underground. As widely described above, the current definitions of the subsoil property right refer to potentially extractable pre-existing subterranean natural resources, not on what could be "injected" or "installed" in it. Among the few studies identified on the subject, the Doctoral Thesis of Viviane Romeiro-Conturbia (2014) stands out, which highlights the fact that the Federal Constitutiondoes not specify the extentand technical definition of soil and subsoil when referring to the ownership of mineral resources, nor if possible the substances re-injected underground would also be owned by the Union.

In this context, several challenges arise regarding the definition of CO2 property rights, from its capture to its permanent storage underground, especially those related to the distribution or imputation of responsibilities to each agent in cases of leakage, environmental accidents and other risks associated with the CCS steps.

The definition of such responsibilities requires, out of departure, the delimitation of ownership rights in transport and storage (permanent injection), as well as the possible transfer of this property between agents. Along these lines, the author makes an important contribution in describing and systematizing different scenarios, identifying theagents on whom such responsibilities mayfall. The followingaspects stand out from Romeiro-Conturbia (2014, p.126-7)::

I. CCS projects in which all activities (capture, transport, and CO2 storage) are managed by the same operator, and there is no transfer of OWNERSHIP of CO2. For example, an oil company that captures CO2 on an offshore platform, transports and stores the gas in a reservoir formation that has been granted, as is the case with the CCS Pre-Salt Lula Project. Another example could be an operator that captures CO2 in a coal-fired power plant, transports gas through its own

tanker trucks or third-party tanker trucks (but the operator still owns CO2 and possible liabilities) and stores CO2 in geological formation by its own means.

- II. CCS projects in which all activities (capture, transport, and CO2 storage) are managed by the same operator, with a transfer of OWNERSHIP of CO2. For example, a coal-made power plant that captures and transports CO2 but transfers OWNERSHIP of CO2 to another company that would be responsible for storing CO2. The first company would serve only as a source of CO2 for a second company to finally store CO2.
- III. CCS projects in which all activities (capture, transport and STORAGE of CO2) are managed by different operators, with two transfers of CO2 ownership. For example, a coal-made power plant (or even a cement or steel plan) that captures and transports CO2 through short-range co2 tanker trucks or pipelines to a pipeline that will transport CO2 over long distances to a given geological reservoir. In this case, there would be the transfer of ownership (a) of the company that captures CO2 to the concessionaire responsible for transporting CO2 over long distances with pipeline hubs and (b) from such hub company to the company responsible for storing CO2 in a given geological reservoir. This company may be the same as the one that captured the CO2 or other different, but the significant legal act here is the transfer of ownership during the process.

In order to facilitate the understanding of these scenarios, Romeiro-Conturbia (2014, p. 127) presents Figure 1 that translates the possibilities of defining property rights::



Fig.1: Possibilities for delimitation of ownership rights and their transfer in CCS projects. Source: Romeiro-Conturbia (2014, p. 127).

As it turns out, there can be many possibilities of activities and agents involved in a CCS project (different stationary sources, different types of transport and different geological reservoirs). A geological reservoir could also store CO2 from different projects, which can make the definition of responsibilities even more complex.

In this sense, to promote legal certainty and predictability of risks, it is necessary transparency and clarity in the information regarding the areas with pipelines for transport and storage of CO2. To this end, Romeiro-Conturbia (2014) proposes the creation of a kind of National Registry of Areas with Geological Storage of Carbon Dioxide or National Register of Geological Areas of Carbon (CNCO2), withde the function of providing and disseminating relevant information about areas containing infrastructure (CO2 pipelines) to transport CO2 and areas containing stored CO2.Accordingto Romeiro-Conturbia (2014, p. 129), the registry would provide information on (free translation):

(i) existing pipelines to transport CO2 in a respective area; (ii) existing wells to store CO2 in a respective area;

(iii) the estimated geographical boundary of an area containing stored CO2; (iv) the amount of CO2 stored;

(v) monitoring plans to track CO2 behavior;

(vi) contingent plans with actions to remedy any possible leakage or damage.

Despite the remarkable effort of Romeiro-Conturbia (2014) to systematize the steps and agents that compose the cycle of activities inherent to sCC activities, there is a legal gap regarding CO2 ownership in the context described above, consequently little can be said about issues related to the right of CO2 ownership in the context of SCC activities, highlighting in the storage phase.

Nocan any safe assumption be made on the liability of their capture, transport and storage, since it is the definition of dependand ownership of CO2. Therefore, it must be appropriate that political decisions deserve to be taken with a view to reflecting the delimitation of rights in specific legislation.

V. FINAL CONSIDERATIONS

As stated throughout this work, the definitions on property rights in Brazil are a subject that is widely debated by Brazilian doctrine, whose definitions of public or private ownership face aseries of intricacies, whichare subject to what is found in thesubsoil of the Brazilian territory. As seen, the Federal Constitution provides for a differentiation between soil and subsoil property, especially as to the mineral resources found in it, which has consequences for the question presented here. That is, to whom would the captured CO2 belong if it were to be permanently storedin geological formations?

As observed, the complexity of the question posed lies precisely in the fact that the Federal Constitution itself exceptionally highlights as the property of the Union the mineral resources found underground, which could indicate, in a first reading, that the ownership of CO2 stored underground would be transferred to the Union and, with it, possibly the responsibilities inherent to it.

On the other hand, as already stated in the course of this work, the definitions relating to the right of ownership of the subsoil currently in force refer to the preexisting natural resources in the subsoil, potentially extractable, and not on what could be "injected" or "install", as is the case of CO2 studied here.

Thus, considering the absence of legislation specific to the theme exposed, and in view of the constitutional determinations, it can be affirmed with relative conviction that there is a huge gray area on the right to property of CO2 injected permanently in geological formation. This scenario demonstrates the legal and regulatory vacuum of CCS activities in Brazil and corroborates the need for in-depth studies and editions of robust legislation, to ensure the necessary conditions for the implementation of this technology in Brazil.

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Reflections about the Relevance of Graffiti and Mural Painting in the Current Architectural Scenario

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Abstract— The research that follows has as main objective to promote reflections about the relevance that mural painting, through graffiti, has been developing in the current scenario not only of urbanism, but also of architecture. There is a remarkable excitement in the market for this urban art, which has been conquering more and more space as art in galleries, museums and other spaces. What is perceived is the elitization and appreciation of what was once considered just an illegal expression of the less favored classes. It is also important to analyze that there is a gap between graffiti-art and delinquent graffiti, which are opposite positions with different plastic results. The finding is that graffiti is being increasingly coveted by the art industry that aims to win over new admirers and collectors, and the exploration of this practice has gradually grown in the areas of interior / exterior architecture, product design, advertising and advertising and fashion.

Keywords—Artistic Expression, Elitization, Language, Urban Intervention.

I. INTRODUCTION

All the major cities in the world exhibit the interference of their street artists. Equipped with atomic brushes and spray paints, they portray a culture that stands out. There is a worldwide demand for art aimed at the great masses, from Pop Art. In Brazil, a country with vast production due to the ethnic and multicultural variety, it could not be different.

Urban art took an important step in breaking with the elitism in which contemporary art was located. For the first time, an art coming from the peripheries and empirically carried out by social classes considered inferior is placed alongside the arts developed in the workshops. Today, the graffiti scene has surpassed all barriers of prejudice and ignorance. It is appropriate, then, to debate and get to know this parietal language that has moved the world artistic panorama and revolutionized current aesthetic concepts. In addition, the present research, of analytical bibliographic character, comes to discuss the question. Graffiti reflects multiculturalism through its diverse styles, which counteract the media's eternal intention to massify a convenient style. It is impossible to dissociate graffiti from the principle of freedom of expression. The irreverence of this street art is linked to a philosophy of life, linked to hip-hop, as music, and to break, while dancing.

II. LITERATURE REVIEW

According to the History of Art, one of the first forms of graphic expression was rock painting, about 40,000 years BC, where prehistoric man portrayed aspects of his daily life on the rocky walls. So, it must be understood that the rock engraving was not only the first form of mural painting, but also the first graffiti configuration. This should be stated with Parramón (1979, p. 11):

> For thousands of years, the primitive man discovered that the earth, the yokes of the plants, the calcined leaves, the trunks and the burnt branches, as well as being mixed

with water or with animals, provide different colors, in a stable way. Then I started to paint, [...] and here I used the most logical thing, because in the end I had the only support I had to hand: the wall, the walls of where I lived.

But, far beyond prehistory, mural painting has been observed in all civilizations and periods of history. The first civilizations were those of the Far East, India, China, Egypt and, later, Greece and Rome, respectively. But the technical apogee of mural painting took place in the Renaissance, through the fresco, which is a technique executed with pigments free from pure water over a fresh mortar. Considered the "noble mural" due to the great demand for knowledge of the pigments on the part of the artist, the fresco is enshrined in the History of Art.

In the 20th century, Mexican muralists Diego Rivera, José Clemente Orozco and David Alfaro Siqueiros organized a manifesto in defense of the need for public art that would be able to speak to the crowds. "We will paint the walls of the streets and the walls of public buildings, of the unions, of all the corners where people who work are gathered", affirmed Siqueiros, in one of the first indications that the mural painting should be popularized. This is what Gitahy (1999, p. 16), designer, visual artist and researcher of urban art in São Paulo, mentions:

> All these data on muralism, along with pop art, already pointed to the origin of contemporary graffiti as an artistic and human expression. This manifestation, which began to appear in Brazil in the 1950s, with the introduction of the spray, passes through the 60s, passes through the 70s and is consecrated as an artistic language in the 1980s, conquering its space in the media.

There are rules that stipulate the structuring of mural painting: workability, resistance and, mainly, the materials used. It would be rare for a muralist to use pastel chalk, for example, when making a mural. The materials used in parietal paints must have good adhesion to the base material, have durability and resistance to the weather in the case of external paints. These are conditions for the construction of a quality panel. In the view of Tirello (2001, p. 66):

> The rules are: the support must be continuous and well compacted, so that the brush slides and fills the planes of the composition with bright or opaque paints, depending on the basic pictorial technique

chosen by the artist. Every care is taken to ensure that each stratum of the painting is intimately connected with each other, ensuring durability and stability of the materials that make up the work.

In the contemporary context, graffiti enters as the type of mural painting of more focus. The word graffiti is the plural of graffito, from Italian, whose meaning refers to the inscription and drawings from ancient times, made in a crude way. Today, the term "graffiti" or even the Brazilian form and also correct "graffiti" is used to describe the painting technique used. Graffiti is a direct descendant of modern muralism and pop culture, from where it inherited resources such as masks, stencils and stickers.

For some scholars in the field, graffiti relates to all the doodles we invented: the doodles, the hearts engraved on the trees, the writing on the doors of public bathrooms, even those that come up during a phone call. However, for others, graffiti is an exclusively artistic expression, where there is an aesthetic concern on the part of the graffiti artist, prioritizing the image, always with a social and moral appeal. Unlike graffiti, which can be considered an aggression against the public patrimony, monochromatic, where there is no plastic concern, using writing as a foundation.

Essentially, graffiti had an exclusively political character, where it carried out social criticisms, denunciations and exposed ideologies. However, this practice lost its value, where he began to make declarations of love, tell jokes, curse and other doodles without any intrinsic intention. Generally, the graffiti artist is associated with the so-called wild style, a style of letters almost unreadable, used since the beginning of the history of graffiti. Despite this, according to Gitahy (1999, p. 23), "graffiti and graffiti always have something in common, they carry transgression and, therefore, they only exist in reasonably open societies - they do not combine with dictatorship".

This graffiti-graffiti dichotomy goes far beyond aesthetic and artistic considerations. While graffiti is seen as an act of vandalism and visual pollution, graffiti emerges as an awareness resource, with a whole social role, where it represents a salvation from juvenile delinquency through a medium so sublime that it is art. This must be complemented by Souza (2008, p.10):

> The whole atmosphere built around street art, such as these workshops that multiply the number of practitioners, the development of new techniques, the public and private interests related to the displacement of such

activities from the scope of delinquency to that of culture, from consumption to production, as well as urban planning, reveal the breadth of social and spatial effects related to the phenomenon.

Currently, the artistic environment has undergone a revolution. Graffiti came to democratize art, previously restricted to museums and private collections. Such changes can be observed in the entire urban environment: in walls, facades, culverts, sidewalks. The city has become the basis for free intervention by artists, who often use the technique in an arbitrary and uncompromised manner, without any spatial or ideological barriers. It appears that graffiti has been developing this role since the mid-60s, however, only now has it gained space among the most respected arts. In the view of Simões (2011, p. 35):

> The fact is that the very strength of this visual language of graffiti, born mainly on the outskirts of large cities, is bringing the answers: street art started to be made on other supports, such as canvases and installations, and is now displayed in galleries, museums and specialized fairs. Urban art, street art, graffiti; there is still no consensus on the best terminology. But there is a certainty: urban art is selling, and well.

In architecture, graffiti has been playing an important role in breaking paradigms, personalizing environments and relaxing spaces. Graffiti has gained its space as an important resource in interior architecture, integrating spaces and using colors and shapes to obtain a unique and exclusive environment. This urban art made a true bridge from the street to the home, where it fell into the taste of the elites as an avant-garde movement.

As an example, in the city of Marseille, France, the Hotel Au Panier Vieux created the "Panic Room", which is nothing more than a room where an absolute half is white and the other half is entirely graffiti, causing a contrast almost disturbing, which justifies the adopted name. The paintings were made by the artist Tilt, who even created the prints for printing on the sheets and curtains, so that nothing escapes the context. The room is an absolute success of the hotel, which features four other rooms with different themes, which are updated annually by renowned artists and designers, with guests paying a higher price to enjoy these environments. Following, an image of this exotic space illustrates what is described here.



Fig. 1: Panic Room, at the French hotel Au Panier Vieux.

Raised to the art category, graffiti blends with almost any room in the house and is also widely used in commercial environments, offices, restaurants, pubs and nightclubs. In the same way as Pop Art, the graffiti technique has been taking its place in the market, influencing areas such as design, publicity and advertising, communicative media and fashion. Many objects are receiving shapes and prints with themes generally used by graffiti artists.

So much is the success of this urban art, that galleries and workshops are specializing exclusively in this language. This is the case of the Choque Cultural gallery, one of the most appreciated in São Paulo, whose main objective is to bring young people closer to plastic arts, as well as to win new collectors. In this gallery, graffiti is an ubiquitous theme in all works, which can be acquired for the most varied values.

Cities are also giving their graffiti artists greater prominence. In Rio de Janeiro, in 2010, the city created the Rio Arte Urbana project, which is very active, which aims to restore and maintain the existing graffiti in the city. The project estimates that 400 works will be restored in the coming years, in addition to promoting the execution of new graffiti and sculptures. One of the main objectives of the program is to get the population closer to both art and the city, so that people develop a more pleasant look at the urban environment in which they operate and are anxious to preserve this environment.

Along with graffiti and of course, mural painting, new techniques of urban art emerge. Trompe-l'oeil, for example, which is an artistic method that creates optical illusions through the study of perspective and an observation point. Its nomenclature originates from a French expression, which means "deceive the eye", since you really have the feeling that that simple painting in two dimensions has height, width and depth. In other words, there is the impression that it is not a two-dimensional painting, but a three-dimensional scene, in 3D. The technique is old, since it was already used by the Roman Empire on murals in the city of Pompeii, where they imitated windows in order to enlarge the environment. At the same time it is used by artists from around the world as a way to make the urban environment more attractive.



Fig. 2: Trompe-l'oeil in Vila Brasilândia, in São Paulo, Brazil, of the Boa Mistura Group.

III. CONCLUSION

Being in the urban bustle of everyday life, visiting a museum or even printed in interior and exterior architecture, the presence of graffiti enriches any landscape through its lines, shapes, colors and poetics. This art makes the city less gray, frigid and colorless. The urban environment is visually polluted by signs, advertisements, electrical wires, graffiti and this expressive language comes in order to soften this indigestible side of the urban fabric.

What can be seen through this research is that over the years, street artists have become closer to the art itself, seeking new techniques and improving the features. And with that, they gradually won the admiration of people and a privileged space in the artistic sphere. Today, graffiti is on the rise, dictates trends and deconstructs prejudices, that is, it has conquered a respectable place to continue to achieve its main objective: expressing political and social criticism, shouting its ideologies and drawing people's attention to the values in force in society. It is hoped that one day, and it is not far from that, every urban center can become an immense art gallery in the open.

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PLC based System for Measuring Concentration of Oxygen in Mines for Miners Safety with O2 Sensor

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Abstract— The health of the human being is always a primary concern of every industry. The mining industry is a risky business. The objective of this paper is to save miners life by considering one measure safety point, measuring the concentration level of oxygen before entering in mines for work. I have used Programmable Logic Control System for converting raw value (electrical signal) generated by O2 sensor to engineering value, which I will display using Human Machine Interface (HMI) readable by humans. As we are aware that in mines there are lots of gases flow in airstream and sometime chemical reactions occurs which affects composition of mine air, results oxidation reduces the percentage of oxygen. So before we enter in mines everyday for work we will measure the concentration of oxygen level in mine.

As we already know that dry air contain 20.9470% of oxygen (21% O2) with 78% nitrogen and 1% other gases. We will program our logic by considering the 20% oxygen is present in our mine's atmosphere. If oxygen level varies below 20% than a alarm will trigger, that alarm will display on HMI and Operator will alert miners before any casualty occur.

Keywords — human machine interface, miners safety, oxygen, O2 sensor, programmable logic control.

I. INTRODUCTION

Oxygen is the most prime constituent for living beings because it preserves life on the earth. It is said that 90% of biochemical and metabolic actions or motion need oxygen.

Our system is at the bottom of a coal mine and it is measuring the concentration of O2 in the mine's air or atmosphere. The main applications of our system are:

- 1. Measurement of oxygen in atmosphere.
- 2. Critically usable for measuring mines oxygen levels.

This is a 'programmable logic controller' based system tuned with 'electrochemical oxygen sensor' primarily used to measure oxygen levels in the ambient air. This project's main tools are as following:

- 1. Programmable logic controller
- 2. Oxygen sensor
- 3. Human machine interface

4. Power supply (24V dc)

The electrochemical oxygen sensor produce a 4-20mA analog signal and Plc will process this signal and it will de-code that signal based on our logic and Human machine interface will show us the concentration level of oxygen in mines. DC power supply will power up all components like Sensor, PLC and HMI.

Our task is to prevent hazardous accidents which can happen in mines due to low or sudden change in mines oxygen level. So in this work, we make a Plc based system using oxygen sensor which will monitor the oxygen level in mine's atmosphere and will alert if O2 level decreases. Measuring oxygen is a critical task. As air is flowing in the mine's atmosphere the O2 sensor will sense the air and measure the oxygen level and generate an output signal in accordance with the oxygen concentration in air and that output will become an input signal to programmable logic controller than plc will process this signal and percentage of oxygen will display on human machine interface which is connected with plc via profibus communication.

Our machine has two cycles: sampling and alarming.

When it's sampling, it will measure the oxygen concentration of the air passing by the sensor.

When oxygen level decrease the standard set point, it will generate an alarm on the human machine interface screen and the operator will sound the buzzer which will alert the miners and their life can be save from unwanted accident.

II. LITERATURE REVIEW

India is one of the biggest shippers of iron ore, chromites, bauxite, mica and manganese, and India is ranked fifth between the mineral producing countries in terms of volume of production. The mining sector contributes nearly 2.4% to India's GDP. India manufactures approximately 88 minerals, which include fuel, atomic, metallic and non-metallic minerals. India's mining prosperity is depends on Odisha, Andhra Pradesh, Rajasthan, Chhattisgarh, Jharkhand, Madhya Pradesh, and Karnataka. So the mining industry is administering both at the federal and state level. Under the constitution of India, the state has power to control mines and mineral development. This mines and mineral department regulate EHS (Environment, Health, and Safety) unit in every mine. EHS unit regulate and provide miners a safe and healthy environment to work. The atmospheric air in mines can be polluted by the presence of other gases such as carbon monoxide, hydrogen sulfide, methane, and excess of carbon dioxide.

Human Beings breathe easiest with 21% oxygen present in air. When other gases mixed with air, oxygen levels drop and that is when the trouble starts. To stop converting this trouble in dangerous accident, we will measure the oxygen concentration in mine's air. For measuring O2 in mine we will use 'Zirconium oxygen sensor'. When air passes through the mine environment, its gases balance or content level changes due to other (different) kinds of pollutant along its path. These pollutant are CO2, carbon monoxide, sulphur dioxide, methane etc.

The literature review presents the block diagram representation, network model, gaseous composition of air and oxygen sensor which explains the concept of measuring oxygen in mine's using programmable logic controller.

2.1 Block Diagram

The block diagram shows the oxygen measuring system of mine's. All the components are connected in proper order and show how this system measures the O2.



Fig 1.1 Typical block diagram of Mine's oxygen measuring system

2.1.1 Network Model

In this work, our task is to measure the oxygen level in mine using O2 sensor. Sensor will transmit data to the control unit and that control unit will process data value send by sensor and evaluate it than generate result. We can understand the network model via following flow chart. Which represents the idea of whole process that how we will measure the oxygen concentration in mines. This flow chart also shows the alarming system if oxygen concentration decreases below the set point, which we have been taken from standard oxygen concentration required for human being to live.



Fig 1.2 Typical Network Model diagram
2.1.2 Gaseous Composition of dry Air

Air is the deceptive combination of gases that surrounds the earth. Air holds major stuff, such as oxygen and nitrogen that most species need to survive. Humans are off course one of them. Standard dry air is the mixture of gases that mixed up at sea level. It is made up of nitrogen, oxygen, argon, carbon dioxide, neon, helium, krypton, hydrogen, and xenon. Masses of air are constantly moving due to that standard dry air is not accurate everywhere at once. The dry air composition in atmosphere is as follows:

Table 1.1: Standard Composition of Dry A	ir
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GAS NAME	CHEMICAL SYMBOL	%BY VOLUME
Nitrogen	N2	78.084
Oxygen	02	20.947
Argon	Ar	0.934
Carbon dioxide	CO2	0.033
Neon	Ne	0.001818
Helium	Не	0.000524
Methane	CH4	0.000179
Krypton	Kr	0.0001
Hydrogen	H2	0.00005
Xenon	Xe	0.000009

Based on above concentration of oxygen level in air, we will measure the concentration level of mine's oxygen using oxygen sensor.

2.1.3 Oxygen Sensor (OXY-FLEX ANALYZER)

The Sensor assembly consists of sensing cell, pumping plate, sensing plate, heater coil. At the core of the O2 sensor is the sensing cell, consists of two 'Zirconium dioxide (ZrO2)' squares coated with a thin porous layer of platinum which acts as electrodes. These electrodes generate necessary catalytic effect for O2 to dissociate, allowing the oxygen ions to be transported in and out of the ZrO2. The cell assembly is surrounded by a heater coil which produces 700 degree centigrade for operation. The ZrO2 square works as an electrochemical oxygen pump, which maintain the pressure inside the chamber is always less than the ambient oxygen pressure outside the chamber. This difference in oxygen pressure generates an output signal which could be a voltage (0-10V) or current (4-20mA) signal.

2.1.4 Electrical Connection and Pin diagram



Fig 1.3 Electrical Connections

Pin out description is as follows: Pin 1: 24Vdc Pin 2: 0Vdc Pin 3: Calibrate Pin 4: cycle Pin 5: 4-20mA/RS232 TX Pin 6: 0-10Vdc/RS232 RX

2.1.5 O2 Sensor Technical Datasheet

- Supply Voltage: 24Vdc
- Current Consumption: 500mA at 24Vdc.
- Digital output: RS232
- Analog Output: 0 10Vdc and 4
 20 mA

III. LOGIC MODEL



Fig 1.4 A typical Logic Model

The logic model shows that the logic of measuring the oxygen concentration in air is totally based on standard oxygen present in atmosphere.

It is important to note that the sensor will generate a 4-20mA analog signal. We will break this analog signal according to standard available oxygen in atmosphere using scaling formula.

3.1 Mathematical Scaling Formula



Here,

IN0---- Integer value low limit (0)

IN1---- Integer value high limit (27648)

IN2---- Low limit of Oxygen value (0)

IN3---- High limit of Oxygen value (21)

IN4---- Integer count of analog value (mA) or sensor output

We have signal coming in current: 4 - 20 mA from sensor output. Now, how do we use this amp in our logic? Well, we can't, so we have to turn this signal into number. We use chips to do that. It's electronics. So let's say we have a 4-20mA signal that we want to use to measure oxygen from 0 - 21 percent. How do we do it?

Well, first we need to break that 4 - 20 mA down into much more than just whole amp. 4, 5, 6, 7.... That's never going to be useful to us. We need more values. So how many can we get? Well, that depends on our chips (built into our analog IO modules).

Here in Siemens PLC, I am using AI8×12bit analog module, means this module has 8 – analog input channels. Here I am using only one channel for one sensor output. This channel address start from PIW256 and in module's hardware configuration we already defined its input scale range from 4 to 20 mA. Siemens standard integer value range is from 0 to 27648. So here 4 mA represent 0 and 20mA represent 27648.

This is all done by chips used in analog module. We only have to define desired address and its scaling range.

IV. TESTS AND SIMULATION ANALYSIS

4.1 Tests

Now we will break this 4 to 20mA in 0 to 27648 integer value and perform scaling using standard oxygen

available in environment which is 21%(0 to 21%). Here we will also cross verify our scaling by assuming that 0 to 21% is 0 to 100%

Means 0 = 0% of oxygen

And 21 = 100% of oxygen

Because in our environment 21% oxygen is available, this is 100% in terms of availability.

Mathematically,

Test_1

When sensor output = 4 mA, than

IN0 = 0 (Integer value low limit)

IN1 = 27648 (Integer value high limit)

IN2 = 0 (Low limit of Oxygen value)

IN3 = 21 (High limit of Oxygen value)

IN4 = 0 (milliamps coming from sensor or integer value at 4 mA)

Put all values in above scaling formula-

$[0*(21-0)/(27648-0)] + [0-\{0*(21-0)/(27648-0)\}]$

We will get the resultant value = 0% of oxygen concentration.

Test_2

When sensor output = 10 mA

IN0 = 0 (Integer value low limit)

IN1 = 27648 (Integer value high limit)

IN2 = 0 (Low limit of Oxygen value)

IN3 = 21 (High limit of Oxygen value)

IN4 = 13824 (milliamps coming from sensor or integer value at 10 mA)

Put all values in above scaling formula-

$[13824*(21\text{-}0)/(27648\text{-}0)] + [0\text{-}\{0*(21\text{-}0)/(27648\text{-}0)\}]$

We will get the resultant value = 10.473% of oxygen concentration.

Test_3

When sensor output = 20mA

IN0 = 0 (Integer value low limit)

IN1 = 27648 (Integer value high limit)

IN2 = 0 (Low limit of Oxygen value)

IN3 = 21 (High limit of Oxygen value)

IN4 = 27648 (milliamps coming from sensor or integer value at 10 mA)

Put all values in above scaling formula-

$\left[27648^{*}(21\text{-}0)/\left(27648\text{-}0\right) \right] + \left[0\text{-}\left\{ 0^{*}(21\text{-}0)/\left(27648\text{-}0\right) \right\} \right]$

We will get the resultant value = 20.947% of oxygen concentration.

4.2 Simulation Analysis

4.2.1 Test_1 Analysis

Sensor output = 4mA

Raw count value = 0

Oxygen concentration = 0%

Level of oxygen = Low, so alarm will trigger to alert operator to take appropriate action. Now we will see all this in simulation environment using following pictures:



0% oxygen concentration

raw count value 0





Showing low level alarm

Fig 1.6 Alarm Screen_1





4.2.2 Test_2 Analysis

Sensor output = 10mA

Raw count value = 13824

Oxygen concentration = 10.473%

Level of oxygen = Low, so alarm will trigger to alert operator to take appropriate action. Now we will see all this in simulation environment using following pictures:



10.473% oxygen concentration raw count value 13824 Fig 1.8 Simulation Result_2

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Fig 1.9 Alarm Screen_2



Showing trend for 10 % O2 concentration Fig 2.0 Trend Screen_1

4.1.3 Test_3 Analysis

Sensor output = 20mA

Raw count value = 27648

Oxygen concentration = 20.947%

Level of oxygen is in good condition. Now we will see all this in simulation environment using following pictures:



20.947% O2 concentration raw count value 27648 Fig 2.1 Simulation Result_3



No alarm

Fig 2.2 Alarm Screen_3



Showing trend for 20.947% O2 concentration Fig 2.3 Trend Screen_3

V. CONCLUSION

This study will help in the field of mining industry to setup new age of safety equipment or in other words how we can use this technology to save human life. This study reduces the unwanted accidents in mining field.

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Multiple Roots and Canals in Mandibular Canines and Premolars in a Brazilian Population: A Cross Sectional Study Using CBCT and Panoramic Radiography

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Abstract— This study aimed to estimate the prevalence of external and internal numerical root variations of mandibular canines and premolars in southern Bahia. 384 Panoramic Radiography (PAN) and 384 Cone Beam Computed Tomography (CBCT) of patients over 14 years old who had all mandibular canines and premolars were evaluated for internal and external numerical variation. Gender predilection of morphological configurations was assessed using the x^2 test (p < 0.05). For the PAN, 0.5% of the patients had a canine with two roots, while 2.1% and 3% had first premolar and second premolar with two roots, respectively. Regarding internal variation, 2.9% had a canine with two canals, while 15.9% and 6.5% had a first premolar and second premolar with two roots, respectively. Three roots, while 16.4% and 2.1% had first premolar and second premolar with two roots, respectively. Three rooted first and second premolar accounted for 0.3%. Regarding the internal variation, 3.4% had a canine with two canals, while 24% and 6.5% had a first premolar and second premolar with two canals, respectively. Three or four canals accounted for 0,7% for first premolars and 0.3% for second premolars. Despite many variants, the most prevalent root configuration for these groups in Bahia's southern region is one root with one canal. This finding may serve as a guide in clinical endodontic therapy.

Keywords— Cone-Beam Computed Tomography, Dental Pulp Cavity, Mandibular Teeth, Panoramic Radiography

I. INTRODUCTION

The roots of human teeth vary in number, size and morphology, which are anatomical changes resulting from the genetic variability of populations, as well as sexual dimorphism and different environmental factors. Among these, the variation in the number of roots and root canals represents great interest in the dental clinic, especially for endodontic treatment [1].

Of all groups of teeth, mandibular premolars comprise the group with most significant root numerical variability. There are records of the first premolar with one root and two or three canals, two roots and two or three canals, three roots and three canals and four roots and four canals [2]. Likewise, there are records of the second premolar with one root and three, four or five canals, two roots and two, three or four canals and four roots and four canals [2].

Conversely, the anterior teeth have little to none numerical variability of the roots, in most cases singlerooted teeth. However, the mandibular canine is the major exception to the rule, as shown by reports of bifurcation from the middle or apical third, as well as only bifurcation of the root canal also from the middle or apical third [3]. The bifurcation of the mandibular canines generally forms a vestibular root and a lingual root/canal. Very rarely, bifurcation is observed from the cervical third of the root [4, 5]. The characterization of external variations as the number of roots can be done by Panoramic Radiography (PAN). This technique allows visualization of the viscerocranium, with details centred on the maxillofacial complex, making it possible to clearly visualize the number of roots [6]. Although internal structures such as root canals are not always clearly distinguishable on a PAN, it is possible to visualize the root canal system [7].

A more accurate imaging option is Cone Beam Computed Tomography (CBCT), which consists on the emission of a beam-shaped ionizing radiation through the entire cranial region. This technique allow us to evaluate the skull's anatomical structures in three dimensions (3D) and provide two dimensional takes with high quality of any part of the irradiated structure. This is of particular importance for the evaluation of internal structures such as root canals [8-10]. In fact, CBCT can be useful to a variety of analysis that demand accuracy for the visualization of facial structures [11, 12].

Therefore, these two techniques are useful to assess external and internal root anatomical variations. This information is of great clinical importance, for endodontic treatment in particular but not only, for it allows to estimate the prevalence of such variations for a given population. Thus, this study aimed to estimate the prevalence of numerical root variations in mandibular canines and premolars in southern Bahia, based on PAN and CBCT images.

II. METHOD

1. Sample selection and analysis

This present work was a retrospective crosssectional observational study using 384 PAN and 384 CBCT from patients over 14 years old who had all canines and lower premolars (6 teeth in total). Images of patients whose evaluated teeth had endodontic treatment or were associated with injuries were excluded from the analysis. The analyzed image exams were all done during 2019 and 2020 at the Dental Radiology Clinic Interface, located in Itabuna, Bahia. The sampling was a stratified random type and consisted of 163 men and 221 women for PAN and 153 men and 231 women for CBCT. Four researchers independently assessed the external and internal variations observed on the radiographs and tomographies. The dental units were classified into three groups, lower canine, first lower premolar and second lower premolar, which were subdivided according to the number of roots and canals. These groups were used to calculate the frequency of these variations, as well as whether these variations had a gender predilection.

2. PAN and CBCT capture and treatment

PAN images were acquired using the Orthopos XG 5 (Sirona Dental System, Germany) at 70kvp voltage and 10mA current for 13 seconds of exposure time. CBCT images were acquired from two devices with different settings. The Orthopos – XG5 (Sirona Dental System, Germany) was used to acquire CBCT images with an HD resolution at 8x8 Field of Vision (FOV), 0.20mm of voxel for 14.3 seconds. The i-CAT (Kavo, USA) was used to acquire CBCT images with HiRes resolution at 8x16 FOV, 0.25mm of voxel for 40 seconds.

3. Statistical Analysis

The sample size was established to represent the estimated population of the southern Bahia region, approximately 661,396 people (2018 estimative), as 384 people is the required size to satisfy a sampling error of 5% (p<0.05). The mandibular canine, mandibular first premolar and mandibular second premolar were divided in groups according to the number of roots and canals. The frequency of each group was calculated, as well as whether these variations had a gender predilection. The predilection of gender variations was estimated by the non-parametric test of x^2 with yates correction.

III. RESULTS

1. Panoramic Radiography

The PAN analysis revealed a low external root variation, with a higher prevalence of monoradicular teeth for all groups analyzed. The mandibular canines had the highest prevalence of teeth with one root, with a single occurrence with two roots (Fig.1), representing only 0.5% of the patients. This low occurrence of two roots was also observed for mandibular first and second premolars, representing only 2.1% and 3% of the patients. No teeth with more than two roots were observed (Table 1).

The internal root variation was more abundant for all groups of teeth analyzed, especially the mandibular first premolar. Around 15.9% of patients had at least one mandibular first premolar with two canals. Only 6.5% of patients had at least one mandibular second premolar two canals (Table 1).

Table.1: Root and canal number variation in 384 patients assessed by PAN

Groups	n° Teeth	% Teeth	nº Patients	% Patients
Canine 1 root	766	99.7%	382	99.5%
Canine 2	2	0.3%	2	0.5%

roots				
Canine 1 canal	756	98.4%	373	97.1%
Canine 2 canals	12	1.6%	11	2.9%
First Premolar 1 root	758	98.7%	376	97.9%
First Premolar 2 roots	10	1.3%	8	2.1%
First Premolar 1 canal	683	89%	323	84.1%
First Premolar 2 canals	85	11%	61	15.9%
Second Premolar 1 root	752	97.9%	373	97%
Second Premolar 2 roots	16	2.1%	11	3%
Second Premolar 1 canal	721	94%	359	93.5%
Second Premolar 2 canals	47	6%	25	6.5%



Fig. 1: Canine (33) with two roots on a panoramic radiography

For the mandibular canines, the presence of two canals was also more common than the presence of two roots, though with a much lower prevalence of 2.9% of patients. No teeth with more than two canals were observed (Table 1). Finally, there was no gender predilection detected for both external and internal variation.

2. Cone-Beam Computed Tomography

Similar results were obtained with CBCT scans, but with a substantial increase in teeth with two roots and two canals and teeth with one root and two canals. Also, the CBCT was able to detect variants not observed in PAN images. Here, the mandibular canines also had the highest prevalence of teeth with one root, with only 2.7% of patients having two roots (Fig.2a). For first premolars, 16.7% of the patients had two roots (Fig.2b), while for second premolars only 2.1% of patients had two roots (Fig.2c). There was only one first and second premolar with three roots (Table 2), both present in the same patient. The internal root variation observed on CBCT scans was greater than the external variation. The mandibular canines with two canals (Fig.2d) were present in 3.4% of patients. Again, premolars showed a more significant variability. For the mandibular first premolar, the two canals variant was present in 24% of the patients (Fig.2e). The mandibular second premolar was less variable with 6.5% of the patients presenting two canals (Fig.2f). CBCT was also able to detect mandibular first premolars with three canals (Fig.3), which accounted 0.7% of the patients. For the mandibular second premolar the variability of this variant was lower, with 6.5% of the patients with two canals and 0,3% with three or four canals (Fig.3). Again, there was no gender predilection for any numerical variations.

 Table. 2: Root and canal number variation in 384 patients
 assessed by CBCT

Group	n°	% Teeth	nº Patients	% Patients
	Teeth			
Canine 1 root	757	98.5%	374	97.3%
Canine 2 roots	11	1.5%	9	2.7%
Canine 1 canal	748	97.3%	371	96.6%
Canine 2 canals	20	2.7%	13	3.4%
First Premolar 1 root	674	87.7%	320	83.3%
First Premolar 2 roots	93	12.2%	63	16.4%
First Premolar 3 roots	1	0.1%	1	0.3%
First Premolar 1 canal	628	81.7%	289	75.3%

First Premolar 2 canals	85	18%	92	24%
First Premolar 3 canals	3	0.3%	3	0.7%
Second Premolar 1 root	757	98.5%	375	97.6%
Second Premolar 2 roots	10	1.4%	8	2.1%
Second Premolar 3 roots	1	0.1%	1	0.3%
Second Premolar 1 canal	734	95.5%	358	93.2%
Second Premolar 2 canals	32	4.2%	25	6.5%
Second Premolar 3 and 4 canals	2	0.3%	1	0.3%



Fig. 2: Transversal sections of Cone Beam CTs: (A) Canine with two roots; (B) First premolar with two roots; (C) Second premolar with two roots; (D) Canine with two canals; (E) First premolar with two canals; (F) Second premolar with two canals. Arrows indicate Bifurcation of Canal and Root (BCR) and Mental Foramen (FM)



Fig. 3: Cone Beam CT axial section of patient with a first premolar with three roots and three canals (44), a second premolar with one root and three canals (35) and a second premolar with three roots and four (45). Arrows indicate canals.

IV. DISCUSSION

In general, the data obtained with CBCT had a higher proportion of variants than to those obtained with PAN. This observation was already expected due to inherent characteristics of each technique. CBCT provides 3D reconstructions of every section form the skull allows a better visualization of external and internal structures, some of which are not always distinguishable in PAN due to overlaps and flattening to form a single take [8]. This makes CBCT an ideal choice for the sort of analysis here proposed, though it does not exclude the possibility of using PAN. A study that compared the CBCT and PAN techniques for visualizing the root anatomy, concluded that in twelve patients with two canals viewed by CBCT, in only two it was possible to suggest the existence of two canals with the PAN [13].

A Brazilian study carried out with 830 canines extracted in São Paulo reported that the prevalence of mandibular canines with two canals was 6.1%, while the presence of two roots was more rarely observed, with a prevalence of 1.7% [14]. Compared to our data, this prevalence of mandibular canines with two canals (6.1%) is higher than that found in both PAN (1.6%) and CBCT (2.7%). The prevalence of mandibular canines with two roots (1.7%) is also higher than that we found in PAN (0.3%), but similar to that we found in CBCT (1.5%). City of Sao Paulo, which makes it mislead to compare.

Studies carried out in other populations report a highly variable prevalence of mandibular canines with two canals or two roots. An Iranian study with 149 canines extracted reported that 20.48% of canines had two canals and 4.7% had two roots, values well above those observed in Brazil [15]. Another Iranian study, now using CBCT of 400 patients, also reported a proportion of variants much higher than that of Brazil, with 28.2% of the canines having two canals and 12.08% with two roots [16]. In contrast, a Malaysian study with CBCT scans of 208 patients found no canine with two roots or two canals [17].

Thus, the prevalence of root configurations of lower canines in the southern Bahia region observed here by PAN and CBCT was similar to that observed in São Paulo, another Brazilian subpopulation. However, this study's sample number was not representative for the City of Sao Paulo, which makes it misleading to establish a trustful comparison with our data [14]. In fact, the same can be stated for much of the studies regarding teeth anatomical variations. Nonetheless, much of the discrepancy in data is believed to be caused by natural genetic variation, whose pool frequency varies considerably across different geographic regions [18].

For the mandibular premolars, PAN images could not detect teeth with more than two roots and two canals, though these are rarely reported and were here detected by CBCT. There are reports of first premolars from two to four roots, and up to four canals [19-21]. The same happens for the second premolar, for which there are reports from two to four roots, and up to five canals [22-24]. However, much of these reports were *in vitro studies* with extracted teeth, allowing better visualization of root morphology through clearing, sectioning, radiography and Micro-CT scanning.

Regardless of such rich variability, the majority accounts for teeth with one root and one canal. A compilation of 8 studies, with 4462 extracted teeth, found that 97.9% of the first lower premolars had a single root, 1.8% had two roots, 0.2% had three roots and 0.1 % had four roots. Concerning the number of canals, a compilation of 16 studies with 4733 extracted teeth showed that 75.8% of the teeth had one canal, while 24.2% had two or more canals [25]. These data are similar to the data we obtained with PAN images, in which 98.7% of the evaluated first premolar had a single root and only 1.3% had two roots, but inferior to those observed with CBCT, in which we had 87.7% with one root and 12.3% with two roots. As for the internal variation, a more conservative trend was observed with PAN images, as 89% of the first premolars had only one canal, and 11% had two canals, while with CBCT the percentage of teeth with two or more canals was

closer to that observed in this compilation, with 18.3%. In all cases, the configuration of one root and two canals was more frequent than the configuration of two roots and two canals, in agreement with the same study.

Similarly, a compilation of 8 studies with a total of 4019 extracted teeth and another one of 11 studies with 3063 extracted teeth revealed the prevalence of mandibular second premolar variations in the number of roots and canals, respectively. This study found that 99.6% of second premolars had only one root, while two or three roots were rarely observed, with a prevalence of 0.3% and 0.1%, respectively, while only 9% of the teeth had two or more canals [26]. As with the analysis for mandibular first premolars, we found similar data with PAN images, in which 97.9% of the lower second premolars had a single root and 2.1% have two roots. This number is also similar to that found with CBCT, in which 98.5% had 1 root and 1.5% had two roots. As for the number of root canals, our data point to a more subtle variation of 6% with PAN and 5.5% in the CBCT images. In general, there is a correlation between the findings, with a general prevalence of mandibular premolars for the configuration of one root and one canal, but a lower frequency of variations when compared to the mandibular first premolar. Interestingly, the mandibular second premolar was the only group in which our data obtained by CBCT showed less variability than that obtained by PAN.

Much of this root variability in premolars is believed to be due to different worldwide genetic backgrounds, particularly the genes involved in rhizogenesis. There seems to be a correlation between the size of posterior teeth and the number of roots and canals. It is observed that the larger the premolar crown, the greater the number of roots and, as a consequence, of root canals. The hypothesis that the number of roots and canals is directly related to the crown's dimensions would not be anything unusual, since rhizogenesis is initiated after the formation of the bell in morphogenesis [27].

Based on this theory, there are several correlations suggested for root variation, among those is the involvement of sexual dimorphism in the number of roots, since male individuals tend to have larger teeth [27]. However, in our study, there was no gender predilection observed in any group, agreeing to many studies with mandibular premolars, but one exception for mandibular first premolars and two exceptions for mandibular second premolar [28, 29]. There was also no gender predilection for the mandibular canine bifurcation.

V. CONCLUSION

Our data allow us to conclude that mandibular canines with more than one canal are rare, and even more rare is the presence of two roots for this group of teeth in the southern region of Bahia. On the other hand, such variations are more common in mandibular premolars, although with a general prevalence for the configuration of one root and one canal. In general, the most prevalent configuration was the same as found in other studies around the globe for each group of teeth, though the variants' frequencies differ in variable degrees to other populations. Finally, as expected, CBCT images produced more reliable data than PAN images.

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Considerations about memory on electricity tariffs: A case study from Brazil

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Abstract— Brazil had experienced a history of very high inflation for many years, having flirted for some time with hyperinflation. By account of this historic, Brazilian society has become accustomed to an indexation that is very present in its the economy. This characteristic makes prices difficult to perceive by society in general. Even considering that nowadays they are under relative control in relation to inflation.

Particularly in the electric power industry, a sector with strong regulation in Brazil, tariff fluctuations have been very volatile. Making this scenario even more complex, the sector is subject to a lot of government influence with intense reductions in the cost of electricity followed by severe readjustments. Although residential electricity tariffs were reduced in real terms between 2001 and 2016, a survey conducted with a group of consumers from two of the country's main concessionaires found that consumers perceived that electricity prices had been increasing.

The authors identify that the complexity of price formation in the electric power industry and the economic crises experienced in more recent years lead to an erroneous perception about the memory of the prices practiced. Opportunities are identified for utilities and the Energy Regulation Agency to improve their communication process with their customers.

Keywords—Brazil, Electricity, Memory, Regulation, Tariffs.

I. INTRODUCTION

During almost the entire 20th century, inflation in Brazil was high. During the last months of the Sarney government (1984-1989) and in the Collor government (1990-1992) the Brazilian economy flirted up with hyperinflation, registering indicators of up to 82% per month (FVG, 2020).

Between July 1964 and July 1994, when the economic measures that controlled the hyperinflationary process in Brazil were implemented, the accumulated inflation was one quadrillion and 302 trillion percent (Leitão, 2011). Social scientist Sergio Abranches identified that because of this experience with high inflation, Brazilian society, to protect itself, introduced a high dose of indexation, in such a way that the Brazilians could even be classified as "homo indexadus" (Leitão, 2011). In the most acute period of the inflationary process, they became accustomed to assessing the economy's prices and tariffs in light of their extensive variability, with almost all contracts indexed to inflation indicators.

Since July 1994, when a heterodox plan to fight inflation, the Real Plan, was implemented, inflation has been contained and maintained at satisfactory levels. Since 1995, the average annual inflation recorded was 6.84% (IBGE, 2020), with a slight downward trend in more recent years. The table 1 shows these figures with relative stability.

Table.1- Average inflation %

Period	Yearly Inflation average %
2005-2019	5,44
2010-2019	5,84
2015-2019	5,56

Authors own elaboration from IBGE data (2020)

This article seeks to identify the process of memorizing energy prices by the Brazilians in the period between 2002 and 2016.

In chapter 2 the authors discuss the concepts associated with the formation of human memory. Chapter 3 presents the main concepts for the formation of electricity tariffs in Brazil. The reference values used in this study from 3 electricity utilities are also presented. Chapter 3 also explains the reasons for the extreme volatility of tariffs in Brazil. Chapter 4 describes the electrical energy consumers memory experiment in relation to their perception of the bills they played. It details the universe studied and the results obtained. Chapter 5 presents the conceptual framework and the statistical model used. Finally, in Chapter 6 is summarized final conclusion regarding the study.

II. SOME CONSIDERATIONS ABOUT MEMORY

There is an unequivocal growth in the supply of information on all subjects, facilitated by the dissemination of research on the world wide web.

According to Miller (1955) in some cases, this exuberant supply of information may not be fully utilized, as there may be an upper limit on the ability of human beings to process information simultaneously, interacting with different elements, resulting unreliable, or inaccurate analyzes.

The issue of availability of information in people's memories, and how it is used for the decision-making process, has been enchanted researchers in the most diverse areas of knowledge, such as Blumenthal (1977) who endorses Miller's positions (1955) considering that too much information could be useless. Impressions and sensations in profusion disappear from memory very quickly.

Miller (1955) even treats information in excess as a phenomenon similar to the concept of variance in statistics. The excess of information makes these information disposables, due to its excess and the contradictions (scientific as well) that they contain. Forgetfulness is the next step.

However, when information in our memory or knowledge is transmitted or taught, it is preserved. In this case, the paradigm, according to Miller, is the covariance or correlation¹.

Tulving conceptualized 3 different types of memory: the Procedural (that is, one that allows us to remember how things are done), the Semantic (which represents the knowledge that someone has of the world in general) and the Episodic (the remembering of some events).

Professor Loftus (1975, 1995), Garry and others (1996) have dedicated to studying aspects related to the perception that the past is remembered differently from reality, depending on the scenarios of their occurrence. These altered perceptions affect judgments about regrets, happiness and deaths for example. Argentines even use an expression to characterize that all the past was better². It should be noted, that these distorted conceptions of reality can affect the role of witnesses in justice. Loftus (1975, 1995) dedicated deeply attention in this matter.

Relevant research on memory was also developed by Schacter and others (2003) featuring 3 types of forgetfulness: The Transient forgetfulness resulting from the inability to keep information for a long time, the forgetfulness resulting from Lapses of Attention (where I left the keys of car?) and the forgetfulness caused by Circumstantial Blocks (the tip of the tongue).

Schacter and others (2003) also identified 4 distortions about memories: (I) Attribution misconceptions, where the person remembers a fact but attributes it to an incorrect source, (II) Suggestibility misconceptions where personal values, criteria of pride or shame lead to a distorted memory of the past, preventing personal image from being affected by bad or worthless events, (III) Misconceptions arising from Bias by which present knowledge and beliefs distort our memories of the past (for example changes in past facts to maintain the coherence with current beliefs; memorable events -- "fisherman's stories"; conflicts and discomforts - for example the purchase of a car that a posteriori proved to be a bad choice), and finally (IV) Misconceptions arising from Persistence where some ideas or their forgetfulness, cannot be changed by traumas or beliefs so ingrained that they do not change even with objective evidence.

Tversky and Kahneman (1973, 2011) have studied the heuristics3 of psychological mechanisms for decision-

¹ In statistics, correlation, dependence or association is any relationship, causal or non-causal, between two or more variables

that can be expressed by math (for example, the relationship between the stature of parents and the of their children).

² Fue mejor todo el tiempo que pasó.

³ Heuristics are cognitive processes used in non-rational decisions, being defined as strategies that ignore part of the information in order to make the choice easier and fast.

making processes where problems that are overly simplified can lead to errors, some of them primary.

In particular Kahneman's book, "Thinking fast and slow" (2011) deals with this effect. Kahneman (2011) has also demonstrated that the speed of a positioning makes the memory processes less efficient and leads to bias in the perception of the actual facts.

The literature on the subject is very vast and represents a topic of great interest for economic and personal relations. Psychology is the recipient that organizes most of the findings in these researches.

III. ELECTRICITY TARIFFS IN BRAZIL

The privatization of Distribution concessionaires, started in the mid 90s changed the tariff model in Brazil from a cost-of-service methodology to a price cap model.

This process happened simultaneously in the mid of a liberal reform very inspired by those that took place in the United Kingdom, initiated in the Thatcher government.

Subsequently, with the advent of a major rationing (June 2001 to February 2002), new reforms were developed in 2004, making the Distributors utilities exclusively companies that must operate in the regulated market.

The tariff model is based on the English incentive price cap model (RPI-X) with tariff revisions every 4 years. Two main aspects influence energy prices to the final consumer, namely the tariff adjustment or review processes and the cost of fossil fuels resulting from the necessary dispatches from thermal plants when there are no hydrics resources.

Brazilian electrical system is largely based on hydroelectric power plants and with the new trend of runof-the-rivers power plants developed in the last 20 years for environmental protection, has increased the need to activate thermal plants in times of hydraulic scarcity.

Consequently, the variable cost of thermal plants is passed through on to the tariffs annually, causing them to be readjust above inflation. On the other hand, when the utilities have their tariff review processes, frequently they show gains in productivity, on these occasions can occur negative readjustments.

Society in general does not understand that similar companies can have such different adjustments. It is worth mentioning that the tariff reviews occur in different years for different concessionaires. One of the reasons is that the National Regulatory Agency- ANEEL (in portuguese acronym) does not have resources to carry out all the reviews all in the same year, the second is related with the privatization birthday (bureaucratic request).

Recently the regulator developed a new methodology, named Tariff Flags. This procedure indicates "ex ante" that in certain period with a bad forecasted hydro affluency, the dispatch of thermal plants will be more frequent. In the yellow and red flag, the costs of fuel are charged in advance, in the green one there is no additional charges.

The regulator informs the flag color in the expectancy that consumers refrain the usage of electricity in unfavorable periods, however the information is not understood by consumers and even by press. Probably, by misunderstanding as a consequence of an inefficient communication process by ANEEL.

To complex the situation in 2012, the government of President Dilma Rousseff (2011-2016) changed the rules for hydroelectric and transmission concessions, with the objective of reducing tariffs. Although the objective was partially achieved, the measure included a robust contribution from the National Treasury for social works expenses and cross subsidies existing in Brazilian tariffs.

The same measures have substantially reduced electric utilities revenues, resulting in an imbalance in their cash flow.

During 2013 and 2014 a severe hydro crisis happened. The crise produced the need for special loans to help the cash flow of Distribution concessionaires. The government justified the help as a need to support an essential public service.

In 2015, the imbalance in the Treasury Accounts produced the inability to make new contributions to this subsidy. Due to the large loans signed with public and private banks, in February of 2015, the Brazilian Government authorized the National Agency of Electricity to exceptionally readjust all tariffs in a single time, in some cases this adjustment has exceeded the 50% barrier. A quick analysis of table 1 and subsequent figure 1 evidence this increase. Even with this exceptional readjustment, figure 1 shows that the tariffs practiced in 2015 were lower than those in force in 2001, considering in the analysis the present values adjusted to 2016 base year.

Table 02 and Figure 01 show the residential class tariffs of three main electricity distributors in the State of São Paulo. These utilities were chosen for this analysis because they allow evaluating both the metropolitan and inland regions of São Paulo State.

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Table.2 – Household tariffs (no taxes included).

	Eletropaulo	Elektro	CPFL Paulista
2001	564,10	601,26	597,12
2002	614,67	657,25	635,72
2003	564,37	665,87	624,77
2004	627,72	714,33	648,28
2005	539,54	659,91	545,16
2006	508,73	663,92	579,95
2007	428,53	508,04	600,15
2008	396,11	533,08	491,03
2009	459,84	528,82	590,16
2010	443,12	516,02	507,15
2011	415,25	482,84	549,87
2012	358,64	470,51	429,24
2013	298,30	392,09	338,55
2014	333,26	504,24	374,54
2015	474,68	555,00	459,03
2016	404,42	447,89	447,19

ANEEL – Tariff Normative (2001-2016)



Fig.1: Household tariffs (no taxes included) R\$/ MWh Present Value 2016

Their tariff values were adjusted to present value until the date of the last adjustment that each concessionaire faced in 2016. (CPFL Paulista in April, Eletropaulo in July and Elektro in August). For this adjustment to present value, the IPCA indicator, the official index of Brazilian inflation, was used.

As is easy to understand, the Brazilians served by these concessionaires paid more for the electric of their homes in 2001 than in 2016.

Figure 1 presents the same data from the previous table graphically, in order to make the reader understands the tariffs volatility. It is worth noting that Brazil has 64 different Distribution concessionaires spread across its continental area. Although only three concessionaires from the State of São Paulo, the most economically developed region in Brazil, were selected for this study, must be noted that the profile presented is similar for all concessionaires, and the curves in figure 1 can be considered homothetic with all the other utilities.

It should be noted that the primary research methodology used in this work and detailed in the following section used consumers from Eletropaulo concessionaires, which represent metropolitan and urbanized regions and for Elektro representing inland regions. CPFL data, also included in table 1 and figure 1, aim to give consistency to the concept of homothetic similarity presented by the authors.

IV. RESEARCH METHODOLOGY AND RESULTS

For this experiment, a survey research methodology was chosen, where the sample studied does not represent the universe of electricity customers, but it allows to analyze the behavior of a group chosen in relation to the objectives investigated. The primary research was carried out in person, in the self-response mode.

The survey was developed from December 2016 to March 2017, where it is worth noting that there was no material change in the price of energy during the interval of application.

A total of 92 residential consumers were interviewed, of which 52 subjects were Elektro customers and 40 were Eletropaulo customers.

Given the complexity of price formation, the authors of this article investigated the perception of energy prices among non-specialists based on the construction of 4 scenarios, 3 hypothetical and 1 real. Curves were constructed for each concessionaire. Each curve showed different trends, increasing prices (alternative B), declining prices (alternative C), relatively stable prices (alternative D) and of course the actual option (alternative A).

During the survey, the respondents in addition to the comparative analysis of the price curves to choose one, they could also inform their income, profession and gender.

The declared income result that 40 participants have income greater than 10 minimum wages in Brazil and 52 with income below this amount. Of the respondents, 30 were female, 49 were male and 13 preferred not to provide their name, gender and profession at the time of the survey. Regarding the study level, 44 respondents had university degrees. The participants were invited to choose the curve that represented his best perception of the prices practiced by the distribution concessionaire in his residence over the last few years, being emphasized for each one, that the inflation had been used to correct the prices until the present date of the search.

Figure 2 shows the curves that were shown to respondents in the Elektro concession area, to illustrate part of the instruments used in primary research. For the other concessionaire (Eletropaulo), the graphics presented were similar to this example, following the same criteria for their design. It should be noted that in all alternatives, the trend lines showed a decrease in prices in 2012 and 2013 with a high adjustment in 2015, to give greater reality to the price curves presented in the survey.



Fig.2: Curves shown to Elektro Customer (R\$/ 200 kWh Month)

Figure 3 presents the results of the research regardless of the concessionaire that served the respondent.



Fig.3: Survey Results (%)

V. CONCEPTUAL ANALYSIS AND STATISTICAL MODEL OF THE STUDY

As presented in section 4, it was found that approximately 90% of the interviewed consumers chose non-valid alternatives (B, C and D, alternatives) considering the four curves with the costs of an electric bill in the concession areas investigated. In addition, most of these consumers (53.26%) opted for a single alternative (alternative B), where the behavior of the price curve shows an upward trend.

In resume, the consumers have done a biased choice, disregarding the real values actually payed.

These results can also be validated by using appropriate models, taking into account criteria such as the number of available alternatives and the total of consumers interviewed.

Mathematical modeling of problems related to consumer preferences is often performed in the literature as a way to formally study subjective results about a given phenomenon (for example Hensher, 1982; Clark et al., 2014).

In other works, for example, Dublin (2014) performs econometric analyzes that capture consumer preferences when they use electric appliances, considering aspects such as durability and energy efficiency.

Hackbarth, (2013) applied a multinomial model to analyze the choice of vehicles powered by alternative fuels, considering a wide range of alternatives (gasoline, diesel, natural gas, hydrogen, hybrids, electric), among other attributes of these vehicles.

In Danziger et al. (2014) consumer preference is analyzed in relation to price uncertainty in two types of retail stores: EDLPs (everyday low price), which have lower average prices and that tend to vary less over time; and HILOs (high and low prices), which have higher average prices, but which vary more over time, and consequently more bargains, even they exist only in a short window of time.

Formally, consumer preferences were characterized from the use of a binomial distribution, as studied by Chen (2010), which combines the average and variance of the prices of a given type of product.

In this work, the use of a mathematical formalism is performed to demonstrate the differences obtained between the actual consumers' choices and the expected values in an unbiased (random) scenario, considering the four choices already mentioned.

Considering a set with N consumers, where each consumer can choose one of four possible choices (A, B, C or D) it was considered that each choice is not biased by any external factor, such as gender or consumer income. In this context, if the choice is made at random, the probability that each graph will be chosen is 25%.

The distribution function that specifies the number of times that an event (choice of an alternative) with

probability of occurrence p can occur in N independent tests (or number of consumers) is called binomial distribution [Chen, 2010].

A peculiarity of this type of distribution is that, if N becomes large (N> 50), it can be treated as a Gaussian distribution, or also known as a normal distribution.

For the data set of the experiment reported here, a probability (p) of 25% (a choice not biased) and a sample (N) of 92 respondents result in an average value (μ) of 23 respondents and an expected standard deviation (Sd) of 4,15.

The same analysis can be done for the expectations related with the consumers that would choose only the "wrong" alternatives (alternatives B, C and D).

The table 03 shows the results with the probability not biased using the Gauss Distribution.

Table 3 Probabilities for non-biased choices

Alternatives	Consumer	Tendency	Probability
	choices		for non-
			biased
			choices.
			(95%
			confidence)
А	9.78%	downward	0.13%
В	53.26%	upward	≈0%
С	20.65%	downward	20.78%
D	16.30%	neutral	6.23%

 $(\mu = 23, S_d = 4.15)$

From the results obtained, it can be seen that there is a strong bias in choosing Chart B as the one that most reflects the perception of consumers in relation to the cost of an electric bill.

Robust results are also found in the probabilities that the choices of the other alternatives were not made at random, especially the correct alternative (option A) that presents the same probability (order of magnitude) of the choice most selected by the respondents (option B).

To reinforce this conclusion, someone can also consider only those consumers who indicated the wrong alternatives for each of the four alternatives, that is, 90.22% of the total of subjects.

In this situation we would have a probability of 33% (1 out of 3 alternatives) and a sample of 83 respondents (excluding those who answered correctly the correct alternative). In this case the figures result in an average value of 27.66 and a standard deviation of 4.29.

These results are shown in Table 04. The results obtained show that, considering only consumers who had an erroneous perception regarding the behavior of electricity tariff, it is possible to verify an even greater evidence to support the hypothesis that the choice was biased.

Table 4- Probabilities for non- biased choices -Only wrong selections

(µ=27,66, S	$S_d = 4.29$
-------------	--------------

Alternatives	Consumer	Tendency	Probability
	choices -		for non-
	Normalized		biased
	data		choices.
			95%
			confidence
В	59.04%	Upward	pprox 0%
С	22.89%	Downward	7.85%
D	18.06%	Neutral	1.10%

All the figures from statistics calculation were produced with the simulators from SISA- Simple Interactive Statistical Analysis (2020).

VI. FINDINGS AND CONCLUSIONS

The results obtained in this qualitative investigation allow us to conclude that Brazilians have a skewed perception that energy tariffs are becoming more expensive, when actually, in the period analyzed they became cheaper in the residential class.

The conceptual framework discussed in sections 2 and 3 support some findings:

The complexity of Brazilian tariffs contradicts any concept with regard to transparency and easy understanding as recommended by the classic work of Bonbright (1961). Price oscillations are chaotic and do not have coherence, neither in regional, or in a relationship with aspects including the service in poor areas. Finally, there is a lack of coherence related to equilibrium in supply and demand and tariffs. This fact stems from the great influence from grid operator strategy choice related about energy safety in future. Energy security decisions makes the water value problem in a trade off with the thermal alternatives an extremely complex one. The communication process is not adequate, neither by the concessionaires nor by the regulatory agency. Public hearings are elitist and of low transparency to society. The low perception, for example, of the tariff flags strategy is an excellent example of this inability to communicate.

Successive economic and political crises with a significant reduction in economic growth measured by GDP (three years in this century showed negative economic growth - recession in the years 2009, 2015 and 2016) produces the feeling that people became poorer (which in a certain way form is a truth) and, therefore, even with the reduction of tariffs in real terms compared to the past, the perception results that they remain more expensive.

The concepts developed by Loftus (1997) and those proposed by Schacter (2003) explain the loss of prices memory, specially related with a more comfortable income in past and Misconceptions arising from Persistence effect.

The interviewer's own model that simplifies in graphical alternatives a topic of relevant complexity may have influenced misunderstandings according to Kahneman (2011).

It turns out that there is an important opportunity of improvement for the regulator and concessionaires to better understand their communication process with the electricity consumers about the amount actually paid. The results could be used to relief the public opinion each new readjustment

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Microgrid Application of Four-Leg Three-phase Inverter

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Abstract— The On-grid inverters use energy from DC sources to feed AC consumers, and also the main grid whenever there is a surplus of energy, as distributed energy resources. A caveat of on-grid inverters generally implied by worldwide electrical standards imposes that whenever a fault occurs on the main grid, local generation must be shut off to prevent unintentional islanding. However, there are some applications where distributed resource systems could improve reliability, and on-grid inverters with off-grid function can continue to operate even when grid power outages occur, known as intentional islanding. Today's micro-grids have better sensing capabilities and superior semiconductor technologies that allow faster response times and higher maximum ratings, improving micro-grid equipment isolation and control capabilities. In this paper, we review anti-islanding tests performed on on-grid inverters with off-grid function in Brazil for conformity assessments and present a case study of a 20 kW hybrid inverter.

Keywords— hybrid, inverter solar, distributed, generation.

I. INTRODUCTION

The distributed generation (DG) market in Brazil is constantly growing, reaching 1423,5 MW of installed capacity in the grid in the third quarter of 2019, with a 111,07% growth in volume compared to 2018, according to the study published by Greener [**Error! Reference source not found.**] (based on data from the Brazilian Revenue Service, and Brazilian Electricity Regulatory Agency – ANEEL), where growth continues at high rates, despite local and foreign economic troubles. In this same sense, Brazilian Energy Balance - 2019 (year 2018) [31] publishes information regarding the micro and distributed mini-generation of electric energy, whose growth was stimulated by regulatory actions, such as that which establishes the possibility of offsetting the surplus energy produced by smaller systems (Net Metering).

Among the different components of distributed resource systems, a large cost is due to the power inverter, which transfers power from a local DC source to AC consumers and the main grid. System input is usually a high voltage source where voltage reduction is generally desired for powering standard AC equipment.

There are two types of power inverters available in the Brazilian market when considering main grid connection or isolation: off-grid and on-grid inverters. Offgrid inverters are intended to provide power to isolated consumers from local DC sources, such as photovoltaic energy, in what is known as island mode operation. Ongrid inverters use power from DC sources to feed AC consumers and also the main grid whenever there is a surplus of energy. This allows the user to earn revenue usually in the form of energy bill deductions.

A caveat of on-grid inverters generally implied by electrical standards imposes that whenever a fault occurs on the main grid, local generation must be shut off to prevent unintentional islanding. However, there are some applications where distributed resources can improve reliability in the case of intentional islanding, as further detailed in IEEE 1574.4 [[3]]. Although not yet officially available in the Brazilian market, on-grid inverters with off-grid function allow both modes of operation, connected or isolated from the main grid. Figure 1 presents a hybrid inverter topology with on-grid operation and off-grid function for critical loads, powered by a photovoltaic source and an additional battery bank for energy storage.



Fig.1. Proposed hybrid inverter grid system.

Despite uncertainties regarding regulation and certification, hybrid inverters are very sought-after in the Brazilian market and there is a considerable future demand for purchase, according to a study by Greener in 2018 [[2]]. Also, today's micro-grids have better sensing capabilities and superior semiconductor technologies with faster response times and higher maximum ratings, where micro-grid equipment isolation and control capabilities allow safer and more reliable operation ever than before. Strict test procedures defined by Brazilian conformity assessment regulations aim to ensure safety and quality to the hybrid inverter market. In this paper, we review anti-islanding tests performed on on-grid inverters with off-grid function in Brazil for conformity assessments and present a case study of a 20 kW prototype.

II. REVIEW OF ANTI-ISLANDING CONFORMITY ASSESSMENTS

Islanding is the transfer to a condition where the electrical installation, including the load and the generator, is isolated from the rest of the power grid [[4]].

This is a situation that electricity distribution companies should avoid. In some cases, intentional islanding may occur where the island is created by the distributor to isolate certain regions from the main power grid. Unintentional islands, however, also occur when network segments that contain private generation and loads are beyond the control of distributors.

The occurrence of unintended islands in distribution networks is a major concern for network operators because they can cause accidents to workers performing line maintenance, assuming the line is designed for maintenance. A study [[8]] attempts to show the additional level of risk for consumers and grid maintenance staff for systems with photovoltaic energy in low voltage distribution networks. [[8]]. Therefore, it is very important to develop anti-islanding measures for DG systems.

Different methods for islanding detection have been developed in recent years [[9]-[26]], among them are passive techniques [[13]-[18]], active techniques [[19]-[22]], hybrid techniques [[23]-[24]], and other notable solutions [[25]-[26]]. No island protection system is fully reliable and all methods have their advantages and disadvantages [[27]-[28]], mostly based on dependability and security, operating time, impact on grid, cost, and adaptability to grid characteristics [[28]].

Among the available techniques, the one used by the inverter that will undergo tests presented in this article is a passive technique. Passive techniques are based on the monitoring of electrical parameters such as voltage, current, frequency, phase and harmonics, as these parameters often vary when the system is in an island condition. The advantages of this technique are its low cost of implementation, the non-introduction of disturbances in the electrical system, as well as being much faster than other techniques for islanding detection [[29]]. As disadvantages, there is the inability of the technique to detect islanding during balanced islanding and a large nondetection zone (NDZ) [[29]-[30]]. Further studies specific to the power grid in which your system is inserted in are important as to settle the threshold values of anti-islanding measures and differentiate such problems from other system disturbances.

As there is no standard for voltage inverters that work with on-grid and off-grid functions, other standards have been adapted [[4]-[6]] to perform conformity assessments. In this paper, we considered most important for consumer and grid safety, parameters such as: undervoltage disconnect time, off-grid connection, network reconnect, and electrical parameter maximum values.

III. METHODOLOGY

The inverter test scheme follows the circuit shown in Figure 2. Since the inverter test is relevant only to the AC

equipment, the DC / DC converter and DC load have been disconnected.



Fig.2: Hybrid inverter test schematic.

When the system is disconnected from the grid, the circuit breaker C/B1 is open, C/B2 is used to determine the initial conditions of the AC load and DC source at the fundamental frequency (60 Hz). The following electrical parameters are measured: Rated output voltage; Operating voltage range; Output power; Output Frequency and Power Factor.



Fig.3: Presented 20kW hybrid inverter and test-bench instruments.

According to the standard [[4]], an oscilloscope is required to measure voltage and current waveforms must have a sampling rate well above the signal frequency to perform time measurements and analysis with precision less than or equal to 1% of nominal voltage. The instruments used in the tests consisted of the Power Quality Analyzer (PQA) Fluke Series II 434 and Oscilloscope LeCroy WaveSurfer 104MXs-B. The hybrid inverter that was tested can be seen in Figure 3.

When the system is powered by the DC source and connected to the network (closed C/B1 and open C/B2), a simulation of inverter behavior begins in the case of a power failure, to test islanding performed by the static transfer switch.

To measure the electrical parameters at inverter output and those coming from the grid, there are two voltage and current sampling modules Sample Vac1 and Vac2 positioned at each end. When the Sample Vac2 signal demonstrates anomalous behavior, the static switch should open disconnecting consumers from the grid.

The parameter that indicates the anomalous behavior for any phase characterizing the mains fault event occurs when the grid voltage value is below 85% the inverter's nominal output voltage. This procedure is based on undervoltage tests of existing on-grid inverter standards.

After the mains fault event, the static transfer switch triggers, isolating the inverter to continue the waveform with steady-state amplitude, frequency and phase. The measurement performed for the test is the time difference between the mains fault event and isolated steady state configuration. The considered stability regime has the following electrical characteristics: effective voltage value above 85% and below 110% of nominal voltage, and frequency within the nominal range (\pm 5%). The time between mains fault and isolated steady state should be equal to or less than 20 ms.

Being in an isolated steady state, is the consumer powered only by the DC/AC inverter, the Sample Vac 1 signal is monitored and compared to the Sample Vac 2 signal. When the grid returns to normal, the inverter identifies the phase difference between the two signals for synchronization of the waveforms.

Synchronization is the gradual delay of the inverter's waveform and change in frequency until Sample Vac 1 matches Sample Vac 2 in frequency and phase. When both signals are synchronized, the static transfer switch is closed, consuming AC power over the network. Once the static switch is closed, the inverter resumes normal operation.

Another parameter measured for the test is the time difference between the network return event and normal operation. The time between events should be between 20 and 300 s, as recommended by the standard [[4]]. A summary of the different test parameters is shown below (Table 1).

Table 1. Summary of the behavior of the switching systemto be analyzed.

Measure\ Event	Network Anomaly (grid fault)	Island Mode (isolated steady state)	Normal Operation
RMS Voltage	Vrms < 85% Vr1 Vrms > 110% Vr	85% Vr< Vrms <110% Vr	85% Vr< Vrms <110% Vr
Acceptable interval for transition to next state	20 ms	20 to 300 s	-

IV. RESULTS

The circuit of Figure 2 was assembled and when the C/B2 switch was closed, the values of the nominal output voltage, power, frequency and power factor were measured, as shown in Figures 4-6.

POTÊNCI	A E ENER	GIA		a. Real	
	Ран	0:00:2	0	-	
in male line in	A		E		
kU	2.95	2.34	1.98	7.27	
- Consequences of the second	A		C	Total	
KUA	2.98	2.53	20.5	7.64	
TRANSPORT	A				
kvar	0.09	+ 0.83	0.01 +	0.94	
	A		C	Total .	
PF	0.99	S6.0	0.98	0.95	-
01/03/18	10:18:35	1270 60H	2 30 MYE	EN50160	
UP BOMM =		TREND	EVENTS	S STU STAI	IP RT

Fig.4: Power factor measurement



Fig.5: Output phases and neutral voltage waveforms.



Fig.6: Output current waveforms.

The time-domain of tests with disconnection from the grid due to undervoltage and reconnection can be seen in Figures 7 and 8.



Fig.7: Time-domain of disconnection test



Fig.8: Time-domain of the reconnection test

Figure 7 shows the network signal (CH1-pink), inverter power (CH2-green) and static transfer switch control signal (CH3-blue); in the event of a mains failure, in the criteria previously described in the Methodology section: Effective Voltage above 85% and below 110% of rated voltage and frequency within specified range (\pm 5%), the inverter isolates consumers from the grid and continues the waveform. After a 10.56ms interval from the network fault event, the inverter reached steady-state output and fed consumers with off-grid power.

Figure 8 displays the reconnection time measurement triggered when the grid returns to normal conditions and the inverter must synchronize the isolated waveform in phase and frequency. After a 71.118s interval from the network return event, the inverter resumed normal on-grid operation. The reconnection test can also be seen in Figures 9-12, which better depict the process of synchronization.



Fig.9: Grid (Sample Vac 1 - Yellow) present during normal on-grid operation (DC Source - Blue).



Fig.10: Grid fault event occurs, static transfer switch isolates inverter in off-grid operation (Sample Vac 2 -Red).



Fig.11: Grid and inverter output unsynchronized, phase and frequency must be matched to close the static transfer switch.



Fig.12: Inverter output synchronized to grid, static transfer switch can now be closed.

V. DISCUSSION

Analyzing the tests, the results found were satisfactory. Time-domain analysis for disconnection from the grid due to undervoltage (10.56ms) and reconnection (71.118s) are within the acceptable intervals for transition to Island Mode (< 20ms) and to Normal Operation (between 20 and 300s). Intervals may vary considering the convergence of the synchronization algorithm and initial conditions. In conformity testing, it is necessary to consider the worst case, the phase difference of 180° which is most distant. For the transition to Normal Operation, a software delay must be introduced if the synchronization is less than 20s, to meet conformity requirements.

The tested inverter was able to disconnect from the system when distortion was introduced to the grid reference. When the grid had a rated voltage below 85%, the static switch opened automatically, and the inverter left the grid. However, it is important to note that according to [[4]] the anti-islanding tests should also verify that the inverter transitions to island mode when the reference is removed from the system.

The inverter was able to reach the stability level in 10.56ms after the grid fault event, which is a very

satisfactory result for the concept of a hybrid inverter. In order to make intentional islanding viable for on-grid inverters that have an off-grid function, the stability and speed of the transitions must be optimal, with least impact to consumers and grid operation.

VI. CONCLUSION

We present a simple methodology for testing hybrid on-grid/off-grid power inverters according do conformity assessments, contributing to the development of distributed generation systems.

In order to certify distributed generation equipment, it is necessary to submit them to the tests specified by [[7]], not specifically designed for hybrid inverters. Therefore, we believe that the developed tests can contribute to the development of certification processes for hybrid inverters in Brazil.

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The challenges of implementing an Electronic Waste Collection Cooperative in the Manaus Free Trade Zone.

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Abstract— This article is about a project to implement an electronic materials recycling cooperative. The idea arose from the realization of a serious problem that was detected in the daily life of the city of Manaus: the disposal of electronic materials directly in the common garbage and even in nature, such as in areas of environmental preservation and in streams.

The cooperative would be a third sector organization, providing a service that the government does not offer and that would also be the obligation of private companies that offer this type of product to society, which should carry out this type of activity and some do not.

The Cooperative's main objective would be to work on efficient social marketing, capable of making society in general aware of the importance of giving this type of waste the correct destination, not to mention that the achievement of this objective would further strengthen its productive chain, thus making society in general start to collaborate with the organization and also with the preservation of the environment.

As for the methodology used, the project for the implementation of the cooperative based in an incentive area was based on market research techniques, in addition the research is classified as exploratory with data collection through bibliographic research.

Keywords— Collection. Cooperative. Organization. Implantation. Electronic.

I. INTRODUCTION

The cooperative under analysis has a project of implementation in a tax incentive area, Manaus Free Trade Zone (ZFM) - economic development model allied to environmental protection. The Manaus Free Trade Zone (ZFM) is a model of economic development implemented by the Brazilian government aiming to enable an economic base in the Western Amazon and Amapá, promote the best productive and social integration of this region to the country, ensuring national sovereignty over its borders. (Available in https://www.gov.br/suframa/pt-br/zfm).

Simultaneously with the economic base implemented by the model that provides the region to house one of the main industrial parks in the country, responsible for one of the largest PIBs in Brazilian industry, there is the growth of environmental problems that deserve attention from the various sectors of the economy: companies, government and citizens. The Electronics segment (including Computer Goods) of the Industrial Pole of Manaus represents the largest manufacturing center of electronic products in South America. For the national market, its importance is strategic. (Available in http://www.suframa.gov.br/invest/onde-eletro-info.cfm).

Therefore, the Cooperative of collection of electronic materials arises from the finding of a serious problem in Manaus: the incorrect disposal of electronic materials, which in many cases will stop directly in the environment, polluting rivers, stream, forest areas, etc. It fits into the profile of organization of third sector, because it will work providing a service that is not yet provided by the Government or by private society. The activities should be from agreements closed with several organizations in the city of Manaus for the provision of this service, mainly with the companies of the Industrial Pole of Manaus, providing the collection service to them. The following are the organizational objectives and goals.

Objectives: To make the society in general of the city of Manaus modify their habits in relation to the disposal of electronic materials, so that they become aware of the importance of the correct disposal of this type of material. Thus contribute to the removal of these residues from nature, as well as working the ideal of social responsibility, which aims to improve the quality of life of people.

Goals: Reduce by 50% the amount of electronic waste disposed directly in the environment within 5 years, as well as raise awareness 20% of the population of the city of Manaus about the importance of the correct disposal of these wastes, in the same period.

II. LEGAL/LEGAL CONSTITUTION

Creation of a Cooperative

Cooperative is an association of at least 20 (twenty) people who voluntarily unite, with a common interest, economically organized in their own democratic way, aim, non-profit, to meet the economic, social or cultural needs and aspirations of their associates.

Cooperatives are classified, by the Organization of Brazilian Cooperatives, in several segments and we are adopting the provision of services whose primary objective is to collectively provide a service from which the social framework needs

Call Notice: Once a Cooperative Organizing Committee has been constituted, a Call Notice for the Constitution of the Cooperative should be published, at least 10 days in advance, in at least one newspaper of greater circulation in the city, calling all those interested in creating the cooperative, already defined, for the Assembly of its Constitution.

Note: This Call Notice must be signed by a representative of the Constitution Committee.

General Assembly of the Constitution:

Hold the General Assembly of the Constitution, for the approval of the Statute and election of the members who will occupy the corporate positions (Board of Directors or Board of Directors and Fiscal Council). Actions to be taken before the meeting:

- Presence Record Book;
- Minutes Record Book;
- Prepare draft Bylaws

• Define at least one slate for the election of the Board (with the *Declaration of Disengagement of candidates*).

- All data of the members, such as:
 - ✓ Full name;
 - \checkmark Complete home address;
 - ✓ Photocopy of documents (Identity and CPF);
 - \checkmark Nationality;
 - ✓ Civil Marital Status;
 - ✓ Two 3x4 photos.

All the events that occurred during the assembly should be compulsorily registered immediately to the meeting was over, it should be written in the book of the Minutes of Meeting of the Cooperative Constitution.

Bylaws:

It is recommended that the Bylaws trace all the characteristics of the Cooperative's legal and administrative organization, reflect its true social profile, avoiding making copies, pure and simple, of other Cooperatives' bylaws.

The Statutes, before being taken to the Commercial Board, must be considered by the OCE - Organization of State Cooperatives, in order to verify that they do not conflict with the current cooperative legislation.

Note: The text of the bylaws can be drafted in the cooperative's own incorporation minutes, or be duly annexed to it, initialed and signed by the President and by all the founders present, and with the attorney's visa.

National Register of Legal Entities - CNPJ:

The next step, after the Assembly General of the Constitution, will be to register in the Cooperative Board of Trade.

The Cooperative must present the following documents to the Board of Trade:

- Minutes of the General Assembly of the Cooperative;
- Bylaws;
- Application filled out, using a specific form, in the form of a cover, purchased in stationery;
- National Cooperative Registration Form (FCN 1 and 2), form purchased in stationery;
- Certified copy of the identity card and CPF of the elected representatives;
- Proof of payment from the Federal Collection Guide, (DARF) forms for sale at stationery stores;

- Proof of payment of the Commercial Board's Collection Guide, acquired in form from the stationery;
- Establishment Registration Form Headquarters, CNPJ, in three copies (for sale in stationery);
- Nothing appears on the components of the Board of Directors with the Federal Revenue Service;
- Certificate of Clearance of the President of the Administrative Council, authenticated by a notary.

Note: On all pages of the Minutes and the Statute, the headings of the lawyer and the president of the Cooperative must appear, and on the last page the signatures of all members.

Registration with the OCE

Every Cooperative must register with the Organization of Brazilian Cooperatives or with the state entity, if any, upon presentation of the bylaws and their subsequent amendments , in accordance with art. No. 107 of Law No. 5,764/71.

Necessary documentation for registration with the OCE:

- 2 Ways of the Cooperative Constitution Minutes;
- 2 Ways of the Bylaws;
- 2 copies of the registration form, provided by the OCE, duly completed and signed;
- 2 Copy of the certificate of filing of the documents of its constitution with the Commercial Registry (certified).

Registration with INSS and Ministry of Labor

If the cooperative hires employees, it is equal to other companies in terms of social charges. To do this, you will need to register with the National Social Security Institute and the Regional Labor Office.

Location and Operation Permit

The Permit for location and operation license must be made at the City Hall of its headquarters to normalize its location and activity.

To obtain registration, the Cooperative must present the following documents:

- Standard requirement provided by the municipal agency;
- Articles of Incorporation of the Cooperative;
- Bylaws;
- Property and Urban Territorial Tax IPTU paid, from the place where the Cooperative will operate;
- Rental agreement or title deed to its headquarters;

Books

The Cooperative must have the following books:

- Registration
- Minutes of Meetings

- Minutes of the Management Bodies
- Minutes of the Fiscal Council
- From the Ethics Council Minutes
- Of the Presence of the Cooperatives in the General Assemblies ;
- Others, Tax and Accounting.

LEGISLATION AND CERTIFICATIONS Legislation

The Cooperative has its registration with the State Commercial Board, with the Municipality of the City, to obtain a business license, licensing from the state environmental agency and from the Fire Department, so that the provision of services is carried out legally under the Legislation. current.

As the Cooperative works with the handling of solid waste produced by the various companies of the Industrial Park of Manaus - PIM, the latter to conform to the National Solid Waste Plan - PNRS, must be attentive to the process of reverse logistics institutionalized by the plan, which says that once the waste is discarded, it is the responsibility of the manufacturers, who must create a system to recycle the product.

The organization must work in partnership with the PIM companies to capture and select the materials to be recycled. Law No. 12,305, which institutes the National Solid Waste Policy, came into force on August 2, 2010, and companies and municipalities would have until the current year of 2020 as the deadline to adapt it. Below is the part that deals with reverse logistics:

...

Art. 3 For the purposes of this Law, the following definitions apply:

XII - reverse logistics: an instrument of economic and social development characterized by a set of actions, procedures and means designed to enable the collection and return of solid waste to the business sector, for reuse, in its cycle or in other productive cycles, or other environmentally appropriate final destination;

As advocated in the National Solid Waste Plan, citizens who consume products manufactured by industries, must have shared responsibility, if collection systems are established, and as organizations are obliged to adapt to reverse logistics, our services, through partnerships will serve to assist in this process. Shared responsibility is expressed in Articles 5 and 6 of the PNRS law.

Certifications

The organization will work and adapt in pursuit of ISO 14001 certification, and for that purpose, the following is an Environmental Management System proposal.

The Environmental Management system expresses the cooperative's commitment to sustainable development, improving the quality of life of its employees and the community in general, and the commitment to its customers and members.

Environmental commitment of the Organization .

The commitment is to maintain the permanent search for "continuous improvement" of the cooperative's activities, internal processes and services provided, with the objective of eliminating or reducing impacts on the environment. To this end, the Cooperative is committed to:

- Periodically assess environmental impacts with a view to preventing pollution of the environment;
- Ensure compliance with legislation;
- Implement and maintain ISO14001;
- Provide structure to meet and improve environmental objectives and targets;
- Implement, maintain and communicate the environmental policy to all its employees, as well as making it available to government entities, the community, customers and suppliers;
- Promote training for all members.

Planning

Q uanto planning within the cooperative processes utilize the methodology known as Plan - Do - Check-Act (PDCA) / (Plan-Do-Check-Act), because through it the thought processes and plan can be processed through execution. Within the planning of the actions we have several items that are detaild below:

- Legal requirements and other requirements: as previously mentioned, our Cooperative is legally grounded for proper functioning, as well as maintaining the attitude of adapting whenever the respective laws are modified;
- Objectives and Goals: the Cooperative aims to use the best available techniques to provide services to its partners that brings the best costbenefit ratio both for those involved and for the environment;
- Implementation and Operation: the cooperative has an environmental management policy to involve all members, from senior management to all members so that the implementation and maintenance of the Environmental Management System is successful;

- Communication: the Cooperative maintains an open communication policy with all members, involving everyone and using internal and external forms of communication;
- Documentation: the Cooperative 's documentation part is organized as follows - through printed documents or in media, and its flowchart follows the following order: Elaboration and / or revision of the document critical analysis approval reproduction distribution control of obsolete custody use and disposal.
- Emergency preparedness and response: the Cooperative periodically simulates accidents, with a preventive character, to avoid the occurrence of accidents and emergency situations.
- Monitoring and Measurement: the possible environmental impacts must be monitored periodically, as well as the monitoring of residues that are in stock must be carried out periodically, so that due to heat, humidity or other constant they will not cause damage.
- Assessment of compliance with legal and other requirements: a cooperative member will be in charge of checking monthly if there has been a change in the cooperative's laws, rules, licenses and authorizations, so that it can always conform to current legislation;
- Non-compliance, Corrective Action and Preventive Action: the Cooperative adopts a methodology to take corrective and preventive actions, always acting on the cause of the problems, as this allows it to correct errors or prevent what may go wrong.
- Record control : The record control at the Cooperative would be made up of the following activities / operations of the cooperative: training records, process monitoring records, pertinent records of service providers and suppliers, incident reports, audit results, results of analysis by Senior Management, records of applicable environmental legal requirements and records of significant environmental aspects,
- Internal audit: the Cooperative would maintain an internal audit calendar, carried out each semester to identify possible errors or flaws in the cooperative's process, thus making it possible to change the item (s) of the Environmental Management System that is (are) giving flow for possible error or failure.

Adoption of Safety Standards at Work

The cooperative will give lectures periodically, educating and instructing the members to follow the strict safety rules, clarifying them about the risks to which they are subject and stimulating their interest in accident prevention issues.

Provide members with appropriate tools and equipment, which must be in perfect maintenance condition, for each type of product / component;

Provide members with appropriate protection (helmets, goggles, gloves, boots, covers, mufflers, etc.), and make their use mandatory;

Ensure the correct way to transport the materials and tools used.

Solid Waste Management

When transporting electronic waste, to avoid the loss of the material transported, overloading of vehicles must be avoided. It is also necessary to avoid the use of collection vehicles with the brakes in bad conditions of use or with worn tires beyond the safety limit.

The management of electronic waste must include the following steps:

- Collection and reception of solid waste: the collectors will move to the indicated location, or at the collection points they will receive the electronic waste, using the necessary equipment for it;
- Sorting: the selectors will be responsible for sorting the collected materials, including separating for final destination those that cannot be recycled. If the product is still in use, we will forward it to Social Projects indicated by partner organizations;
- Disassembly: using all the individual protection apparatus, the selectors will disassemble the product, thus de-characterizing it. PPE is essential, since they will carry out the mischaracterization of the material, which may contain elements such as: Lead, Vanadium, Cadmium, Bromine, Antimony, Cadmium, Barium, Mercury and Beryllium, among others and that if carried out without due precaution, you can lead to contamination.
- Separation of components: then the selector will separate the items according to the type of component;
- Compaction and packaging: afterwards, the materials will be packed according to the destination for recycling;
- Weighing: the weight of the packaged products to be sent for recycling will be measured;

 Transport / destination: with the materials segregated according to their classification, they are removed to recycling partners that will continue the process of reusing electronic waste.

III. HUMAN RESOURCE ANALYSIS AND STRATEGIES

Objectives, Goals and Strategies

The Cooperative's Human Resources department should have as its main philosophy to serve society through people who are committed and motivated to provide a quality service, for this it selects and invests in people who are willing to learn and improve their hand more and more workforce.

The Cooperative must be aware of the importance of people to achieve its goals, since for them people are the most precious asset they have. The intention is to make all people aware of the importance of each one's work, as the work of each employee is of paramount importance in carrying out the organization's activities. For this reason the organization must work r a developer valuation policy.

Valuing occurs through respect for each employee, regardless of the role they play in the organization, and also by the relentless pursuit of higher levels of safety, both for people who carry out activities inside and outside the organization.

The availability of safety equipment makes people feel safer in the performance of their activities, especially those who work directly in the production process, which requires great care so that the activity can flow without any unforeseen events that may cause any harm. physical harm to people. For this, the organization makes it mandatory to use gloves, lab coats, goggles and boots in productive activities (collection, analysis and separation of materials), in order to minimize the risks of accidents, as well as direct contact of people with materials sharp and can pose risks to health, such as: radioactive substances present in batteries.

Therefore, the main objective of the Cooperative is to serve society in general, providing a quality service that can make people change the way they act, being aware of the importance of the correct destination of electronic waste; as well as the responsibility towards the people who collaborate with the activities of the organization, generating jobs and income and making them feel valued and safe in the performance of their activities, aware of their importance within the process. In this way, we will be fulfilling our main goal: socio-environmental responsibility.

Job Description and Functions

The Cooperative, being a medium-sized Cooperative, must have a very lean staff, with a larger number of people in the productive area. The functional organization chart is structured as follows:



The positions and functions are described as follows:

Position: General Manager

Requirements: Complete Higher Education in Administration, Knowledge of ISO 14000 and Basic Computer Science.

Main Activities: Responsible for HR Management, Production Costs, Development of Marketing Strategies, Logistics Control and Production Monitoring.

Position: Logistics Manager

Requirements: Desirable Complete Higher Education in Administration, Domain of the geographic area of the organization and Basic Computer Science.

Main Activities: Responsible for managing the path of the entire production cycle from the collection of materials to the sending of them to organizations that will give the correct destination, as well as the choice of the most advantageous means of transportation for the organization.

Reporting to: General Manager

Position: Production Manager

Requirements: Desirable Complete Higher Education in Administration, Knowledge of ISO 14000 standards,

Knowledge of Production Management Tools and Basic Informatics.

Main Activities: Responsible for: Managing the pace of production, inspecting if safety rules are being observed, checking if the type of material sent to the organizations that will give the correct destination is in accordance with what was requested.

Reporting to: General Manager

Position: Material Selection Manager

Requirements: Desirable Technical Course in Electronic Equipment, Knowledge of parts found in this equipment and knowledge of parts that can be recycled.

Main Activities: Responsible for specifying the type of material to be selected.

Reporting to: General Manager

Position: Driver

Requirements: Desirable Complete Medium Level, National Driver's License Level C.

Main Activities: Responsible for relocating collectors to material collection locations, as well as conducting home searches for larger materials.

Reporting to: Logistics Manager

Position: Collector

Requirements: Desirable Complete Medium Level

Main Activities: Responsible for collecting in the indicated places, obeying the safety criteria.

Reporting to: Production Manager

Position: Selector

Requirements: Desirable Complete Medium Level

Main Activities: Responsible for selecting the collected materials according to the established by the manager, obeying the safety criteria.

Subordinate to: Material Selection Manager

IV. MARKETING ANALYSIS AND STRATEGIES

Social Marketing

The Cooperative should aim to raise awareness and expand the importance of e-waste management for society, directing it in a correct and sustainable manner. Social marketing should be used as a strategic management of the process of introducing social innovations based on the adoption of individual and collective behaviors, attitudes and practices, guided by ethical precepts, based on human rights and social equity. The practical application of the true concepts of social marketing is essential for social transformation to become a reality within the of organizational objectives organizations. The involvement of organizations in the social area is of paramount importance, however, there is a need for it to be coated with great humility. This means knowing how to listen to the other, especially when dealing with a new environment or job market. Listening and learning are reconstructing a story. The arrogance only blocks the ability to expand new knowledge aimed at the social area, benefiting society.

We analyze some aspects that should be applied for a good social marketing performance:

• Identify the markets in which the organization operates or may operate, its various target audiences and the respective segments;

- Research, analyze and learn about the behaviors, attitudes and practices of the population segments to be reached;
- Establish the positioning that the concept or social cause promoted has in mind of the various target audiences;
- Define, create, propose and develop the social products necessary to obtain the desired behavioral changes;
- Establish the organization's marketing mix (Products, Prices, Promotion, Distribution Points, Target Audiences and Personnel).

Marketing strategies

At first, it is encouraged to focus on the brand and on the services that the Cooperative will provide in a sustainable manner, society must be made to see the brand in various parts of the city and realize that there are organizations concerned with sustainable development, the objective is to promote the services that the Cooperative offers, which is electronic waste collection and later recycling, encourage society to go to the collection point and deposit their electronic waste consciously. Below are some examples of marketing that should be developed with the support of some companies that are interested in developing a sustainable vision and their own brand through the Cooperative:

- Urban furniture
- Print
- Billboard
- TV
- Facebook
- Radio

Some organizations understand social marketing as profitable opportunism; they believe that it is enough to develop a philanthropic project to be perceived as citizen brands or a socially responsible organization. Deception, since a brand-citizen or socially responsible organization is the one that expresses its social responsibility continuously, contributing to the improvement of the quality of social life, and therefore, under no circumstances, can be seen as opportunism. Motivation needs to be legitimate, closely linked to the organization's internal values (mission and vision) and to the sincere desire to benefit society. Lasting, well-planned social actions based on social and ethical responsibility, communicated in an appropriate manner, bear lasting fruit.

The Cooperative must bet on Social Marketing, as it is an excellent marketing tool. Through this tool, it is possible to change society's behavior in order to improve the common well-being of all. If the objective of the so-called social marketing is as and only to increase the profitability or publicize the organization, this is not, effectively, the real social marketing, however, when as a result and not because, the profitability or the disclosure of the organization suffers additions, one can be sure that social marketing is being well targeted.

Another marketing strategy is to make the brand of the companies that hire our recycling services visible to society, making it an additional attraction for companies because we are working on environmental marketing for them.

The idea is to work in the following way: Brand awareness and partners ' brands alone .



E-waste collection cooperative

partners:

V. PRODUCTION ANALYSIS AND **STRATEGIES**

Productive process

1 - Collection:

This is the first step in the process. It collects equipment that is not in use. The material is collected by the cooperative itself, together with the collection points, which are located in shopping centers, and taken to the subunits , where they were stored for seven days.

2 - Transportation:

Every seven days, these materials are transported from the subunits to the central unit, a 500 square meter shed, where the final stages of the process are made .

3 - Material Sorting:

Waste is separated by type of material, such as: iron, copper, silver, gold, plastic, plates, etc.

Unprocessed materials in the cooperative itself, such as cell phone batteries, are packaged and sent directly to the recycling company. Hazardous waste is shipped outside Brazil.

4 - Automation:

The various processes present in the e-waste cooperative are mostly automated. The machines are responsible for packaging and transporting scrap. The cooperative has important tools that assist in production management.

5 - Storage and Destination:

Materials are recorded by quality and type. Packaged and delivered to the companies that will recycle the raw material, the so-called manufacturing companies

VI. LOGISTICS ANALYSIS AND STRATEGIES

Service Logistics

The Cooperative's Logistics has as main objective to practice the so-called "Reverse Logistics" of electronics so that companies can recycle raw materials to reuse them in their production processes.

The process will take place as follows:

• Collection points will be distributed at strategic points in the city:

- \checkmark One in a supermarket located in the south of the city;
- One located at a fair in the south of the city;
- One at the bus terminal in the north of the city;

- \checkmark One at a fair in the north of the city;
- \checkmark One in a supermarket on the west side of the city;
- \checkmark One at a fair on the west side;
- ✓ One at each bus terminal on the east side of the city;
- \checkmark One at a mall on the east side;
- \checkmark One at another mall on the east side;
- \checkmark One in a mall in the south-central area of the city;
- ✓ One at another mall in the south-central area of the city;
- \checkmark One in a store in the city center;
- ✓ One in a supermarket in the center (Carrefour Centro);
- ✓ Shed on the east side of the city making selective collections at home and also in the city dumps;

• A fleet of trucks will be set up to transport the products from the collection points to the Central Shed, which will be located on the east side of the city, where the products will be selected according to what is established by the companies that contracted our services;

• In the shed, the material will be collected and sorted and, later, this material will be packed and loaded on trucks to be transported to the companies associated with the Cooperative that will give the correct destination.



VII. COST ANALYSIS AND STRATEGIES

Strategy Formulation

The services sector has some peculiar characteristics that give it different competitive aspects from manufacturing companies. Competition between service companies takes place in a difficult economic environment, and there are many reasons for this situation: relatively few barriers to entry for competitors; minimal opportunities for economies of scale; erratic fluctuations in sales; disadvantages in negotiations, due to the size of many companies; product substitution; customer loyalty; barriers to the exit of competitors. And in the specific case in question, we will be facing a real break of paradigms regarding the aspect of socioenvironmental responsibility as it is currently seen by society.

In view of the highly competitive scenario in the service sector, strategic cost management is paramount, in view of the need to know and accurately measure the expenses incurred in the company's activities, so that sufficient information can be identified for evaluation the profitability of the client portfolio and also the profitability of each client or the service provided.

Implementation of a cost control system

The s efforts to control costs are interesting as they are added to form the final product price, an important aspect in the characterization of the so - called "competitive companies."

A monthly (or even half-yearly, whichever is more convenient) monitoring of the company's financial performance will be carried out. Accounting analysis for decision making allows this control with instruments such as cash flow. According to GITMAN (2010), cash flow is the blood that flows through the company's veins, and, therefore, a fundamental determinant of the value of the business. Good planning and management of this instrument ensures solvency and generates positive cash flow for owners.

Comparative analyzes of the risk X return type between exclusive investments will enable more effective decision making, avoiding unnecessary indebtedness, because, as we know, depending on the return to be provided, indebtedness becomes, in fact, investments that provide profitability for the company.

In this context, the Cooperative should use cost management reports as an element of communication, transmitting and shaping goals.

In addition, the following competitive strategies must be adopted:

- ✓ Search for Low Cost Customers: Serving some customers costs less than others, and the Cooperative will seek to win them over;
- ✓ Standardization of a Personalized Service: Search for the improvement of the routine in the provision of the service, which will result in a gain of scale and, consequently, a reduction in the unit cost of the service;
- ✓ Reduced Service Interaction in Services: By reducing contact between the customer and the employee, labor costs are significantly reduced.

- ✓ Offline Service Operations: Some services do not require the presence of the customer to provide them; in these cases, the service transaction will be decoupled, reducing expenses with facilities, for example.
- ✓ In addition, the Cooperative , having as philosophy the commitment and motivation of its employees, must strive for wide internal dissemination through e-mail, posters, information about the cooperative and any roundtable sessions with its managers. So that everyone is engaged in achieving the goals.

In addition, the Cooperative , having as philosophy the commitment and motivation of its collaborators, must strive for wide internal dissemination through e-mail, posters, information about the cooperative and eventual round-table sessions with its managers, the so that everyone is engaged in achieving the goals.

The Cooperative will be subject to the Brazilian Accounting Standard, ITG 2004, of November 24, 2017. This standard establishes specific criteria and procedures for recording changes in equity and structure of financial statements, valuation and minimum information to be included in explanatory notes. for the cooperative entity. To start activities, the costs of the Cooperative are estimated as follows:

With an initial capital of 100,000.00 paid in two vehicles and a property.

WORK COSTS (wages) R \$ 18,510.00

(+) INDIRECT COSTS (+) R \$ 800.00

(=) TOTAL COSTS (=) R \$ 19,310.00

CUSTOMER QTY X VALUE OF SERVICE PROVIDED = MONTHLY REVENUE

5 x R \$ 4,600.00 = R \$ 23,000.00

REVENUE R \$ 23,000.00

(-) TOTAL COSTS (-) R \$ 19,310.00

(=) GROSS PROFIT (=) R \$ 3,690.00

(-) ADMINISTRATIVE COSTS

- ✓ WATER
- ✓ ENERGY
- ✓ OFFICE MATERIAL (-) R \$ 1,000.00

(-) COMMERCIAL EXPENSES (-) R \$ 150.00

- (-) FINANCIAL EXPENSES
 - ✓ FINANC. OF FURNITURE AND EQUIPMENT
 (-) R \$ 200.00

(=) NET INCOME (=) R \$ 2,340.00

VIII. FINAL CONSIDERATIONS

Finally, it can be seen that the Cooperative's proposal is to provide a relevant service to society, as it would be working on a major problem that was detected in the city of Manaus: the improper disposal of electronic materials.

The Cooperative must work in such a way that it can provide a quality service and with socioenvironmental responsibility, respecting the environment and, mainly, the quality of life of people, both of the people who are part of the organization and of society in general.

Therefore, the objective of the Cooperative is to make people aware and know the importance of the correct disposal not only of electronic waste, but also of all types of waste produced, as the correct disposal contributes a lot to remove tons of waste that are discarded directly into the environment. Thus, if the main objective of its implementation is achieved, it will be contributing to the preservation of the environment in which we live and, consequently, to the quality of life of future generations.

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Validity of items and Identification of aspects to be improved based on the Client Perception in a Surgery Clinic using the Lawshe Method

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Abstract— The goal of this study was to validate items of a questionnaire and identify issues to be improved in nursing care, according to the perception of patients, in a surgery clinic sector of a private clinic, in the municipality of Macaé, Rio de Janeiro State, Brazil. The Lawshe method (1975) was adopted in order to maintain or exclude items on the questionnaire, comprised by 21 items. The set of questions was applied to 81 patients in the immediate pre-operative period, from November 2018 to March 2019, before undergoing elective surgeries (scheduled and non-emergency). In terms of results, the application of this method presented the items that were given prominence in the socioeconomic profile. The item with the greatest importance in terms of average is "Comfort"; in satisfaction, it is the "Number of professionals"; the greatest GAP is "Timeliness in referral to surgery". It was also presented an analysis of the scatter graph demonstrating the coherence of most items to the right upper quadrant in "maintain".

Keywords— Lawshe, Satisfaction, Nursing Care, Surgery Clinic.

I. INTRODUCTION

Bearing in mind the importance and satisfaction in the provision of services, hospitals prove to be major companies generating relevant assistance services in interpersonal relationships of caring. According to data from the Ministry of Health (BRASÍLIA, 2018), referring to the *Empresa Brasileira de Serviços Hospitalares* (Brazilian Company of Hospital Services) – EBSERH (2018), the satisfaction of whoever is given the service is a condition recognized in patients in the field of health, consolidated by a satisfaction from the achievement of their expectations with respect to the service provided.

As part of the set of institutions, hospitals have unique characteristics, and their complexity has been affecting changes over the course of history, with integrated structures of processes that involve decision-making, planning and execution of services. Patients must be listened to, as they are an essential part of the health-disease process.

In this regard, changes that have been occurring in hospitals have required professionals committed to the production process to meet current social demands. This adaptation to the new management overview has been influencing on the generation of services. There are, on the other hand, the behavioral aspects of service providers, such as creativity, initiative, empathy, flexibility, warmth, and more.

In the context of nursing as a profession focused on social practice in a holistic and socially determined manner, it can be seen that deepening and consolidating methodologies aimed at the quality of health services in the restructuring of internal processes generates benefits for employees and patients.As such, it is worth obtaining a health management progression plan intended to manage improvements in hospital services.

This study adopted a methodology using the Scielo database, based on keywords. These words were refined by publications that referenced foundations and principles intended.According to the survey, the Lawshe method (1975) was applied with the purpose of identifying the essentiality of the items that are part of the questionnaire.

The work aimed at validating the items for the elaboration of the questionnaire, making it possible to evaluate the importance and satisfaction of clients in the immediate preoperative period in a surgery clinic located in a mediumsized private hospital, in the city of Macaé, state of Rio de Janeiro, Brazil.

Hence, the following questions remain:Why should quality in health care be linked? Would it be important to be aware of patient satisfaction in hospital units, especially in the surgical unit, in the pre-operative period?Is there anything essential to make patients feel satisfied with their nursing care? What are the attributes that distinguish the most with the application of the Lawshe method?

II. THEORETICAL BACKGROUND

2.1 Hospital Services

Hospitals are service-providing institutions, with great social implications, high complexity and peculiarities, giving emphasis to high-quality practices, acquiring a specific unique approach. Accordingly, hospital institutions are considered as open systems, which suffer interference from the environment, influenced by evolution and changes in all social fields, interacting with the multidisciplinary social space (BONATO, 2011).

In accordance with Santos (2011), there is a need for planning in hospitals to achieve their goals to deliver services. Managers should operate both strong and weak organizational factors, while motivating their work team. Clients do not tolerate errors, because any dissatisfaction that may affect their lives, causing them harm, is damaging to the service. Souza and Lacerda (2009) affirm that hospital services are expected to be executed effectively and efficiently.

Roeder (2008) states that the latest in hospital administration are the quality programs, which reflect the new state of the services in this market. Future perspectives in the field of medicine are not only linked to new technologies; it is essential to make an urgent analysis of the most appropriate way to manage the services.

2.2 Nursing Services in the Surgery Department

Among the services in health units, there is the surgery clinic, in which the target audience is the patient, who is the one in which the selected treatment refers to the surgical procedure, thus calling him/her a surgical patient. This therapeutic conduct somehow encompasses both an organic and a psychic process, which leads, to some extent, to painful and distressing feelings (PITREZ; PIONER, 2003).

The human essence of the patient is taken into consideration, in a context of admission to an operative procedure, in the initial stage in the surgery clinic. When admitted to the hospital, he/she brings their feelings, their intelligence, their myths, their perceptions acquired in education, culture, and life experiences (DURMAN, 2000).

As a team providing care, and for being the one who makes the first contact with the patient in the surgery clinic, nursing needs to be attentive to recognize these signs, with perception, maturity, promptness and warmth. Caring is the practice defined by behaviors and actions in the practice of foundations, encompassing the way of being and relating (WALDOW, 1998).

In the care context for operative preparation, the patient undergoes significant changes in the preoperative stage, not only in physical aspects but also in psychics, because of prior experiences and thoughts, which in most cases generate feelings of uncertainty and fragility. Nursing care requires nurses in the operating room to take a comprehensive and continuous look at the basic human needs in question, including his or her family, to help him or her with actions and procedures (MOREIRA; POPOV, 2009).

The preoperative period is divided into mediate and immediate preoperative periods. The mediate one comprises the assistance provided to the patient in the scheduled surgeries, in which the operative moment are the elective surgeries. It includes from the admission of the patient to the hospital to 24 hours before the surgery takes place. The primary goal is to prepare the patient, both psychologically and physically, for the operative phase and to stabilize the conditions that may interfere with his/her recovery. The immediate preoperative period begins with providing care to the patient immediately, that is, a few hours before surgery, and ends when surgery is initiated (SENA, 2013; SMELTZER et al., 2002).

As such, Moreira and Popov (2009) describe the preoperative visit as a means of systematizing the care on which the nurse acts in a significant way to provide the patient with emotional support with personal attention on guidelines with respect to the anesthetic-operative procedures to which he or she will be submitted.

This confirms being a consistent, continuous and effective communication tool between the professional nurse and the patient, aiming at valuing and respecting him/her as a person with experiential values and expectations.

Davidow and Malone (2001) affirm the operational aspects of the sector that receives the patient cannot be ignored as components of satisfaction. The field of service development comprises segmenting the clients based on their expectations and expectations concerning the services and adjusting structural and assistance processes with planning to offer them.

2.3 Quantitative Model to Recognize the Content Validity: the Lawshe Proposal

Lawshe (1975) presented a model that organizes a content in a scoreboard, prepared by experts, with the purpose of evaluating skills, knowledge, rights, or other distinctive characteristic of the capacity of a person to be evaluated, and who should have a copy of the test or set of items to be analyzed.

The author (1975) indicates that these categories are associated with the skill, knowledge, or competence measured by the item to develop the task. Since the lecturers score their opinion on each item in categories (1) nonessential; (2) essential; (3) I do not know, the number of matches in the essential category is determined, and it is expected that the major agreements between the participants have in fact more than 50% of agreements, which should occur among the participants in this category, considering that the item has some level of content validity. For defining the consensus of the panel members in the "essential" category, Lawshe suggests, in this method, the calculation of the Content Validity Ratio – CVR for each item of the questionnaire, defined by Equation 1.

Equation 1:

$$CVR = \frac{(n - \frac{N}{2})}{\frac{N}{2}}$$

n:indicates the number of experts who considered the criterion to be "essential ".

N:considers the total number of experts who evaluated the criterion.

Lawshe intended this expression to be interpreted as a correlation to take values from -1 to +1; so that the CVR is negative if the agreement occurs in less than half of the participants; so that the CVR is null if it has exactly half of the agreements panel list; and, lastly, so that the CVR is positive if there are over half the agreements. In addition, one should think it is not only that, positive CVR, but, statistically significant. Because of the anomalies in the tables of CVR minimum values defined by Lawshe (1975), the minimum value of CVR for each criterion was considered (WILSON; PAN; SCHUMSKY, 2012).

2.3 Simple Satisfaction

Simple Satisfaction is a method that considers the client's satisfaction in relation to the attributes, with a differential semantic scale of gradation of five points, in which the extremes indicate 5 - totally satisfied and 1 - totally unsatisfied (FONTENOT, HENKE, CARSON, 2005). The attributes that, according to the respondents, achieve lower mean satisfaction are taken into consideration for possible improvements (MATSUKUMA; HERNANDEZ, 2007).

Lisbôa (2011) adds that the Simple Satisfaction method is founded on the calculation of the mean satisfaction for each attribute, according to the responses of respondents. This method does not consider the importance of the items for the client, so it does not offer any data that can assist the management to prioritize the actions or to break the criteria using the same satisfaction rates (FONTENOT; HENKE; CARSON, 2005).

2.4 GAP Analysis

It becomes possible to calculate the difference between the Importance and Satisfaction means for each attribute using the GAP analysis (MATSUKUMA; HERNANDEZ, 2007). When acquiring a service, clients intrinsically present an initial expectation; hence, when this expectation does not meet the expectations of the client, there is a divergence or GAP. As such, the items indicated for improvement are the ones that show the greatest difference between the satisfaction and importance mean (LISBÔA, 2011).

2.5 Importance versus Satisfaction

This method displays the plotting of the Importance means, on the x-axis (abscissae), and Satisfaction mean, on the y-axis (ordinate), on a graph (Figure 1) formed by four quadrants, which are, "surplus", "maintain", "attention", and "improve".





Based on the analysis of Figure 1, the upper left quadrant ("surplus"), which indicates Satisfaction, is located above the mean, while the one related to Importance is located below the mean. Conversely, the upper right quadrant ("maintain") provides both Satisfaction and Importance above the mean; thus, the attributes positioned in this quadrant should be maintained. Regarding the lower left quadrant ("attention"), both Importance and Satisfaction are below the mean; consequently, the items in this position deserve attention, since they may become important. Finally, the lower right quadrant ("improve") indicates Importance is above the mean, while Satisfaction is below the mean; so, the items in this quadrant need improvement and should be prioritized (MATSUKUMA; HERNANDEZ, 2007; LISBÔA, 2011).

This methodology emphasizes the identification of which attributes are found in the "improve" quadrant and, by this identification, recommendations for actions and proposals for improvement to reverse the scenario are made. If many attributes are found in this quadrant, and the organization does not have the resources to improve them as a whole, it is important to concentrate on those with the highest level of Importance and low level of Satisfaction (FONTENOT; HENKE; CARSON, 2005).

2.6 Multiplicative Approach (Weighted Dissatisfaction)

A Multiplicative Approach, or Weighted Dissatisfaction, is shown by the calculation of the difference between the highest (totally satisfied) Satisfaction score and the mean Satisfaction identified by the consumer on the performance of attributes related to services or products. The result of this mean is then multiplied by the mean of the importance assigned to the item by the respondents, obtaining the Weighted Dissatisfaction Index. The attributes that present the highest values are considered critical and should be prioritized in the implementation of improvements (MATSUKUMA; HERNANDEZ, 2007; LISBÔA, 2011).

III. METHODOLOGY

This research was conducted from November 2018 to March 2019, and patients in the preoperative phase of elective surgeries answered 81 questionnaires.

In this stage, the following methodological steps are described:

- Elaboration and application of the questionnaire;
- Data collection;
- Application of the Lawshe method;
- Application of the Likert scale.

3.1 Preparation and Application of the Questionnaire

At first, the search for abstracts and citations of the scientific literature was carried out in the Scielo database, refining articles that addressed the principles and foundations scored in this study. Four keywords were used for this search: "Quality in nursing care", "Preoperative visit", "Quality in surgical nursing care" and "Perioperative care". This resulted in 16 articles for their proximity to the theme concerned. From the 16 articles analyzed, a compilation of the contextualization of each of them was made.

For the preparation of the questionnaire, the evaluation criteria identified in the selected articles were grouped by blocks of nursing services, hospital structural resources and factors intrinsic to the surgical patient.

Table 1 shows the distribution of items per articles, as well as how repeated they are.

Items	Articles*															
Items	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16
1 – Calmness						Х							Х			
2 - Confidence in well- being in the surgery clinic						Х							Х			
3 – Feeling of security in preoperative procedures				Х		Х					Х		Х		Х	
4-Progressiveimprovementinpreoperative events													Х			
5 - Quality in care	Х		Х	Х		Х	Х	Х	Х	Х		Х	Х			
6 - Decrease of anxiety					Х											
7-Time to clarify doubts					Х									Х		
8 – Guarantee			Х					Х								
9 - Confidence of being under the care of a nursing staff								X								
10 - Nursing staff	X	X		Х			Х	X								
11- Risksrelatedtoproceduresofanesthesia in surgery											Х					
12 - Guidelines on surgery			X													
13 - Personal attention												Х				
14 – Welcoming																Х
15 – Comfort																Х

Table 1 – Distribution of attributes per articles

* A1 -Level of satisfaction of clients in a private hospital; A2 - Patient satisfaction according to the way the patient is admitted to a university hospital; A3 -Need for care: the patient view and the nursing staff; A4 -Systematized care in cardiac preoperative: Theory of Transpersonal Care from the perspective of nurses and clients; A5 - Behind the mask, a look that cares: preoperative nursing visit; A6 - Preoperative Nursing Visit; -Patients' opinion; A7 -Evaluating the performance indicator surgical suspension as a quality factor in surgical patient care; A8 -Response of the nursing service in the view of the client; A9 - Nursing diagnosis in surgery clinic; A10 - Indicators of assistance in a surgery clinic; A11 -Design of a tool to measure perceptions about the use of the checklist of the Safe Surgery Program of the World Health Organization; A12 -Analysis of intensity, sensory and affective aspects of pain in patients in the immediate postoperative period; A13 - Nursing in Surgery Room: thirty years after the creation of the Perioperative Nursing Assistance System; A14 - Knowledge and expectations of women in the immediate preoperative of elective surgery; A15 - Nurse practice in patient care in the immediate preoperative period of elective surgery; A16 - Evaluation of the intensity and discomfort of perioperative thirst.

Source: Elaborated by the author (2019)

Table 1 shows that the items that had the most emphasis were "Quality in care", appearing ten times, followed by "Nursing Staff" and "Security", which are repeated five times. "Time to clarify doubts" was repeated three times. "Guarantee", "Confidence", and "Calmness" each appeared in two articles. The other ones were in only one article each totaling 15 criteria.

The service blocks were evaluated under the following Lawshe criteria (1975): (1) non-essential; (2) essential; (3) I do not know. Other important criteria to be followed are the respondent profile, that is, gender; marital status; age bracket; family income; education; and if surgery has been performed before, according to the model of the completed questionnaire described in (APPENDIX A).

Considering the perception of nursing supervisors, open questions were applied in order to include in the study the commitment of those who take care. These questions were the following:

- What are the most important aspects for you to leave the patient satisfied with the services provided in the surgery clinic?
- What are the positive points you highlight that are found in the surgery clinic in the preoperative phase?
- What are the negative points you highlight that are found in the surgery clinic in the preoperative phase?

Based on the reports obtained, six items were added to the final questionnaire, providing relevance and identity to the study. These items were "Professionalism"; "Nursing staff concern"; "Clothing"; "Bed (patient unit)"; "Number of professionals"; and " Timeliness in referral to surgery".

Also, under this view, some previous items were also rewritten in order to facilitate the understanding of the respondent. These items were "Confidence" – "Confidence in well-being in the surgery clinic"; "Security" – "Feeling of security in preoperative procedures"; "Progressive improvement" – "Progressive improvement in preoperative events"; and "Confidence" – "Confidence of being under the care of a nursing staff".

Data Collection

The object of research was refined to determine a probabilistic sample of patients admitted to a surgery clinic at a private hospital, located in the municipality of Macaé, state of Rio de Janeiro, in the immediate preoperative phase of elective surgeries. For delimiting the sample, a survey of surgeries at the elective surgical moment of 2018 was conducted, which resulted in 2908 surgeries, considering both elective and emergency operative moments, resulting in a monthly average of 242 surgeries.

As such, a free and informed consent form – FICF (Appendix B) was applied, with all the data of the researcher and the study in question. Therefore, the research complies with the criteria of research ethics with human beings, according to the NHC (National Health Council) resolution n° 466/12. Before being referred to the operating room, 90 patients were approached in bed, but nine refused to participate in the study, so 81 questionnaires were responded to.

After data collection, the questionnaires were transferred to a spreadsheet in Microsoft Excel 2010 software. To list the criteria, an analysis was conducted using the interviews, according to the profile of patients, delimited as follows:

- Sex;
- Marital status;
- Age bracket (from 20 to 69 years old);
- Family income (from 1 to more than 10 minimum wages);
- Education (from elementary to university education);
- Performance or not of any previous operative procedure.

Accordingly, it was developed an analysis of perception of patients in relation to nursing care considering the items consideredregarding the importance and satisfaction of the dimensions presented.

Application of the Lawshe Method

The method proposed by Lawshe (1975) validates the items that make up the questionnaire by means of a statistical analysis of the criteria considered essential. Hence, after the survey of 15 criteria found by means of the initial literature review, six more items were added due to the contribution of nursing supervisors, being a valuable component of the study, totaling 21.

The Content Validity Ratio (CVR) of each criterion was calculated, of which 21 criteria were regarded as valid by the participants. To perform this calculation, the following formula developed by Lawshe (1975) was applied, defined by Equation 2.

Equation 2

$$CVR = \frac{\left(n - \frac{N}{2}\right)}{\frac{N}{2}}$$

in which "n" is the number of experts who classify each item as "essential" and "N", the number of patients who responded to the questionnaire, excluding those who did not know or "IDK" (SOUZA et al., 2015).

In the questionnaires, the validation according to the Lawshe criterion was performed in the following categories: (1) not important; (2) important, but not essential; (3) essential; and (IDK) I do not know, besides containing data related to the profile of respondents, and socioeconomic and cultural aspects.

The Likert Scale for Evaluating Items

After validating the criteria that compose the questionnaire, the Likert scale was adopted in order to

collect the data to determine the level of importance and satisfaction of patients with regard to nursing care.

Criteria were used in the questionnaire to measure the level of satisfaction and importance of each item cited by the Likert five-point scale (LIKERT, 1932), and five alternatives were presented in gradation (1 to 5) and one more option of abstention (N - I do not know). The judgment scale for the two dimensions of satisfaction and importance adopted was as follows: 1 - very low; 2 - low; 3 - medium; 4 - high; 5 - very high. Based on the answers to these questionnaires, an analysis of the results was prepared.

IV. RESULTS OF THE RESEARCH

Table 2 shows the overall result of perception of items considered essential by clients/visitors, and the items that could be excluded or maintained are observed. This Table is particularly relevant for presenting a view of the whole, which evidences what can be considered as essential for the researched public, patients, and for observing the items that could be excluded or maintained.

		1					
Items		ne	Ν	%essenciais	CVRcal	CVRcrí	Decision
					с	t	
1.	Calmness	19	19	100.0%	1.000	0.450	Maintain
2.	Confidence in well-being in the surgery clinic	16	19	84.2%	0.684	0.450	Maintain
3.	Feeling of security in preoperative procedures	16	19	84.2%	0.684	0.450	Maintain
4.	Progressive improvement in preoperative events	8	19	42.1%	-0.158	0.450	Exclude
5.	Quality in care	14	19	73.7%	0.474	0.450	Maintain
6.	Decrease of anxiety	10	19	52.6%	0.053	0.450	Exclude
7.	Time to clarify doubts	11	19	57.9%	0.158	0.450	Exclude
8.	Guarantee	9	19	47.4%	-0.053	0.450	Exclude
9.	Confidence of being under the care of a nursing staff	14	19	73.7%	0.474	0.450	Maintain
10.	Nursing staff	16	19	84.2%	0.684	0.450	Maintain
11.	Risks related to procedures of anesthesia in surgery	11	19	57.9%	0.158	0.450	Exclude

Table 2: Application of the Lawshe Method

12. Guidelines on surgery	8	19	42.1%	-0.158	0.450	Exclude
13. Personal attention	19	19	100.0%	1.000	0.450	Maintain
14. Welcome	18	19	94.7%	0.895	0.450	Maintain
15. Comfort	14	19	73.7%	0.474	0.450	Maintain

Source: Elaborated by the author (2019)

In this stage, the results obtained with the application of the research using the Lawshe method are displayed. Table 2 depicts that, after the application of the method, from the perspective of 19 patients, nine items had the judgment to be **maintained**: Calmness and confidence, with 100%; welcome, with 94.7%; confidence, security, and nursing staff, with 84.2%; and comfort, quality in care, and confidence, with 73.7%.And six items had as **exclusion** judgment: important moment to clarify doubts and risks to the surgical anesthetic procedures, with 57.9%; decrease of anxiety, with 52.6%; guarantee, 47.4%; and, finally, guidelines on surgery and continuous improvement, with 42.1%, which were evaluated to be maintained in the study due to the proximity and importance in the relations of assistance to the operating room.

In this way, the need for all 15 component items to be maintained for the questionnaire was judged. Besides these, a new phase was investigated with the nurses as leaders of the surgery clinic staff, thereby adding six more items.

The questionnaire in question has the following items: 1 - Calmness; 2 -Confidence in well-being in the surgery clinic; 3 -Feeling of security in preoperative procedures; 4 - Progressive improvement in preoperative events; 5 -Quality in care; 6 - Decrease of anxiety; 7 -Time to clarify doubts; 8 - Guarantee; 9 -Confidence of being under the care of a nursing staff; 10 -Nursing staff; 11 -Risks related to procedures of anesthesia in surgery; 12 -Guidelines on surgery; 13 -Personal attention; 14 -Welcome; 15 -Comfort; 16 -Professionalism; 17 -Nursing staff concern; 18 -Clothing; 19 -;Bed (patient unit) 20 -Number of professionals; and 21 -Timeliness in referral to surgery.

Mapping of Patient Admission Process

When analyzing Figure 2, it can be observed the flowchart of the patient with operative need by means of the management of elective surgery (scheduled and non-emergency surgery).



Fig.2: Flowchart of the patient within the hospital Source: Elaborated by the author (2019)

Elective surgery is performed through two access routes (Figure 2), either by the surgeon or by transference (internal or external). When arriving at the hospital, the patient is directed to the reception desk and sent to the inpatient sector, where the identification record is made, for which he/she has to present the civil identity, health insurance card, and the medical request for admission.

Afterwards, the hospital employee sends the patient to the surgery clinic, on the third floor, after reading and signing the consent form. In this block, he/she is received by the nursing staff, which will install he/she in the patient unit (bed), where it performs the preoperative care (measurement of vital signs, delivery of the trousseau, among others), thus ending with the registration in the medical record and waiting for the call to the operating room.

Profile of Respondents

The profile of respondents evaluated was drawn based on some factors, such as female and male gender; marital status (single, married/stable union, widower or divorced); age bracket (20 to 69 years); family income (income bracket between one salary and more than ten minimum wages); level of education (incomplete elementary, complete elementary, complete high school, complete college degree and incomplete university degree); finishing with or without some surgical procedure, both with yes and no answer options.

As can be seen in Figure 3, male and female questions show that 54% of respondents are male and 46% female, not showing a significant imbalance in the sample.





Source: Elaborated by the author (2019)

Male/Female

In relation to marital status, as depicted in Figure 4, 79% of respondents are married/stable union; 19% are single; 1% are widowed; and 1% are divorced.



Fig.4: Percentage of respondents per marital status Source: Elaborated by the author (2019)

Figure 5 presents the percentage of respondents per bracket group, of which 33% are between 30 and 39 years old; 23%, between 50 and 69 years old; 19%, between 40 and 49 years old; 15%, between 25 and 29 years old; and

10%, between 20 and 24 years old. This is very noticeable in the age bracket of greater prevalence, since there is a favorable clinical condition for elective operative practices.



Fig.5: Percentage of respondents per age bracket Source: Elaborated by the author (2019)

As noted in Figure 6, the question regarding family income demonstrates that 36% of respondents have income from three to five minimum wages; 26%, from two to three minimum wages; 21%, from five to ten minimum wages; 16%, from one to two minimum wages; and 1%, income not exceeding one minimum wage. By the characteristic of the private hospital sector, one can see the prevalence of patients affiliated to health insurance companies, associated to employment contracts.



Fig.6: Percentage of respondents per family income Source: Elaborated by the author (2019)

In relation to the level of education of respondents, Figure 7 shows that 59% have complete high school; 22% have complete college education; 10% have complete elementary school; 8% have incomplete college education; and 1% have incomplete elementary school. Thus, it can be identified that the market is absorbed by high school professionals.



Fig.7: Percentage of respondents per education level Source: Elaborated by the author (2019)

Figure 8 proves that 64% of respondents have already had experience with surgical, dental, and/or medical procedures. Regarding that, it should be noted the results of other operative experiences influence the recognition of satisfaction and importance during hospitalization.



Fig.8: Percentage of respondents with previous surgery Source: Elaborated by the author (2019)

V. RESULTS AND DISCUSSIONS

1.5.1 Level of Importance

Figure 9 shows the means and the standard error related to the Level of Importance of the items that compose the questionnaire.

ance	Level of Importan	
4	2 3	
	4,95 A	15- Comfort
	4,94 A	5- Quality in care
	4,91 A	9- Confidence of being under the care of nursing staff
1	4,91 A	16- Profissionalism
,	4,90 A	19- Bed (patient unit)
ŀ	4,90 A	14- Welcome
ŀ	4,89 A	13-Personal Attention
ŀ	4,88 A	2- Confidence in well-bring in the sugery clinic
٢	4,88 A	17- Nursing staff concern
F	4,87 A	4- Progressive improvement in preoperative events
	4,87 A	12- Guidelines on sugery
F	4,86 A	20- Number of professionals
	4,84 A	3- Felling of security in preoperative procedures
	4,84 A	10- Nursing Staff
	4,81 A	- 1- Calmness
	4,81 A	6- Decrease of anxiety
	4,81 A	- 18- Clothing
	4,80 A	7- Time to clarity doubts
	4,79 A	8- Guarantee
	4.78 A	21- Timeliness in referral to surgery
	4.69.8	11- Risks related to procedunes of anesthesia in surgery
T	4,05 A	

Fig.9: Level of Importance (means and standard error) Source: Elaborated by the author (2019)

From Figure 9, it can be observed that "comfort" was considered the most important item in the view of the respondents. Nevertheless, all items presented a high level of importance, once the graph shows that the results are between 4.95 and 4.69, being 5 (very high or very important) the highest value susceptible of response.

Furthermore, the items do not significantly differ from the means (P>0.05), as, according to the Tukey test, letter A was maintained for all the items.

1.5.2 Level of Satisfaction

In Figure 10, it is possible to examine the means and the standard error relevant to the Level of Satisfaction of the items in the questionnaire.

	Level of Satisfaction 1 2 3 4	5
- 20- Number of professionals	4,76 A	1
- 9-Confidence of being under the care of nursing staff	4,75 A	
- 10 Nursing Staff	4,75 A	
- 16- Profissionalism	4,73 A	
- 2- Confidence in well-bring in the sugery clinic	4,69 A	
14- Welcome	4,68 AB	
5- Quality in care	4,68 AB	
13- Personal Attention	4,67 AB	
8- Guarantee	4,66 AB	
19-Bed (patient unit)	4,64 AB H	
17 Nursing staff concern	4,63 AB	
15- Comfort	4,60 AB	
18- Clothing	4,60 AB	
4 Progressive improvement in preoperative events	4,58 AB	
12- Guidelines on sugery	4,57 AB	
7- Time to clarity doubts	4,57 AB	
 Felling of security in preoperative procedures 	4,57 AB	
1- Calmness	4,54 AB	
6- Decrease of anxiety	4,51 AB	
11 Risks related to procedunes of anesthesia in surgery	4,39 AB	
21-Timeliness in referral to surgery	4,22 B	

Fig.10: Level of satisfaction (means and standard error) Source: Elaborated by the author (2019)

In Figure 10, it is observed the item "Number of professionals" is the one with the highest level of satisfaction. Nevertheless, as in the graph of the level of Importance, also in the level of Satisfaction, the means were high, all above 4, ranging from 4.76 (highest mean) for the item "Number of professionals", and 4.22 (lowest mean), for the item "Timeliness in referral to surgery".

Conversely, the item "Timeliness in referral to surgery", with the lowest mean score for Satisfaction, shows a difference in relation to the Tukey test, with the Satisfaction being no longer "very high", unlike all other items, not presenting the letter A, that is, presenting significant difference (P>0.05).

1.5.3 GAP





Fig.11: GAP



The GAP, in Figure 11, shows the difference between Importance and Satisfaction of the items that compose the questionnaire. As such, the items with the highest GAP have high Importance and low Satisfaction, as is the case, for instance, of the item "Timeliness in referral to surgery". On the other hand, the items with the lowest GAP, such as "Nursing Staff", have low Importance and high Satisfaction.

3.5.4 GAP Method

Table 3 illustrates the reference values assigned to each of the items with regard to Importance, Satisfaction, and GAP.

DESCRIPTION	IMPORTANCE	SATISFACTION	GAP
1- Calmness	4.81	4.54	0.27
2- Confidence in well-being in the surgery clinic	4.88	4.69	0.19
3- Feeling of security in preoperative procedures	4.84	4.57	0.28
4- Progressive improvement in preoperative events	4.87	4.58	0.29
5- Quality in care	4.94	4.68	0.26
6- Decrease of anxiety	4.81	4.51	0.31
7- Time to clarify doubts	4.80	4.57	0.23
8- Guarantee	4.79	4.66	0.13
9- Confidence of being under the care of a nursing staff	4.91	4.75	0.16
10- Nursing staff	4.84	4.75	0.09
11- Risks related to procedures of anesthesia in surgery	4.69	4.39	0.29
12- Guidelines on surgery	4.87	4.57	0.30
13- Personal attention	4.89	4.67	0.22
14- Welcome	4.90	4.68	0.22
15- Comfort	4.95	4.60	0.35
16- Professionalism	4.91	4.73	0.19
17- Nursing staff concern	4.88	4.63	0.25
18- Clothing	4.81	4.60	0.22
19- Bed (patient unit)	4.90	4.64	0.26
20- Number of professionals	4.86	4.76	0.11
21- Timeliness in referral to surgery	4.78	4.22	0.56

Table 3: Values assigned to each of the items for Importance, Satisfaction, and GAP.

Source: Elaborated by the author (2019)

In this Table 3, it is possible to analyze the 21 items that make up the questionnaire with the tabulated data on Importance, Satisfaction and GAP, in a way that makes the comparison of them easier.

Hence, it can be seen that the reference item regarding Importance, with a mean of 4.95, is the item "Comfort". This same item also has a mean of 4.60 for Satisfaction and 0.35 for GAP.

As for the highest mean of Satisfaction, the item "Number of professionals" is highlighted, with a mean of 4.76. This same item also presents 4.86 with regard to Importance and 0.11 with respect to the GAP mean.

In relation to GAP, the highest average was given in the item "Timeliness in referral to surgery", with 0.56, with a mean of Importance of 4.78 and Satisfaction of 4.22.

1.5.5 Weighted Dissatisfaction

Figure 12 shows the Weighted Dissatisfaction in relation to the items evaluated in the questionnaire applied.



Fig.12: Weighted Dissatisfaction

Source: Elaborated by the author (2019)

The Weighted Dissatisfaction (Figure 12) demonstrates the dissatisfaction of patients who responded to the questionnaires in relation to the items evaluated, being the item that generates the greatest dissatisfaction the "Timeliness in referral to surgery", with a value of 8.50, followed by "Risks related to procedures of anesthesia in surgery", with a mean Weighted Dissatisfaction of 7.55. On the other hand, the item with the lowest Weighted Dissatisfaction is "Number of professionals", with a mean of 6.02.

1.5.5 Multiplicative Approach Method

Table 4 shows the reference values for the level of Satisfaction, Level of Dissatisfaction, Level of Importance, and Weighted Dissatisfaction.

Table 4: V	Value of 1	reference d	of Satisfaction,	Dissatisfaction,	Importance,	and Weighted	Dissatisfaction.
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Description	Reference	Satisfaction	Dissatisfaction	Importance	Weighted Dissatisfaction
1 Columnage	6.00	4.54	1.46	4.01	7.02
1- Caimness	0.00	4.54	1.40	4.81	7.02
2- Confidence in well-being in	6.00	4.69	1.31	4.88	6.39
the surgery clinic					
3- Feeling of security in	6.00	4.57	1.43	4.84	6.92
preoperative procedures					
4- Progressive improvement in	6.00	4.58	1.42	4.87	6.91
preoperative events					
5- Quality in care	6.00	4.68	1.33	4.94	6.57
6- Decrease of anxiety	6.00	4.51	1.49	4.81	7.16
7- Time to clarify doubts	6.00	4.57	1.43	4.80	6.86
8- Guarantee	6.00	4.66	1.34	4.79	6.41
9- Confidence of being under	6.00	4.75	1.25	4.91	6.13
the care of a nursing staff					
10- Nursing staff	6.00	4.75	1.25	4.84	6.05
11- Risks related to procedures	6.00	4.39	1.61	4.69	7.55
of anesthesia in surgery					
12- Guidelines on surgery	6.00	4.57	1.43	4.87	6.96

13- Personal attention	6.00	4.67	1.33	4.89	6.50
14- Welcome	6.00	4.68	1.32	4.90	6.46
15- Comfort	6.00	4.60	1.40	4.95	6.93
16- Professionalism	6.00	4.73	1.28	4.91	6.28
17- Nursing staff concern	6.00	4.63	1.37	4.88	6.68
18- Clothing	6.00	4.60	1.40	4.81	6.73
19- Bed (patient unit)	6.00	4.64	1.36	4.90	6.66
20- Number of professionals	6.00	4.76	1.24	4.86	6.02
21- Timeliness in referral to	6.00	4.22	1.78	4.78	8.50
surgery					

Source: Elaborated by the author (2019)

Analyzing Table 4, the means presented among the four segments (Satisfaction, Dissatisfaction, Importance, and Weighted Dissatisfaction) are compared. With regard to Dissatisfaction, the item with the highest mean is "Timeliness in referral to surgery", with 1.78.

This same item presents, in relation to Satisfaction, the mean of 4.22; in relation to Importance, 4.78; and, finally, concerning Weighted Dissatisfaction, the mean of 8.50, that is, the item highlighted in this topic presents the highest means for both Dissatisfaction and Weighted Dissatisfaction.



Fig.13: Importance versus Satisfaction

Source: Elaborated by the author (2019)

In Figure 13, the four quadrants of the scatter graph are analyzed: "surplus", "maintain", "attention", and "improve". Apparently, in a superficial analysis, all items are in the right upper quadrant, i.e., "maintain". Hence, it shows high Satisfaction and greater importance of the items from the perspective of the respondents of the questionnaire.

3.5.6 Importance *versus* Satisfaction (enlarged image)

In Figure 14, the "surplus" and "maintain" quadrants were enlarged to facilitate the visualization of the items.

It is possible to observe the enlargement of only the "maintain" quadrant and, in this way, make the individual analysis of the items.



Fig.14: Enlargement of the "maintain" quadrant Source: Elaborated by the author (2019)

Items 11 and 21 differ from the others. Item 11 refers to "Risks related to procedures of anesthesia in surgery", and item 21 corresponds to "Timeliness in referral to surgery". Item 11 presents 4.69 as to Importance and 4.39 as to Satisfaction. On the other hand, item 21 presents 4.78 regarding Importance and 4.22 concerning Satisfaction.

VI. FINAL CONSIDERATIONS

Results indicate there is still an operational need to conduct management processes that strengthen health staff to be well trained and aware regarding client assistance. Regarding the attributes researched, it was evidenced that, in general, all of them are closely linked to interpersonal and interprofessional relationships, mainly for the nursing and generators of medical staff. relationships and communication. Nevertheless, the need to raise the standards of quality in health services of the operating room should not be eliminated, recognizing patient satisfaction as an important indicator for measuring the quality of health services, as well as guiding the planning of actions in a holistic and systematic way, decision making, and monitoring of the results of services.

Results indicate that, analyzing the 21 items that compose the questionnaire applied in this study, the item that is most important as to the mean for the respondents is the 15, "Comfort", with 4.95. As for satisfaction, the item that is highlighted with the mean 4.76 is item 20, "Number of professionals", with 4.95. In terms of GAP, that is, the difference calculated between the values of Importance and Satisfaction, the item with the highest GAP is 21, "Timeliness in referral to surgery", with a mean of 0.56.

In the stage of Dissatisfaction and Weighted Dissatisfaction, the item with emphasis is 21, "Timeliness in referral to surgery". As for Dissatisfaction, the mean was 1.78, and as regards Weighted Dissatisfaction, 8.50.

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Nursing Assistance to Patients in Paliative Oncological Care: Integrative Literature Review.

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Abstract— Objective: to know the scientific evidence about the role of nurses in palliative cancer care. *Method:* this is a bibliographic study, descriptive, literature review type, with searches performed in the virtual libraries Scientific Electronic Library Online and Virtual Library in Health. The sample consisted of 17 articles, and the data were processed in the SOFTWARE IRAMUTEQ® and analyzed descriptively by the Reinert method. **Results:** six classes were organized and, of these, four categories emerged: Class 1 - Emotional support of professionals and family in relation to palliative cancer care; Classes 2, 5 and 6 – Evidence-based practices promoting interventions to nursing care; Class 3 - The importance of coping strategies for reconfiguration of care for quality in nursing care; Class 4 - Process of knowledge about palliative care and deficits in care. **Conclusion:** it was identified that it is fundamental the role of nurses in the execution of palliative care, whether in the initial or terminal phase of cancer patients, providing less aggressive interventions and better quality of life.

Keywords — Nursing Care, Palliative Care, Oncology Nursing, Hospice and Palliative Care Nursing, Nursing Research.

I. INTRODUCTION

Cancer is characterized by abnormal growth of cells that have the ability to spread between tissues. Thus, and can occur in more than one hundred different types of cells, these divide rapidly and are often very aggressive and uncontrollable, which determines the formation of tumors, which can spread to other areas of the body, causing metastases (SILVA, FCF, et al. 2020). Thus, cancer treatment is extensive and traumatic for everyone involved: patient, family and health professionals. Even with the use of all curative technological resources, in all cases when there is a possibility of cure, there is psychological, social, spiritual and physical suffering during the treatment. (SOUSA ADRS, et al. 2019). In this sense, patients diagnosed with cancer may use palliative care treatment during the disease (SOUSA ADRS, et al. 2019). Therefore, interventions in palliative care are of paramount importance to try to minimize suffering, especially in patients with metastasis, as well as to relieve and improve the patient's life condition. This care does not replace conventional treatments, but is added to them, being very significant at the beginning of the disease reducing psychosocial damage (Dr. DOSE; Dr. MCCABE; Dr. SLOAN, 2018).

The World Health Organization (WHO) characterizes palliative care as a specialty that offers total care of the patient's body, mind and spirit and also offers support to the family (SOUSA ADRS, et al. 2019). Thus, in palliative care, the patient and the family are the main focus, aiming at the control and relief of physical, spiritual and psychosocial suffering, so that quality care and a dignified death can be achieved (SEMTCHUCK ALD, et al. 2017).

According to SILVA, FCF, et al. 2020, considering that care is an important action for health promotion and recovery, including for those patients with no prospects for cure and survival, it is essential that the performance of health professionals in the area of palliative care should be based on participation of a multidisciplinary team, as this model of care recommends care related to the following aspects: physical, spiritual, mental and social body of patients. (BRANDÃO, MCP, et al, 2017).

In this sense, for quality care, the presence of a multidisciplinary team is paramount. Among these professionals, the nursing team stand out for being at all times and maintaining direct contact with the patient and his family, thus strengthening a humanized vision that transcends the physical issue. Although there is no cure, the nurse's relationship with the patient and family does not end, on the contrary, the relationship becomes closer, consequently the bond increases, bringing benefits to both (SEMTCHUCK ALD, et al, 2017).

With its professional practice, nurses can provide the patient with favorable welfare and the possibility of healing, and provide comfortable, basic and pathophysiological care, as well as being attentive to the wishes, desires and needs of patients. (BRANDÃO, MCP, et al, 2017). According to Law No. 52/2012 on the Bases of Palliative Care, health professionals must be prepared and properly trained to promote a better quality of life and comfort for patients affected by cancer. It is very important that patients' wishes and wishes are respected and attended to for the integrality of this well-being.

Therefore, nursing interventions in Palliative Cares should start at the time of diagnosis together with curative

care and remain throughout the treatment. The individual diagnosed with cancer certainly achieves an excellent quality of life if there is early diagnosis of the disease and the implementation of palliative care. In addition, it is essential to highlight the importance of planning nursing actions in the development of palliative care, identifying that care is important so that the impact that cancer on the lives of patients and their families can be efficiently controlled (SOUSA ADRS, et al. 2019).

In addition, it is important to pay attention to the measurement of pain in cancer victims, since the basis of palliative care is the reduction of distress, which in most cases, is related to this vital sign. Pain arises from physical, biological and biopsychosocial factors that determine the carcinogen, therefore, the role of nurses is fundamental, and should be based on systematic and judicious assistance to identify problems and elaborate the diagnoses and expected nursing results for be able to intervene with this care (MELLO; et al, 2019).

Given the above, it is evident that the palliative care provided by nurses to cancer patients is essential, as they provide benefits to individuals such as reducing pain and bringing comfort to their families (BRANDÃO, MCP, et al, 2017).

The experiences, both academic and personal, are expressions of data treated by authors, where the implementation of this care makes all the difference in the care provided to patients with cancer, especially for those with no expectation of cure, but this practice needs to be strengthened in the daily lives of professionals from both the hospital and primary care areas. Example, brandão, MCP, et al (2017), is cited, which in their study perceives that the professional's initiative and the performance of the multidisciplinary team are essential for the success of palliative care.

This study is relevant since we observed more the application of this care in terminal patients, being little offered in the initial phase of diagnosis. And even in the terminal phase, there are gaps in their employment and this happens in the face of factors such as overload of the professional, excessive workload and lack of training. Psychological unpreparedness of the professional to attend this contingent of cancer patients, as well as their family members who are fragile, added to the ignorance or neglect of this action.

Thus, it presupposes a deficit in professional training in the face of quality training based on scientific evidence. With that, we observed in our academic experience, the interest of Teaching and Research Institutions in developing educational events focused on this theme. In view of this theme, considering that the nursing team is the one that most dedicates itself to caring for people, the study presents the following guiding question: What is the scientific evidence on the role of nurses in palliative oncology care?

Therefore, the study aimed to: Know the scientific evidence on the role of nurses in palliative oncology care.

II. METHOD

This is a bibliographic, descriptive analysis, type integrative literature review, which allowed exploring and understanding a distinct theme from other independent studies. It is noted that the execution of the study was carried out in five main stages: identification of the fundamental question of the study; search in the literature; definition of inclusion and exclusion criteria; evaluation of the data; interpretation and discussion of the results and presentation of the review/ synthesis of knowledge. With this, the following guiding question was used to guide the integrative review: What are the main care nursing offers for patients in palliative care and the challenges faced.

For the realization of this study, it was consulted, virtual libraries Scientific Electronic Library Online (SciELO), Virtual Health Library (VHL) and PubMed database. For the search, the descriptors in Health Sciences (DeCS) were used, namely "Oncological Nursing", "Nursing Care" and "Palliative Care", using the Boolean operators "AND" and "OR" for perform associations of all descriptors with each other.

The search was conducted during the period from 03 to 20 November 2020. The following inclusion criteria were considered for the selection of the material: full articles; available in open access in Portuguese and English published in the years 2016 to 2020.

Initially, 2,838 publications were found, however, after applying the inclusion criteria, this amount was reduced to 1,283 articles. 153 articles were found in the VHL, 12 in SciELO and 1,118 in PubMed, with 8 duplicated articles in the VHL, 2 in Scielo and 43 in PubMed. Thus, after reading the titles, 178 articles were selected and 50 articles were summarized, leaving 17 studies selected for full reading, 02 in the VHL, 02 in Scielo and 13 in PubMed. 1,180 articles were excluded because they were not complete or did not answer the research question. Therefore, 17 articles were selected for the analysis and elaboration of the textual corpus. **Table 1** shows the table for the article selection process.

Data base Found **Duplicates** Excluded Selected Included BVS 153 2 8 139 6 Scielo 12 2 4 2 6 Pubmed 1.118 43 1.035 40 13

Table 1 - Results of articles of agreement in the investigated databases, in the period from 2016 to 2020. Belém (PA), Brazil,2020.

From the pre-reading of each selected article in the search, it was possible to evaluate and characterize them according to authorship, year of publication, title, virtual libraries, objective, method, main conclusions and levels of evidence.

Studies were considered as strong evidence (metaanalysis of multiple studies controlled-Level 1; individual study with experimental-Level 2 design), moderate evidence (study with almost-experimental design as a study without randomization with single group before and after test, time series or case-control-Level 3; study with non-experimental design as correlational and qualitative descriptive research or case-level 4 studies; case report or data obtained systematically, of verifiable quality or program evaluation data-Novel 5), weak evidence (opinion of reputable authorities based on clinical competence or opinion of expert committees, including interpretations of information not based on Level 6 research).

The textual corpus was elaborated with the conclusions of the articles, organizing it in a single text file for processing and analysis in the software IRAMUTEQ® (Interface of R pour lês Analyses Multidimensionnelles de Textes et de Questionnaires). Camargo BV, Justo AM. 2013, it is noteworthy that IRAMUTEQ®, organized by

Pierre Ratinaud, was first applied in Brazil in 2013. It is a program that is docked in the R software and enables different ways of statistical analysis regarding textual bodies and tables of subjects by words. For the analysis of the study, the tool of the Descending Hierarchical Classification (DHC), suggested by Reinert (1990), was established, in which publications are classified as attribution of their respective vocabularies, and their grouping is distributed by the frequency of the reduced forms.

The purpose of the DHC analysis is to obtain classes of text segments that, in addition to presenting similar vocabularies, have different vocabularies from the text segments of the other classes. It was noted that, during data processing, IRAMUTEQ® observed the separation of the corpus into 17 text units, 89 text segments, 1031 different forms and 3081 occurrences of words in the text. It is punctuated that the mean frequency of the forms was 34.617978, generating distinct semantic classes, analyzed by DHC. Seventy-one text segments were used out of a total of 89, i.e., 79.78% of the corpus was used for analysis. The words with frequency equal to or greater than the mean frequency (three), frequency twice and greater than or equal to 20 and p value with significance \geq 0.01875 were relevant. Each class was revealed by the most significant words and their respective associations with the class (chi-square).

Thus, after the described phase, the publications were analyzed through a critical reading of the selected studies, in order to extract information related to the care that nursing offers to patients in palliative care, according to its content and reflection in the light of the recommendations of literature. Hense, after grouping by content similarity, four categories emerged: Class 1 - Emotional professionals's suport and family's suport in the face of palliative cancer care; Classes 2, 5 and 6 - Evidence-based practices promoting interventions in nursing care; Class 3 -The importance of coping strategies to reconfigure care in favor of quality in nursing care; Class 4 - Process of knowledge about palliative care and deficits in care.

III. RESULTS AND DISCUSSION

After selection, only 17 articles met the criteria established in this review, four in 2020 (23.5%), five in 2019 (29.4%), two in 2018 (11.7%), four in 2017 (23.5%) and two in 2016 (11.7%). It was noted that thirteen are in the Pubmed database (76.4%), two are in the SciELO virtual library (11.8%) and two in the VHL virtual library (11.8%). As for languages, ten studies were registered in English (58.8%) and seven in Portuguese (41.1%). As for the methodology used, thirteen studies were classified as qualitative (76.4%) and four as quantitative (23.5%). Therefore, the articles included in this review are presented, which reveal the specifications related to the code of each article, title, author, year, country of study, database, objective, method and completion points of each article, represented in the table 2, article distribution table. Through the analysis in IRAMUTEQ®, the dendogram of the acquired classes is shown, illustrating the division of the corpus for the final category, in order to determine which topic in each category is more representative and which word is more frequent, as shown in Table 3. The corpus was constituted by 17 texts, with 89 segments analyzed, that is, 79.78% of the corpus. Reinert's method was used, crossing segments of text and words, where six classes emerged according to the dendogram below.

According to the analysis of the classes, four categories emerged, whose order corresponds to the following classes 2, 5, 4, 3, 6 and 1: **Emotional support from professionals** and family regarding palliative oncology care; Evidence-based practices promoting interventions in nursing care; The importance of coping strategies for reconfiguring care in favor of quality in nursing care; Knowledge process about palliative care and health care deficits.

N°	Author. Title. Periodic. Year	Base	Objetive	Metodology	Conclusions	Evidence Level
A1	Kim, J.S, Kim, J., &		The purpose of this	Quantitative,	Our results reflects	
	Gelegjamts, D.		study was to examine	cross-sectional	that nurses have	
	Knowledge, attitude	Pubmed	knowledge, attitudes,	and	positive attitudes	Level 4
	and self-efficacy	1 donied	and self-efficacy	descriptive	toward palliative care	Level
	towards palliative		toward EOL care	study.	however lack of	
	care among nurses in		among Mongolian		confidence in	

Table 2 – Distribution of Studies. Belém (PA), Brazil, 2020.

	Mongolia: A cross- sectional descriptive study.2020		oncology nurses, and to identify variables related to elf- efficacy. Predictors of self-efficacy toward EOL care were also investigated.		providing palliative care and limited knowledge of palliative care.	
A2	Seow, H., Barbera, L., Pataky, R., Lawson, B., O'Leary, E., Fassbender, K., McGrail, K., Burge, F., Brouwers, M., & Sutradhar, R. Does Increasing Home Care Nursing Reduce Emergency Department Visits at the End of Life? A Population-Based Cohort Study of Cancer Decedents. 2016	Pubmed	To examine the temporal association between home care nursing rate on emergency department (ED) visit rate in the subsequent week during the last six months of life	Qualitative study, retrospective cohort	The study showed a temporal association between receiving nursing at the end of life in a given week during the last six months of life, and more standardized nursing in the last month of life, with a reduction in the ED rate in the subsequent week.	Level 4
A3	Pan, H. H., Shih, H. L., Wu, L. F., Hung, Y. C., Chu, C. M., & Wang, K. Y. Path modeling of knowledge, attitude and practice toward palliative care consultation service among Taiwanese nursing staff: a cross- sectional study. 2017	Pubmed	The aim of this study was to explore the causal relationship between knowledge, attitude and PCCS practice using path modeling between Taiwanese nursing team.	Qualitative study, descriptive cross-sectional research.	Based on this study, it is proposed that consultation with PCCS has a positive impact on the care of terminally ill patients. Encouragement of staff to undertake further education can improve the practice of ward staff providing palliative care.	Level 4
A4	Ferrell B. National Consensus Project Clinical Practice Guidelines for Quality Palliative Care: Implications for Oncology Nursing. 2019	Pubmed	The objective of the 4th edition of (NCP Guidelines) aims to improve access to quality palliative care for all people with serious illnesses regardless of configuration, diagnosis, prognosis or age.	Qualitative study, systematic review.	That the 4th edition of the NCP Guidelines sets a high standard of quality for all professionals serving patients of all ages in all care settings. Those looking to develop or expand palliative care can integrate the NCP Guidelines.	Level 5
A5	Paiva, C.F., Santos,		To analyze the	Qualitative,	Nurses, supported by	Level 5

	T.C., Montenegro, H.R., Costa, R., Martins, G.C., & Filho, A.J. Reconfiguration of palliative oncological nursing care: nursing contributions. 2020.	Scielo	strategies implemented by nurses to reconfigure palliative oncological care due to the hospital accreditation process in <i>Hospital</i> <i>do Câncer</i> <i>IV</i> (Hospital of Cancer IV).	historical- social study	an alliance with the institution directors, implemented effective strategies and reached significant advancement.	
A6	Santos, D.C., Silva, M.M., Moreira, M.C., Zepeda, K.G., & Gaspar, R.B. Planning patient care in palliative care in oncology intensive care. 2017	Scielo	Analyze the understanding of health professionals about the assistance to the patient in end- of-life care in the oncologic intensive care unit (ICU), and discuss the objectives they seek to achieve when planning assistance from the palliative care perspective.	Descriptive, qualitative study.	Assistance planning from the perspective of palliative care in the context is incipient; challenges are listed for the practice and it is concerned with humanizing care.	Level 4
A7	Agarwal, R., & Epstein, A. S. Advance Care Planning and End-of- Life Decision Making for Patients with Cancer. 2018.	Pubmed	To highlight the importance, challenges, and evolution of advance care planning for patients with cancer	Descriptive, qualitative study. Study based on a systemic, qualitative review.	Advancecareplanningisfundamentaltosupportthepersonhoodofpatientswithadvancedcancer.Patientsmustbeencouragedbyphysiciansand nursestoarticulatewhatmattersand providesmeaningto them asthey live, cope, andreceive treatmenttheir cancer.	Level 5
A8	Haun, M.W., Estel, S., Rücker, G., Friederich, H.C., Villalobos, M., Thomas, M., & Hartmann, M. Early palliative care for adults with advanced cancer. 2017.	Pubmed	To compare effects of early palliative care interventions versus treatment as usual/standard cancer care on health-related quality of life, depression, symptom intensity, and survival among adults	Descriptive, qualitative study. Study based on a systemic, qualitative review.	This systematic review of a small number of trials indicates that early palliative care interventions may have more beneficial effects on quality of life and symptom intensity among	Level 5

			with a diagnosis of		patients with	
			advanced cancer.		advanced cancer than	
					among those given	
					usual/standard cancer	
					care alone	
A9	Dose, A. M.,		Therefore, the aim of	Qualitative,	This study was	
	McCabe, P. J.,		this study was to	analytical	innovative in its use	
	Krecke, C. A., &		examine the influence	cross-sectional	of DT/LP for those	
	Sloan, J. A.		of the combination of	study	still receiving active	
	Outcomes of a		interventions (TD		cancer treatment and	
	Dignity Therapy/Life		plus LP) in various		not at the impending	
	Plan Intervention for	Pubmed	psychosocial		end of life, in	Level 4
	Patients With		outcomes for those		accordance with	
	Advanced Cancer		with advanced cancer		guidelines to provide	
	Undergoing		in chemotherapy.		palliative care	
	Chemotherapy. 2018.		12		interventions	
	15				simultaneously with	
					cancer treatment	
A 10						
A10	Mello, B.S., Almeida,		To select outcomes	Qualitative	The selection of	
	M.A., Pruinelli, L., &		and indicators of the	study,	results and priority	
	Lucena, A.F. Nursing		Nursing Outcomes	integrative	indicators for the	
	outcomes for pain		Classification (NOC),	review.	assessment of pain in	
	assessment of		in order to assess		palliative care, as	
	patients undergoing		patients with cancer		well as the	
	palliative care. 2019.		under palliative care		construction of its	
		Pubmed	with Acute and		definitions, will	Level 5
			Chronic Pain Nursing		support clinical	
			Diagnoses; and to		practice.	
			construct the			
			conceptual and			
			operational			
			definitions of the			
			indicators.			
A 1 1	Causa A.D. C'l			Onalitati	T4 has see 1 1 1 1 1	
AII	Sousa, A.D., Silva,		to identify, in	Quantative	It has concluded that	
	L.F., & Paiva, E.D.		scientific	study,	greater emphasis	
	Nursing interventions		productions, nursing	integrative	should be given to	
	in palliative care in		interventions in	review.	palliative care in	
	Pediatric Oncology:		palliative care in		academic and	
	An integrative	BVS	children and		professional training	
	review. 2019.		adolescents with		and that further	
			câncer.		studies in search of	. .
					the best evidence	Level 5
					should be conducted	
					to support nursing	
					Evidence-Based	
					Practices.	
					Descriptors:	
					Palliative Care;	
					Nursing Diagnosis:	
					Child; Adolescent;	

					Neoplasms.	
A12	Semtchuck, A.L., Genovesi, F.F., & Santos, J.L. Palliative care in pediatric oncology: integrative review. 2017.	BVS	To verify the main databases of scientific literature which evidence related to children with cancer in palliative care, with an increased focus on action of the nursing team.	Qualitative study, integrative review.	The care of children with cancer in palliative care professionals go through situations of suffering together with the child and family, because they create bonds due to large hospitalization and frequent readmissions periods. Understand whypalliative care offer quality of life of children with cancer, providing comfort, controlling pain and often the play, involving the family in the process of decisions and care.	Level 5
AIS	Santos, N.A., Gomes, S.V., Rodrigues, C.M., Santos, J., & Passos, J.P. Coping strategies used by oncology palliative care nurses: an integrative review. 2016.	Pubmed	was to characterize the coping strategies used by nurses who provide palliative care to cancer patients.	Qualitative study, integrative review.	It was concluded that building effective coping strategies can make work more enjoyable, reduce occupational risks, and improve management indicators and the quality of care provided to patients.	Level 5
A14	Verri, E.R., Bitencourt, N.A., Oliveira, J.A., Júnior, R.S., Marques, H.S., Porto, M.A., & Rodrigues, D.G. Nursing professionals: understanding about pediatric palliative care. 2019.	Pubmed	To investigate the understanding and practice of pediatric palliative care.	Qualitative, exploratory and descriptive study.	It is necessary to include palliative care in the academic training of professionals, favoring the knowledge of the subject and preparing the professional to deal with death and dying, as well as the need for a space in the health institutions that provide shelter for the difficulties of professionals	Level 4

					working in this context.	
A15	Lundereng, E.D., Dihle, A., & Steindal, S.A. Nurses' experiences and perspectives on collaborative discharge planning when patients receiving palliative care for cancer are discharged home from hospitals. 2020.	Pubmed	To explore nurses' experiences and perspectives on discharge collaboration when patients receiving palliative care for cancer are discharged home from hospitals.	Quantitative, descriptive and exploratory study.	To improve the care of patients receiving palliative care for cancer outside the hospital setting, better communication is a key factor to promote confidence and understanding between nurses working in different settings of health care.	Level 4
A16	Huisman, B.A., Geijteman, E.C., Dees, M.K., Schonewille, N.N., Wieles, M., Zuylen, L.V., Szadek, M.K., & Heide, A.V. Role of nurses in medication management at the end of life: a qualitative interview study. 2020.	Pubmed	The aim of this study is to gain insight into the perspectives of patients, informal caregivers, nurses and physicians on the role of nurses in medication management at the end of life.	Qualitative study, constant comparative method.	We found that nurses can and should play an important role in medication management at the end of life by informing, supporting, representing and involving all relevant parties.	Level 4
A17	Ferreira, F.S., Meira, K.C., Félix, R.S., Oliveira, I.R., Pinto, C.M., Silva, M.A., & Santos, J. Associated factors with the knowledge of nurses of a high complexity oncology centre in Brazil, on the management of cancer pain. 2019.	Pubmed	Objective to evaluate the knowledge of oncology nurses on pain management, as well as the factors associated with it.	Qualitative, analytical cross-sectional study.	The study's findings point to the need for continuing education, updated education and reflection, especially for nurses with less professional experience.	Level 4

Table 3 - Dendogram. Belém (PA), Brazil, 2020.



Category 1 - Emotional support from professionals and family regarding palliative oncology care.

In this category it is evident that when the health professional is faced with the oncological diagnosis, with no prospect of cure, they also deal with various types and feelings such as: sadness, pain, insecurity, even so, the professional needs to know how to share the emotional, and overcome these feelings to protect themselves from the suffering generated by these patients. The interpersonal relationship is very important in palliative care, where the nursing professional will perceive all the aspects that involve the path being taken by the patient and his relatives, and so be able to offer support, help so that the patient feels welcomed in a difficult moment. The bond happens in a natural way, which must be valued with admiration, love, friendship and trust, thus, a reciprocal learning. Verbal and non-verbal communication is very important, since some gestures are worth more than many words, and always try to maintain empathy in communicating with the patient and family (A12).

It is perceptible that some nursing professionals do not have an educational preparation, which the importance of introducing in Palliative Care in the qualification, so that future health professionals can accept and understand the end of each life. Nursing care in the fundamentals of humanization, articulates technical and emotional care, providing the bond between nurse-patient-family, seeking to offer quality of life for patients undergoing treatment (A11).

It appears that palliative care is seen by some patients and family members as a method of offering comfort and welcoming to alleviate the discomfort caused by the disease. It is emphasized that palliative care, is seen by some patients and family members as a method of offering comfort and welcome to alleviate the discomfort caused by the disease. Thus, making the small life time that remains for some patients, making it more bearable, and without hastening death (A14). Santos et al (2018), refers that the family, in turn, seeks a relationship of trust with the professional in search of effective care for the patient who no longer responds to therapeutic expectations, trying through differentiated care that palliative care provides a dignified death to the terminal pacient. It is perceived that the nursing systematization processes are interconnected with palliative care in the performance of knowledge and thoughts aimed at resolving the difficulties encountered in palliative care.

It is noticed that the participation of a qualified, humanized multidisciplinary team that performs comprehensive care is extremely important, the assistance directly affects the quality of the service provided, also seeking to focus on the physical and emotional aspects, valuing the cultural, religious and ethical aspects, aiming at well-being, quality of life and respect. For assistance to be effective, it needs to be differentiated, looking for evidence and factors that may have caused discomfort, pain and a more frequent factor that affects patients in palliative care, and thus, together with the systematization of nursing that can carry out the diagnosis, prescription and evaluation with greater effectiveness, either pharmacologically or not, alleviating the suffering of each patient (A05).

In the study by Alcantara et al (2018), we can read that the nursing professional recognizes his difficulty in caring for patients in palliative care and the family, highlights the importance of humanized care and reports on facing terminality, since the human beings are not used to dealing with losses, referring to the expression of different feelings. It is noted that palliative care is not only providing technical assistance and medicines, but offering comfort and support to the family, leaving aside the biomedical process, but directing a holistic look at the patient and the family.

Category 2, 5 and 6 - Evidence-based practices promoting nursing care interventions.

Ineffective communication between professionalpatient, can hinder the implementation of Early Care Planning (PCA) affecting the knowledge and understanding of decision making and choice of care at the end of this patient's life. The lack of training reveals the professional's unpreparedness in dealing with PCA in face of the patient's demands or else the thought that its applicability may negatively affect physical and mental health, interfering with active cancer treatment (A7).

According to seven researches, cancer patients who started palliative care early had their quality of life improved compared to those who had usual control treatment, in terms of survival rate, did not indicate significant differences, as well as depressive symptoms. The intensity of symptoms was lower in those who received palliative care, in contrast, a study showed a higher percentage of side effects (**A8**).

Another study of 20 cancer patients showed that 89% were women with pancreatic cancer, while 78% were men with lung cancer. Seven people died of pancreatic cancer and four died of lung cancer four months after diagnosis. All were in conventional treatment, and to raise the quality of life was associated palliative care added to Dignity Therapy (DT) (A9).

Of thirteen nurses participating in a given survey, 8 (61.5%) had the title of Expert with a median duration of graduation of 120 months; 8 (61.5%) had experience in acting in oncology, 4 (30.8%) with experience in palliative care with a median duration of experience in oncology of 72 months; 3 (23.1%) participated in palliative care for 4 years or more and 4 (30.8%) for 2 to 4 years; 3 (23.1%) published up to 10 articles or presented papers on palliative care. Therefore, from the findings of specialist nurses it was possible to observe that the nursing process is fundamental to define the care interventions (A10). According to the article cited Markus, Betiolli, Pereira de Souza, Marques and Migoto (2017) affirm that more scientific research is needed addressing the nurse's role regarding palliation of cancer patients in order to improve their care through qualification and preparedness to deal with the death process. They also reiterate the lack or poverty of the subject matter in Universities, Colleges and Specialization Courses, as well as the lack of adequate structure to implement a more dignified care, besides the scarcity of human resources and appropriate materials to assist the patient at the end of life.

Regarding the scientific production of nursing interventions in the palliative care of children and adolescents with cancer, 18 articles were published, of which 67% were international journals from China, the United States, Turkey, Portugal and Jordan and 33% national (A11). To reinforce the findings according to Rodrigues dos Santos, Gomes, Rodrigues, Santos and Passos (2018), the nurse plays a vital role in the execution of the PC, supervising and coordinating the care actions focused on the patient and the family, reducing discomfort and suffering from the control of symptoms, especially pain. The success of palliative care depends on the initiative and qualification of the professional who will provide quality care, and on the acceptance and understanding of the health condition by the patient.

The nurse's performance reflects the hospital discharge of the patient who receives palliative care. However, there is a disagreement between hospital nurses who argue that patients under palliative care need institutional care, while home nurses also felt able to care for these patients at home, according to the clinical status. A good communication between the two sectors facilitates the patient's transition moment, as well as accurate and precise information facilitates diagnosis, interventions and treatment, avoiding readmissions. The anticipated discharge planning would reflect on the team's collaborative work and the outcome of the patient's discharge. (A15).

Another analysis was carried out in order to minimize the unnecessary use of drugs in terminally ill patients, since the adverse effects may outweigh their benefits. Given this fact, 76 people were interviewed, among them patients, caregivers, doctors and the nurse himself, who was recognized as a fundamental element in the care process, such as in medication management. It is part of the nurse's responsibility to inform, guide, support, register and explain the purpose of such a drug, adjust the treatment plan, propose changes in the administration routes and analyze whether the use is really necessary, as well as perform a multidimensional approach, being able to reflect on reducing medication intake. Guide the caregiver as the patient's representative, in case the patient presents a reduction in consciousness and also a medication manager, in addition to exercising an informative function, letting the doctor know about the patient's improvements or worsens (A16).

Another review was carried out in which the knowledge of 207 nurses in relation to pain management in cancer patients was evaluated, 54.1% had adequate knowledge of the topic. The oldest, with the longest training and professional experience, had the best knowledge rates compared to those with inadequate knowledge. Only 25% received instruction at undergraduate level, while 81% learned in the practice of the profession and 52.4% at graduate level. Regarding palliative care, 92.1% used analgesia, 13.5% used hypnosis and 9.5% did-in exercises. With respect to continuing education as a source of information on pain management, a comparison was made of those with adequate knowledge versus inadequate knowledge, respectively, 36.8% versus 20.07% (A17).

Category 3 - The importance of coping strategies to reconfigure care in favor of quality in nursing care.

The main coping strategies used by nurses who assist cancer patients in palliative care focus on problems and emotions. Therefore, coping strategies are divided into two categories: (1) problem-oriented coping strategies, in which professionals will work to change the stressful situation, such as training sessions and team meetings to expose the group's difficulties; (2) coping strategies focused on emotions. In this strategy, the professional seeks to adjust his emotional state in the face of the pressures experienced, such as religion, being a way of understanding and reducing suffering, interference outside the work environment and forms of support from family and friends. As highlighted in the interview, the main findings are that participants often present emotional coping strategies (A14).

According to Pimenta, CAM, 2020, coping strategies are related to situational factors, that is, a person can use or change strategies according to the moment and type of stress experienced. In this sense, it is necessary to emphasize that the relationship between nurse and patient established in palliative care aims at humanization and only implements useful therapeutic measures, so that, while seeking to understand the negative effects, the positive effects are still sought. Thus, the palliative care nurse plays a fundamental role in education, care, promotion, coordination and care for patients and family members to reduce discomfort, control symptoms and relieve suffering.

In oncology palliative care, research on coping strategies based on this problem has shown that nursing activities include participatory management; continuing and / or permanent education; group meetings to expose the group's difficulties; practice and training to correct personal difficulties, allowing behavior and work and consequently the transformation of the stressor element. Continuing or permanent education is a strategy for valuing and evaluating the quality of workers, to ensure the improvement of the qualification of assistance and to help develop effective coping strategies (A13). Regarding the reconfiguration of palliative cancer treatment, one of the strategies is the implementation of a nursing department. Thus, it is necessary to consider that when the nurse presents himself as a leader, the team will recognize his autonomy, providing him with the ability to communicate with other health professionals, a greater commitment to the patient and, thus, gaining professional appreciation (A05). Strategic planning and reasoning skills are the basic tools of nursing leaders, it is a management process that includes the development of strategic objectives based on external conditions and service plans so that they can be executed, measurable and consistent (A13).

It is necessary to emphasize the importance of the nurse leader prioritizing the development of skills to meet institutional and regulatory requirements. Continuing education also plays an important role in overcoming this resistance, as it is generated by the needs and reality of the work environment, developing from situations experienced daily. It aims to discuss and benefit from reality, stimulating critical thinking, and promoting the development of workers through behaviors based on constant knowledge. In addition, it can improve practical efficiency and improve the qualification of teamwork, add new perspectives on how to assist and lead professionals and provide a new way of sharing knowledge (SALUM NC; PRADO ML, 2014).

Amestoy SC, et al, 2017, it is emphasized that there is no right or wrong response strategy for a given situation, but the effective or ineffective strategy that depends on the individual and / or situation. Therefore, it is necessary to share the coping strategies developed and formulated by nurses who work in palliative oncology care, as they represent the relationship of survival of individuals in the face of work situations, are characterized as unfavorable and can be considered as factors that protect the health of nurses inserted in this work environment (**A05**).

Category 4 - Process of knowledge about palliative care and deficits in care.

It is clear that some nurses had little knowledge in oncology and palliative care, with this training was proposed, which aimed to show that nurses have a major role in providing palliative care at the end of the patient's life. In this training, the professional experienced the patient's experience and death and the anguish that family members experience (A01).

It was also shown that professionals who already work in palliative care, feel a deficit in dealing with the psychological and spiritual state of patients and their families. It is known that palliative care is not just a body care itself, but it is a holistic, comprehensive and psychological approach, in which spiritual care is a primary aspect that the nurse must offer to the patient in palliative care. (A01).

It is observed that in the process of palliative care of patients in the ICU, it involves several elements and aspects, such as: contradictions, negative feelings, assistance with little humanization. Death awakens in many professionals the perception of their own finiteness, generating internal conflict, doubts about its efficiency, quality and objectives in the care provided (A06).

It is observed that some nursing professionals are afraid of the use of morphine in a long term, as they fear the patient's dependence on the drug, but are in favor of adjuvant therapies, since morphine is important in pain control, which is one of the factors that most aggravate patients in palliative care. In complementary medicine, reflect broad acceptance of morphine, together with the monitoring of family members who must remain with the patient until his death (A06).

It is evident that many professionals have a deficit in working in palliative care, often due to the lack of knowledge about this care. However, when the professional acts in the palliative care process, he faces the challenge of not knowing how to deal with the patient's dying and death process, which can often reflect on the quality of care. It is necessary to invest in permanent education for the health team, so that the nursing professional can offer better assistance and diagnoses in patient care, and together there is an emotional support for this professional, so they will know how to act in the face of the death of their patient (A06).

It is noticed that the palliative care service processes may be integrated with quality in any health environment, following the principles and practices of quality palliative care happens when professionals have the necessary qualifications, education, training and support, thus, they can provide an ideal care centered on the patient and the family. Palliative care begins with a broad and extensive assessment, and focuses on patient and family involvement, communication, coordination of care and continuity of health care (A04).

According to the World Health Organization (WHO), palliative care is a more humanized care proposal, it is care that should not be seen as an obligation, but as an act of respect and solidarity with the patient. According to Correia et al. (2017), the role of nursing in palliative care general knowledge of consists of degenerative malignancies, to establish comfort and good communication with the patient. The nurse who works in

palliative care of the patient, needs to guide the patient and his family in the care that will be performed, clarifying and solving doubts, always aiming at the well-being and quality of care of their patients.

According to Goi and Oliveira (2018), the nursing team causes emotional wear and tear, due to the bond created with the patient, as the professional closely monitors the patient's suffering, with this the professional deals with a great challenge, of many sometimes not knowing how to deal with the patient's dying and death process. In view of this, the nursing team seeks to promote to the patient the relief of their pain, comfort and well-being, in addition to the basic and pathophysiological care that the patient needs and also to fulfill their wishes and desires. Thus, the palliative care of the nursing professional is paramount for patients, it is evident that the way of caring for the patient offers quality of life and comfort until their last days.

However, according to Baker et al. (2015), in their studies showed that many professionals have a deficit in working in palliative care, many times this deficit occurs due to lack of knowledge about what palliative care is. The justification that some professionals use to limit care is lack of knowledge, difficulty in communicating with the patient and his family because it is treating an illness without a cure. It is necessary to invest in permanent education for the health team, so that the team recognizes the palliative care patient, promotes a better prognosis and selects those eligible or not for intensive care, and that there is an emotional support, so that the professional knows how to act in face of this patient's death situation.

According to Ávila et al. (2017) many nursing professionals find it difficult to deal with cancer patients in palliative care, as they have not been approached in their lives as academics, in other words, addressing this theme during graduation is essential, to train qualified professionals who know how to promote health and to know how to deal with terminal illnesses, where there is no expectation of cure.

IV. CONCLUSION

An important contribution was evidenced in the identification of coping strategies used by nurses in palliative care, however, it is understood that their development will depend on the individual and the environment in which he is inserted. In this sense, it is noted the importance of discussing this topic in order to provide a favorable scenario for the development of strategies by nurses, for the evolution and reconfiguration of nursing palliative care in the face of the new challenges that were imposed. It was noticed that for palliative oncology care to be performed with excellence, more institutional investments and professional qualification are needed. In addition, it is believed that the strategies, when effective, may favor a more productive, less stressful daily life, reducing the high rates of absenteeism, increasing work overload. It is suggested, based on the above, to conduct training for professionals on the subject and to offer them a space for exposure and the elaboration of their emotions.

Thus, it is clear that the trained nursing team has an important role in palliative care, the nurse with his holistic look aims with his actions to offer to the patient who is at the end of life, humanized care, comfort and emotional peace. However, there are still few studies that point to professionals involved in care, especially the nursing team, which needs early preparation and skills development for this type of care. The professional's unpreparedness reflects in the patient's care, most of the times due to lack of knowledge, the professional feels powerless for not giving a cure prognosis. Deficit in teamwork and little humanized care. Therefore, there is a need for training and emotional support for these professionals without knowledge of palliative care in cancer patients.

It is noteworthy in the results that nurses who provide assistance to the patient who is in the palliative care process, suffer from coping with various types of feelings in the face of the situations that involve treatment, in addition to also involving the feeling of the patient's family. Thus, the function of this professional who is in the care of the terminally ill patient is to recognize the difficulties in assisting this patient and his family. The suffering of the patient who is in the palliative care process is also experienced with his family. This whole process involves strategies for coping with the disease, which results from the instrumentalization of the professional to perform a more humanized care, such as: empathy, verbal and non-verbal communication, and the spirituality that can be supported by the family. Thus, when humanized care is provided where the patient and family find comfort, solidarity, support, and empathy in the nurse's assistance in palliative care, the process for cancer patients becomes less painful. Through this, rescuing the importance of nursing work, together with the interdisciplinary team in assisting cancer patients.

It is concluded that the nurse is fundamental in the execution of palliative care, being this the professional in charge of guiding, registering and explaining the oncological process in which his patients are, aiming to promote the improvement or relief of the health condition. Therefore, the recognition of its role by other professionals, caregivers and patients is essential, enabling the strengthening of the bond and the good progress of the treatment.

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Occupational health and the biopsychosocial aspects of health professionals in the face of the Covid-19 Pandemic: Integrative Literature Review

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Abstract— Objetives: to verify in the literature, the situations of health workers in coping with the covid-19 pandemic. Methodology: This is a bibliographic, descriptive, integrative literature review type analysis, an Evidence Based Practice instrument. A bibliographic survey was carried out in digital databases, according to pre-established methodological rigor; information was collected in November 2020, in the SCIELO databases where 10 articles were used according to inclusion criteria. Results: the findings refer to the health of health professionals in a broad way, analyzing not only their physical well-being but also the biopsychosocial well-being. Conclusion: It becomes evident the significant challenges experienced by health professionals, which reflects not only in their lives but in the lives of millions of others, because it is through these professionals that there is help in facing the current epidemiological situation. This is a clear reminder of the neglect and little importance of the biopsychosocial well-being of this employer.

Keywords— Occupational Health, Health Personnel, Pandemics, Coronavirus Infections, Communicable Diseases.

I. INTRODUCTION

Occupational Health is the set of measures that, through actions of epidemiological surveillance and health surveillance. It aims for the worker a healthy environment, being valuable for good in collective and individual. Occupational health guarantees the promotion and protection of the health of workers, aiming at the recovery and rehabilitation of health, it is an important strategy not only to guarantee the health of workers, but also to contribute positively to productivity, product quality, motivation and satisfaction of work and, therefore, for the general improvement in the quality of life of each individual and the whole community, it is a collective asset (Brazil, WHO, 2020). According to ordinance no. 1,823, of August 23, 2012, in Art. 2, the National Policy for Workers' Health, aims to define the principles, guidelines and strategies to be observed by the three branches of System management Unified Health System (SUS), the development of comprehensive health care for workers, emphasizing the surveillance, promotion and protection of workers' health and the reduction of morbidity and mortality resulting from development models and production processes (Brasil, MS, 2012).

In relation to the current global epidemiological situation, health professionals are at the forefront, which makes them the group of workers most at risk of acquiring work-related infectious and parasitic diseases (DIP-RT), including COVID-19. And taking note of the official records is of cause for concern, considering that, in Brazil, not all parasitic infectious diseases are compulsory to report and are part of the Notifiable Diseases Information System (SINAN) (Santana, et al, 2020).

The Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-Cov2) pandemic, better known as the new coronavirus 2019 (COVID-19), comes as a challenge to the global health system, due to the large number of infected and the consumption of resources indispensable for their coping, as they present significant numbers of infected people demanding hospitalization and intensive hospital care (Ribeiro, et al., 2020).

Within health institutions, as a confrontation measure, a multiprofessional team is needed, covering both health workers and support services, such as, for instance, servants, cupbearers, security and, among others, are workers who work in the front line of care, regardless the type of assistance and health status, in times of pandemic or outside it (Ribeiro, et al, Moreover, every work activity and every worker has its importance, and needs to be prepared, not only for their protection, but also to understand that their activity may play an important role in fighting the epidemic (Miranda, FM., et al., 2020).

Faced with this scenario, negative feelings arise such as: fear, anguish, worry, anger, feeling of helplessness, among others. These feelings generated both by the uncertainty of what is to come, as well as by the social isolation required of family members who are exposed to the risk of contagion, experience the conflict of preserving themselves away from daily obligations, although often family, financial and social circumstances do not grant this option (Ribeiro, et al., 2020).

Healthcare workers form several groups from different professional areas and are directly coming into contact with patients infected by OVID-19, and for this reason they are in the group at risk of being infected. Throughout the course of the pandemic, failures in the health sector to ensure the safety of these professionals, who are involved in the care of patients infected by the virus, have been exposed. In this sense, exposure to the virus can be understood as biological exposure and most, if not all, multiprofessional staff have a huge risk of developing the disease because they are exposed to the virus, due to performing procedures in or near the area routes (Miranda, FM., et al., 2020).

Thus, contamination is related to the failure or lack of protection parameters against the disease in the lack of Personal Protective Equipment (PPE), agglomeration from asymptomatic individuals who remained in contact with the health team, among others. In order to develop more knowledge about the disease and understand its action in the transmission of the virus in health workers, several organizations such as the World Health Organization (WHO) and other institutions have contributed to the studies in a scientific manner, defining protocols, and interventions on the current situation of this pandemic (Miranda, FM., et al., 2020).

Primary health care (PHC) is the basis for the development of the health system with its high level of resolution. However, due to the health emergency experienced by OVID-19 around the world, Brazil is in a scenario of crisis in PHC, because there was a need for changes and search for new strategies. However, the population's health demands continue to exist and increase, which in the future may cause a worsening in health conditions. And, it was necessary to intensify biosecurity care in order to continue maintaining the necessary actions with personal and collective protection (Theodosio, SS., Leandro, SS, 2020).

PHC team members seeking to prevent several diseases, including SARS-CoV-2 infection, have developed strategies such as: drive-thru vaccination; spaces outside UBS structures, and homes; organization of environments, separating symptomatic from asymptomatic; participation in the VOCID-19 contingency committee; guidance on the proper use of PPE (Theodosio, SS., Leandro, SS, 2020).

Thus, the current scenario has led the Ministry of Health (MS) and the Councils to use technology to their advantage, providing remote care for people with mild and moderate symptoms of the disease, even in cases indicating severity. It is necessary for the PHC to be able to maintain its processes of readjustment for its care in a comprehensive way aiming at prevention, promotion, protection, diagnosis and treatment, as we have no way of knowing when the pandemic will end (Teodósio, SS., Leandro, SS, 2020).

Given the above, considering that health professionals are in direct contact with infected patients due to the intense routine in the face of the current pandemic, the study arises with the following guiding question: What are the different situations that health professionals are experiencing during the pandemic?

Thus, the study aimed to verify in the literature, the situations of health workers in coping with the covid-19 pandemic.

II. METHOD

It is a bibliographic, descriptive, integrative literature review type analysis, which allowed to analyze data from a delimited theme based on other articles. There were six stages for the elaboration of the study: identification of the guiding question for review; search in the literature; inclusion criteria with complete articles of the last two years; evaluation of the data; analysis and interpretation and discussion of the results and review report. Based on this, the following guiding question was used to elaborate this integrative review: What are the different situations health professionals are experiencing during the pandemic?

The selection of articles for the study was obtained from the Scientific Electronic Library Online (SciELO) virtual library. For the search, the descriptors in Health Sciences (DeCS) were used, such as "Worker health", "Pandemia" and "Covid-19", the Boolean operators "AND" and "OR" were used to perform the associations of all descriptors with each other.

The search was carried out from the 5th to the 23rd of November 2020. The following inclusion criteria were taken into account for the choice of material: full articles in Portuguese and English, in the last two years, published in the period from 2019 to 2020.

A total of 41 initial articles were found, after the inclusion criteria, this number reduced to 19 articles, all from Scielo. Given this fact, 27 articles were excluded by title and abstract because they did not fit the guiding question and 04 by duplication, while 10 studies were selected by the abstract for full reading and textual production. **Table 1** shows the table for the article selection process.

Table 1 - Results of articles of agreement in the investigated databases, from 2019 to 2020. Belém (PA), Brazil, 2020.

Data base	Found	Duplicates	Excluded	Selected	Included
Scielo	41	04	27	19	10

From the cited criteria, it was possible to collect all data regarding the articles regarding authorship, year of publication, title, virtual library, objective, method, main conclusions and levels of evidence. To collect the data and elaborate the textual corpus, an instrument such as Bardin was used. According to Mendes and Miskulin (2016), the method presented by Bardin for Content Analysis is quite rich in details and didactic. Bardin's method is divided into 3 stages, which are: Pre-analysis: In this phase, it is possible to evaluate what makes sense to analyze and what still needs to be collected. Thus, a fluctuating reading of the material is made to see which subjects are addressed, choose the documents to be analyzed, constitute the corpus based on completeness, representativeness, homogeneity and pertinence. formulate hypotheses and objectives. After that, the second stage of the process is carried out. Exploration of the material: In this step, the material is coded and categorized. In coding, the registration and context units must be cut. The registration units can be the word, the

egistration units can be the word

theme, the object or referent, the character, the event or the document, it is also to make the enumeration according to the previously established criteria. And the last step is the treatment of the results obtained and interpretation, the interpretation of the collected results can be done through inference, which is a type of controlled interpretation. At this stage, it is necessary to obtain the sender or producer of the message, the individual receiving the message, the message itself and the medium, the channel through which the message was sent. From that, four categories were explored and analyzed by the Bardin instrument, so it was possible to describe their results and discussions.

With that, after the described phase, the publications were analyzed through a thorough reading of the included articles, in order to obtain information regarding the different situations that health professionals are experiencing during the pandemic, according to its contents and the reflection in light of the literature recommendations. Therefore, after grouping by similarity of content, four categories emerged: Category 1 - Mental Health of Health Professionals in the face of the new coronavirus pandemic; Category 2 - Health conditions of professionals when facing Covid-19; Category 3 - Impact of the pandemic on the working conditions of health professionals; Category 4 - Challenges of protecting workers' health in the context of the pandemic context.

III. RESULTS AND DISCUSSION

The **table 2** represents the characteristics of these studies, in which Portuguese (100%) predominates, with 7 quantitative methods (70.0%) and 3 qualitative methods (30.0%), published in 2020 (100%), in national journals (100%) and indexed in the Scielo database (100%). In this comprehensive review of the literature, ten original scientific articles were analyzed, strictly according to the sample selection previously determined.

 Table 2 - Description of the studies included in the integrative review, according to periodicals, titles, author (s), year of publication and summary, Ursi.2008

N°	Autor. Título. Periódico. Ano	Base	Objetivo	Metodologia	Conclusões	Nível Evidência
A1	Cavalcante, J. R., Santos, A. C., Bremm, J. M., Lobo, A. P., Macário, E. M., Oliveira, W. K., & França, G. V. COVID-19 in Brazil: evolution of the epidemic up until epidemiological week 20 of 2020. Epidemiologia e Serviços de Saúde.2020	SCIELO	To describe the evolution of COVID- 19 in Brazil up until epidemiological week 20 of 2020.	This is an ecological study based on data and official documents from the Brazilian Ministry of Health and international organizations; comparisons were made between Brazil and other countries and incidence and mortality rates were calculated.	Brazil is one of the countries with the highest number of confirmed cases and deaths, with marked regional differences.	Level 5
A2	Silva, L. S., Machado, E. L., Oliveira, H. N., & Ribeiro, A. P. Working conditions and lack of information on the impact of COVID-19 among health workers. Revista Brasileira de Saúde Ocupacional. 2020	SCIELO	To discuss the health and safety conditions of the health workers who care for COVID- 19 patients, from the perspective of the information gathered by their professional class representatives and from institutional recommendations.	Quantitative study	We end by discussing how the exposure to these working conditions may lead the health workers to experience other clinical events that require compliance measures concerning the amount of professionals, improvement in organization and in working conditions,	Level 5
					provision of adequate personal protective equipment, and implementation of measures to strengthen health teams to face COVID-19.	
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A3	Helioterio, M. C., Lopes, F. Q., Sousa, C. C., Souza, F. O., Pinho, P. S., Sousa, F. N., & Araújo, T. M. COVID- 19: why the protection of health workers is a priority in the fight against the pandemic? Trabalho, Educação e Saúde. 2020	SCIELO	This article aims to summarize and systematize aspects related to the health and working conditions of health workers in this pandemic, especially in Brazil, successful experiences in the protection of healthcare work in other countries and recommendations for the Brazilian context.	Quantitative study	The performance of these workers is a central element in facing the pandemic, therefore, the plan to combat COVID-19 must include protection and preservation of their physical and mental health.	Level 5
A4	Faro, A., Bahiano, M. A., Nakano, T. C., Reis, C., Silva, B. F., & Vitti, L. S. COVID-19 and mental health: the emergence of care. Estudos de Psicologia (Campinas). 2020	SCIELO	This article aims to gather information and research findings on the impact of such crises on mental health.	Technical and scientific literature review, quantitative.	To conclude, it presents questions related to the emergence of mental health care provided by Psychology and other health professionals in order to reduce negative impacts of this crisis and act in a preventive function.	Level 5
A5	Schmidt, B., Crepaldi, M. A., Bolze, S. D., Silva, L. N., & Demenech, L. M. Mental health and psychological interventions during the new coronavirus pandemic (COVID- 19). Estudos de Psicologia (Campinas). 2020.	SCIELO	The aim of the current study was to systematize knowledge on the impacts of the new coronavirus pandemic on mental health, as well as on psychological interventions related to the disease.	Technical and scientific literature review, quantitative.	Finally, we discuss both the potential and the challenges of practicing psychology in Brazil during the pandemic.	Nível 5
A6	Esperidião, E., Saidel, M. G., & Rodrigues, J. Mental Health: Focusing On Health Professionals. Revista Brasileira de	SCIELO	Professionals have been susceptible to psychological distress as they struggle to carry out professional tasks, allied to	Technical and scientific literature review, quantitative.	In this sense, as a strategy of mental health care for workers, it is suggested to map the epidemiological profile of professionals	Level 4

	Enfermagem. 2020		emotional instability		in psychological	
			in the face of fear,		distress and with	
			pain, and sadness of		diagnoses of mental	
			patients		disorders.	
A7	Teixeira, C. F., Soares, C. M., Souza, E. A., Lisboa, E. S., Pinto, I. C., Andrade, L. R., & Espiridião, M. A. The health of healthcare professionals coping with the Covid-19 pandemic. Ciência & Saúde Coletiva. 2020	SCIELO	This work aims to systematize a set of scientific evidence presented in international papers that identify the main problems affecting health professionals directly involved in coping with the COVID-19 pandemic and point out actions and strategies for the protection and healthcare of these professionals.	Quantitative study, systematic review.	Emphasizing the necessary measures for the protection and promotion of the physical and mental health of health professionals and workers.	Level 5
A8	Almeida, I. M. Health protection for healthcare workers in COVID-19 times and responses to the pandemic. Revista Brasileira de Saúde Ocupacional. 2020	SCIELO	To discuss challenges for developing and implementing response and strategic readiness plans against COVID-19.	Qualitative Bibliographic Study.	The programs challenges is how to recognize and respond quickly to the changes that lead to new risks.	Level 6
A9	Filho, J. M., & Algranti, E. Challenges and paradoxes of the return to work amidst the COVID-19 pandemic. Revista Brasileira de Saúde Ocupacional. 2020	SCIELO	The issue of planning and returning to work is a global concern.	Qualitative Bibliographic Study.	The recent chaos observed in some Brazilian cities shows that, in the context of economic reopening, without observing the necessary premises, the problem will overcome work spaces, putting at risk not only the working population, but the population as a whole.	Level 6

A10	Santana, A. C., Santos,		The study aims to	Study of an	From the theme	
	L. E., & Santos, L. S.		carry out an	integrative	addressed, it is clear	
	COVID-19, continuous		integrative review on	review with	that nursing	
	stress and burnout		the relationship	analysis and	professionals are	
	syndrome: how is the		between continuous	synthesis of	exposed daily to	
	health of nursing		stress and Burnout	research,	physical, chemical,	
	professionals? Ciência		Syn-drome associated	qualitative.	biological,	
	Biológicas e de Saúde	Periodic	with the current		psychosocial and	Level 5
	UNIT.2020		pandemic, and how		ergonomic risks in the	
			they can negatively		work environment and	
			influence the health		these can directly	
			of nursing		compromise their	
			professionals.		health and the service	
					provided to their	
					clients.	
					1	1

The analysis of the literature found that it is possible to formulate four categories from relevant points of view. Thus, the following categories were developed: **Category 1** - Mental Health of Health Professionals in the face of the new coronavirus pandemic; **Category 2** - Health conditions of professionals when facing Covid-19; **Category 3** - Impact of the pandemic on the working conditions of health professionals; **Category 4** -Challenges of protecting workers' health in the context of the pandemic context.

Category 1 - Mental Health of Health Professionals in the face of the new coronavirus pandemic.

It is noted that health professionals face stressful situations in relation to the pandemic. Since these are directly acting on the front line of care, consequently, they are more exposed to the risk that contamination by covid-19 can cause. The aggravating factor of this situation is also the scarcity of personal protective equipment. However, there are many challenges faced by these professionals who end up developing high symptoms of anxiety and depression (A05).

Santos, AF., Cardoso, CL, (2010), point out that the source of the stress found is associated with "work conditions", referring to "work overload" and "work management". The factor most associated with worker stress was work overload, where the demand for care by users increases and the lack of workers is notable.

Focusing on health professionals, psychological emergency care was proposed in situations vulnerable to psychic illnesses in order to balance the emotions and mishaps arising from the pandemic and encourage these workers to seek psychological help when necessary (A04). For Costa, MT, Borges, LO, Barros, SC, (2015), workers with mental illnesses present depressive symptoms and negative affectivity, both active and apathetic with regard to work and do not show feelings of positivity. This means that the individual suffers silently without expressing his feelings at work.

The susceptibility of these workers to psychological suffering when facing work activities with countless difficulties and emotional destabilization, in the face of adverse situations, feelings of fear and pain and sadness of the people being assisted. However, there is a remarkable awakening to mental health actions aimed at professionals on the front of care. (A06).

According to Gonçalves, et al., (2013), studies show that in health care, both physical and psychic, the welcome and bond are the foundations that guide the assistance, especially when it is developed in the psychic field, offering the sick individual humanized and differentiated health care.

Category 2 - Health conditions of professionals facing Covid-19.

It became evident that it is necessary to discuss and adapt a better way of working, seeking protection and health promotion of health professionals, whether physical or mental protection. Taking into account the conditions of these Brazilian health workers, taking measures that can be included as service protocols. (A07).

Yan, et al., (2020), talks about the effects caused by the continuous use of Personal Protective Equipment (PPE), equipment of paramount importance to minimize the risks of contamination by COVID-19 of health professionals. Skin lesions that are linked to protective measures, of those who treat patients with COVID-19, considering that

these professionals may not be able to continue using their PPE in combating the new coronavirus due to skin lesions. The prevalence of these injuries related to the use of protective equipment was 97.0% (526/542) among frontline health professionals and included skin lesions that affected the nose, hands, face and forehead. The constant washing and hygiene of the hands, can also be related to a dermatitis of greater prevalence in the hands. The appearance of lesions on the skin and mucosa is the result of the incorrect use of PPE, which can even lead to secondary infections in the dermis. Chinese experts advise the correct use, following the standards of use, sterilization and cleaning, in order to reduce the effects caused by the constant use of PPE against infection by Sars-CoV-2.

In this context, health professionals who work on the front line of the new coronavirus pandemic are more susceptible to developing work-related health problems, such as: anxiety, distress, insomnia and depression. These symptoms may be related to emotional stress affecting the professional's well-being, which consequently leads to factors that influence the quality of care provided by these professionals. Fear, loneliness, high exposure to the virus, the high rate of contagion of the virus, the low level of knowledge about the disease, in addition to the lack of PPE and adequate training, are some of the determinants that influence the quality of life of health professionals who are at the head of the Covid-19 pandemic (A10).

According to Martins, FS., Silva, KM., Nunes (2015), altered emotional conditions can be seen more frequently among managers, as they have the power to make decisions, which implies the collection and responsibility of the shit they occupy, because they perform several functions at the same time and with deadlines, in addition to the interpersonal relationship of different personalities. Many professionals have social aspects and mental health influenced by work relationships.

Category 3 - Impact of the pandemic on the working conditions of health professionals.

Brazilian nurses are still the most affected by COVID-19, in which deaths are greater in relation to other countries. Thus, being affirmed by the Federal Nursing Council (Cofen) and the International Nursing Council, in a list of 157 deaths, being (nurses, technicians and assistants), a greater quantity than in other countries, for example the United States, with 146, United Kingdom 77 (A02).

Second, Souza, DO., (2020), the economy a priori was one of the biggest decisive barriers to the spread of the virus, nationally or internationally. Soon the decision belatedly resulted in the strengthening of sales, but it affected workers facing COVID-19, having a greater excessive workload, physical and emotional exhaustion, and even the devaluation of life, thus making social withdrawal difficult in the face of relaxation. In some countries it is not confirmed whether there was a contribution in this way, but without quarantine, control would be impossible, even with governments overturning such measures, with the view that chaos would ensue, even in the midst of so many deaths of health professionals.

The use of PPE as protection at work implies important aspects, and the increase in beds improves the quality of care, related to high demand. However, the applicability of measures and strategies is necessary when aiming at the safety and protection of workers at levels as a whole, it gives more basic attention to high complexity. In view of the health protection of health workers who are closely linked to coping with COVID-19 (A03).

According to Theodósio, SS., Leandro, SS, (2020), in view of the fields of action, has suffered with the lack of protection (IPEs), being challenged to review and seek the best process of work and assistance, placing restrictions, making use of alcohol gel in places propitious to facilitate the blocking of contamination of people there present, to thus give continuity to the services offered to the population, prioritizing needs, reinventing themselves, intervening in the promotion and prevention of daily health, acting in a safe way and taking care already predefined by the world health organization.

Category 4 - Challenges of worker health protection in the context of the pandemic.

During the first month of COVID-19 in the country, there were already 1,313 health professionals with flu-like symptoms in Pernambucos, and 58.9% were diagnosed with the disease through tests carried out, across the country about 5,174 suspected cases were registered, according to COFEN and 2.9%, corresponding to 24 people, died of the disease. According to the data and complaints made, they showed that there was an absence of PPE for the professionals who worked on the front line of COVID-19, and without the proper protection against biological risks, the number of cases has increased. In this sense, not only physical symptoms have affected health professionals as well, they present high psychological distress due to the experience of these workers who work on the front line, where they reported depression, anxiety, insomnia and stress, and their social withdrawal even from their families for fear of contagion, has affected this class of workers. It is essential to monitor the working conditions and health of frontline workers to combat COVID-19, so that there is in fact compliance with

regulatory standards, such as NR32, which refers to worker biosafety (A01).

PPE plays the role of protecting the health of health workers, and on the world stage it has been somewhat unique, decreasing the risk of biological contamination, as they act as a barrier, preventing the spread of the virus. However, it was noticed that many health professionals were being infected due to a shortage of PPE, and due to failures in the correct placement and removal of this equipment and within 4 to 6 days, they were asymptomatic and could transmit the virus. This requires new training and capacity building on the part of management, because with the correct use of this equipment, health professionals can reduce the spread of the virus in the workplace (A08).

According to Loro, MM., Et al., (2016), although there is knowledge of the devices, it is clear that failures in the use of PPE are recurrent, and should be used as a way of preventing occupational exposure; professionals refer to receiving their equipment, but do not use it because they do not know how to identify which procedures each PPE should be used in, and today in the current pandemic scenario it reflects the high number of contamination by health professionals. It is necessary to encourage the use of this equipment for the safety of the professional against potential pathogen agents, in order to interfere with the health of the same, so that the professional can continue dealing with the care of those who need it.

The process of progressive resumption requires a larger and more specific organization and care, especially in the workplace, where it was observed that essential activities can favor great transmission, as these activities normally deal directly with the public, with little ventilation or systems closed, thus being a major risk factor for contamination. For the International Labor Organization (ILO), return must be considered, but following national and international policies, aiming at a safe return for workers, offering individual safety equipment and correctly guiding its use and disposal, seeking to reduce risks contamination of the same, because if in the return to work of these employees of companies, hospitals, and the like, there is no attempt to reduce the exposure of the worker, it may reflect again in full hospitals and a new wave of COVID-19 (A09).

According to Barroso, et al., 2020, as the pandemic spreads, we see the importance of using PPE and adopting measures of awareness and training, not only for health professionals, but for workers who work in other services considered essential, because they need to be correctly targeted so that they do not spread the virus, guide the general population that social isolation and the correct use of PPE are fundamental measures to increase protection and reduce the spread of COVID-19 in the social environment..

IV. CONCLUSION

It was noticed that in the midst of the current pandemic, health professionals are exposed to situations of work overload, stress and risks of contamination by the covid-19 virus. Thus, concerns arise that may generate other harm to these professionals, since when it is in complete well being provides better assistance to the user. Measures that aim at the integral health of this worker need to be adopted to face the pandemic, since there is still no vaccine to prevent contamination and they need to be psychologically and physically prepared.

Therefore, considering that the meanings of work in a worker's life are collectively structured with interpersonal relationships established, including the existence of risks in the work of these professionals taking into account material and physical conditions, the organization of processes and the relationships between social actors. The results indicated corroborate the need for a public policy aimed at defining interventions and strategies in order to promote mental health in primary care. It is worth mentioning that a study focused on the issue of stress in the work environment, where individual characteristics and coping with adversities are relevant with regard to the appearance of stress.

In this sense, it became evident that nursing workers are extremely important health professionals, doing extreme and stressful jobs, being able to obtain occupational diseases, which cause them anguish, loneliness and constant stress. Pandemic aggravates the situation of these health professionals, as they are exposed to the greatest risks, increase the fear of being contaminated and contaminating their families, in addition to having the burden of facing the pain of patients and their companions, affecting their mental health. Through social media, it must reinforce the importance of what is being done by these health professionals to minimize the spread of the virus. Not forgetting to also value the Unified Health System (SUS), so that this system works. Without forgetting the important recommendations of WHO that everyone can help health professionals, ensuring the safety of their families and society. Studies in the area are important to increase research related to the topic, which improve the quality of life of health professionals, who develop a role in patient care.

As a result of so many errors seen in the course of the pandemic, the number of cases and deaths is alarming and sad. Therefore, it is worth thinking that not only the population's health is what matters, since in reports that there are still many negligent people, this behavior directly harms the function of those who work in the midst of chaos, due to and due to the lack of personal protection, beds, labor rights affected, stressful working hours, among many others. Finally, it is necessary to promote better working conditions so that the work can be carried out properly and achieve its goals and purposes of care, and not forget the importance of health workers who are on the front line of COVID-19.

After the arrival of COVID-19 in Brazil, there was a growing number of suspicious and confirmed cases mainly among health professionals who were in the front line of fighting the disease, which took a very large proportion, due to several factors and one of them was the scarcity of PPE and lack of adequate training for its use and disposal, since these equipments can exercise a "barrier" function for the virus. Management often does not invest in continuing education for health professionals, even though they are fundamental for the improvement and daily updating of professionals who deal directly with the population, being exposed to various agents, which in some cases can lead to death.

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Anxiety, Depression and Quality of Life in Industry 4.0: A literature review

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Abstract—With an increasingly competitive labor market and rising unemployment rates, inadequate working conditions such as: low wages, unhealthy environments, excessive noise and heat, accumulation of functions, excess working hours and regime in different shifts, are factors that may contribute to the emergence of mental and behavioral disorders. In order to carry out this study, a systematic literature review was carried out using the Methodi Ordinatio method, through the following steps: selection of databases; definition of keywords and their combinations; definition of search criteria; extraction of searches from databases; elimination of duplicate articles; definition and application criteria for the exclusion of articles that are not compatible with the proposed theme. It was possible to identify that there is a low number of scientific productions that address the themes of quality of life, anxiety and depression, and industry 4.0, which is an opportunity for future studies.

Keywords—Industry 4.0, Depression, Anxiety, Quality of Life.

I. INTRODUCTION

The absence of workers at their place of work is converted into reduced productivity, such data, known as absenteeism, is associated with delays, reduced individual performance and turnover (JOHNS, 2010). The employee, when presenting at work affected by a disease, and with a drop in performance due to health problems, is related to presenteeism (SCHULTZ, 2007).

According to Harnois & Gabriel (2000) the weight of mental health disorders on health and productivity has been underestimated over time. According to researchers from the UK Department of Health and the British Industrial Confederation, they estimated that between 15-30% of workers will experience some form of mental health problem throughout their careers. Mental health problems are the leading cause of illness and disability, among the main disorders are depressive disorders, which predominate in the United States workforce.

The science that investigates mental health in the industrial environment is called industrial psychology, and the entire development of industrial psychology and industrial sociology Elton Mayo (1945), initially studied

the effects of workers' physical conditions on productivity, and the reason for constant conflicts between workers and employers that impacted productivity.

Human relations, whether man to man, or man with machine and material, occupy a complex space in the industrial enterprise. Regardless of mechanization, machines must be designed, operated, and supervised by man, and the study of this human behavior, aims to provide support for increasing efficiency and reducing production and distribution costs (VITELES, 1955; MYERS, 1922).

In order to remain competitive, companies demand beyond the human capacity, the fulfillment of previously established goals, which lead them to the search for survival, in this way, employees and managers enter an immersive state at work, feeling the limit of their own abilities at face new goals, which end up generating more anxiety, fear and anguish (DOWNS, 2000; MOTTA, 2012).

When analyzing the industrial transition scenario that takes place in the 21st century, it is necessary to investigate the mental health and quality of life of the worker, who is the main affected by the changes. Therefore, for the preparation of the literature review work, the *Methodi Ordinatio* method proposed by Pagani et al. (2015) in the Scopus, Web of Science, PubMed and MedLine databases.

The present work is structured as follows: after this introduction, the theoretical basis is carried out regarding the concepts that underpin the research, followed by the methodological procedures used in carrying out the research. Finally, the analysis and discussion of the data is presented, ending with the final considerations of the work, its limitations and suggestions for future research.

II. BIBLIOGRAPHY REVIEW

2.1 Industry 4.0

Industry is a part of the economy that produces material goods, which are highly mechanized and automated, and since the beginning of industrialization technological advances have led to changes in paradigms, known as "industrial revolutions". The first industrial revolution was due to the use of mechanics, while the second industrial revolution was due to the intensive use of electric energy, while the third industrial revolution was due to the widespread use of digitalization, and finally, in the 21st century the era in which we combine internet technology and "smart" objects with manufacturing, known as Industry 4.0 (LASI, 2014).

Industry 4.0 includes a variety of technologies, methods and principles, with the aim of increasing the autonomy and dynamics of systems, developing new opportunities. To adapt to the concept of industry 4.0, there is a need to develop technology transfer processes with its suppliers (SILVA & KOVALESKI, 2018).

Understood as a new industrial stage, industry 4.0 integrates manufacturing operating systems and information and communication technologies, especially the Internet-of-Things (IoT), a cloud system, forming the concept Cyber-Physical Systems for industry 4.0 (WANG, 2015). Cyber-Physical Systems are considered as physical artifacts controlled, monitored, coordinated and integrated into networks by an embedded system. This embedded system is a combination of hardware and software components, connected in an environment through sensors, to perform predefined tasks in real time, assembling a specific data (STOCK, 2018).

For Frank et al. (2019) technologies in industry 4.0 can be separated into at least two different layers according to their main objective, according to Figure 1.



Fig 1: Theoretical scheme of Industry 4.0 technologies Source: Frank et al. (2019).

The front-end technologies of Industry 4.0 conceptualize emerging technologies (Smart Manufacturing), that is, the way the product is offered (Smart Products), how the raw material and products are delivered (Smart Supply Chain), and the new working models supported by new technologies (Smart Working) (FRANK, 2019).

Manufacturing jobs are facing a risk of being automated, in this way, human beings will be affected by increased knowledge at work and task uncertainties (STOCK, 2018). Therefore, human resource management has been defined as an effective employment strategy and the development of a highly committed and qualified workforce to achieve the company's objectives (HECKLAU, 2016).

2.2 Anxiety

According to Spielberger (1966), the discriminatory use of the term anxiety refers to different constructions. The most commonly used denotation is a complex emotional reaction or state that varies in intensity and fluctuates over time due to stressful situations that affect an individual. While, for the American Psychiatric Society (2019), anxiety is a normal reaction to stress and can be beneficial in some situations, such as serving as a warning to identify a danger, however, it differs from anxiety disorders that involve fear or excessive anxiety.

The term "anxiety" also refers to individual differences in anxious tendency as a personality trait, people prone to anxiety as a personality trait are more willing to manifest anxious states than non-anxious people, while neurotic individuals have high traits of anxious personality and are more likely to respond to situations involving threats to self-esteem with greater increases in intensity of anxious state than people with lesser traces of anxiety (SPIELBERGER, 1966).

Anxiety is due to a concern, which is capable of ruining extensions of human life, be it the idea of the danger of falling into conformity with the ideals of success that are imposed by society and that as a result, says goodbye to dignity and respect. And it is caused by, among other elements: recession, redundancy, promotion, retirement, conversations with colleagues in the same industry, and / or news of great successes of friends (DE BOTTON, 2004).

According to the United States Department of Health and Humanitarian Services (HHS, 2019), there are five major categories of anxiety disorders, namely: generalized anxiety disorder, obsessive-compulsive disorder, panic disorder, post-stress disorder traumatic, and social phobia (or social anxiety disorder). Generalized Anxious Disorder is characterized by chronic anxiety, exaggerated worry and tension, even though there is nothing to cause it. Obsessive-Compulsive Disorder is characterized by recurring unwanted thoughts, given as obsessions, and / or repetitive behaviors, called compulsives. Panic Disorder is characterized by repeated and unexpected episodes of intense fear, accompanied by physical symptoms that can include chest pain, heart palpitations, short breaths, dizziness, and abdominal pain (HHS, 2019). Also, according to HHS (2019), Posttraumatic Stress Disorder is characterized by the development after exposure to a frightening event or the result of a serious physical injury that occurred or was threatened. Finally, Social Phobia or Social Anxiety Disorder is characterized by enormous anxiety in daily social situations.

According to Linden (2007), the evidence that the work environment can play an important role in the development of anxiety problems and disorders has increased, and it is discussed as "bullying", "work stress", "burnout", or "overwork". In the results found by Halsam et. al (2005), it was identified that the uncontrollable workload contributed to anxiety. The post-traumatic stress disorder related to the work environment has been highlighted. According to Laposa et. al (2003), work-related anxiety disorders can manifest themselves in the form of phobia, social anxiety, or generalized anxiety and fears of insufficiency.

The lack of treatment, according to Halsam et. al (2005), has the potential to become a problem for employees who suffer from anxiety or depression, as they may experience symptoms of fatigue, or low concentration, which implies performance. According to Jones et. al (2015), organizations have emphasized the importance of improving employee psychological health, absenteeism, turnover and presenteeism, as mechanisms that affect the company's performance.

The relationship between anxiety and depression remains unknown, as shown by the study by Dealy et al. (1981), who investigate patients with symptoms of anxiety and depression, traditionally diagnosed based on their rates of depressive symptoms and anxiety symptoms. These authors found that there was no clear link between patients with anxiety and depressive disorders.

2.3 Depression

Depression, according to the American Psychological Association (2020), is the most common mental disorder, people with depression may experience a lack of interest and pleasure in daily activities, in addition to significant weight loss, insomnia or excessive sleep, lack of energy, lack of concentration, feelings of devaluation or excessive guilt and focused thoughts of death or suicide. According to Mousa (2016), in the United States, severe depression affects 14.8 million adults every year.

The difference, for Lewinsohn et al. (2000), between mood swings between degrees of significant and clinical depression, such as severe depression, and those that occur normally remains a problem. However, for the National Clinical Practice Guideline 90 (2010), the identification of severe depression is based not only on its severity, but also on the permanence, presence of other symptoms, and the functional and social severity.

Although the degrees of normal and clinically significant depression do not have clear, easy differences, the greater the severity of the depression, the greater the morbidity and adverse consequences. When considering other aspects, such as duration, stage of the disease and history of treatment, there are problems found in the classification of depression in categories (KESSING, 2007; LEWINSOHN, 2000).

Because of the complexity in identifying the severity of the depressive disorder, the literature recommends the use of a depression scale for the initial assessment. For this, there is a preference for the use of short scales with a "yes / no" answer format, such as the GDS with 30 items, or the Brief Depression Scale (BDS) with 11 items (BECK, 1998).

III. METHODOLOGY

3.1 Review principles

In order to carry out this study, a systematic literature review was carried out using the following steps to exclude articles that are not compatible with the proposed theme. The scheme of the steps is illustrated in Table 1.

Step	Definition	Activity	Tal des
i)	Selection of databases	Four databases were selected: Scopus, Web of Science, PubMed and MedLine.	Inc Ex
ii)	Definition of keywords and their combinations	The keywords defined were "industry 4.0", "anxiety", "depression", "quality of life", "HADS" and "WHOQOL", their combinations are detailed below.	LA
iii)	Defining the search criteria	Research without time limit, works inserted as articles in the area of Psychology, Engineering, Social Science and Medicine. Containing in your title any of the keywords mentioned in step ii.	Inc
iv)	Extraction of the searches found	The searches were extracted from the databases in the format ". ris ", treated using the JabRef program.	
v)	Duplication elimination	The elimination of duplicate articles was done by the JabRef tool.	
vi)	Definition and exclusion criteria for articles	After treating the results found for the removal of duplicates, the articles went through the refinement phase using the inclusion and exclusion criteria.	
vii)	Search for number of citations and impact factor	For the execution of Methodi Ordinatio, the number of citations of the articles and the impact factor of the journal in which the article was published are required.	

Table 1: Systematic review steps

Source: The authors (2020).

To ensure that all articles could be consistently accessed with fewer subjective opinions, the fundamental review principles for inclusion and exclusion criteria in step vi were defined in Table 2:

Table	2:	Inclusion	and	exclusion	criteria	and	their
descriptions.							

_		
Inclusion /	Criteria	Description
Exclusion		
D 1 1	XX 1111	TTA A 1 1 1
Exclusion	Unavailable	UA: Articles that
	Articles (UA)	could not be read.
	Non-related (NR)	NR-1: An article
		that does not
		address any of the
		topics of anxiety,
		depression, quality
		of life or industry
		4.0.
Inclusion	Dercially related	DD 1. An article
menusion	(DD)	about anxiety but
	(1 K)	uprelated to
		industry 4.0
		muusuy 4.0
		PR-2: An article on
		depression, but
		unrelated to
		industry 4.0
		PR-3: An article on
		quality of life, but
		unrelated to
		industry 4.0
		PR-4: An article on
		industry 4.0, but
		unrelated to
		anxiety, depression
		or quality of life
		PR-5: An article on
		industry 40 in
		relation to quality
		of life
		PR-6: An article on
		industry 4.0 related
		to anxiety
		PR-7: An article on
		industry 4.0 in
		connection with
		depression PR-8:
		An article on
		anxiety and
		depression, and / or
		quality of life, but
		unrelated to

		industry 4.0.
Closely (CR)	related	FR-1: An article that is specifically dedicated to anxiety, depression, quality of life and
		industry 4.0.

Source: The authors (2020).

3.2 Systematic literature review method

In this study, the combination of the terms proposed in step ii generated the results in each selected database. 372 results were found using the combination and search criteria in the database Scopus, Web of Science, PubMed and MedLine, which are presented in Table 3 according to the keyword in the title, abstract and keywords, selecting only articles for filtering.

Table 3: Exploratory search results.

	Scopus	Web of Science	PubMed	MedLine
"Industry 4.0" AND "quality of life" AND "anxiety" AND "depression"	0	0	1	22
"industry 4.0" AND "quality of life" AND "anxiety" OR "depression"	0	1	3	53
"Industry 4.0" AND "quality of life" AND "HADS"	0	0	0	0
"industry 4.0" AND "WHOQOL" AND "anxiety" AND "depression"	0	0	0	0
"industry 4.0" AND "WHOQOL" AND "HADS"	0	0	0	1
"industry 4.0" AND "quality of life"	12	11	49	0
"industry 4.0" AND "quality of life" OR "depression"	13	12	57	0
"industry 4.0" AND "WHOQOL"	0	0	0	8
"industry 4.0" AND "HADS"	63	0	0	5
"industry 4.0" AND ("anxiety" OR "depression" AND "quality of life")	0	5	3	53

Source: The authors (2020).

After collecting the articles from the databases in the .ris format, the articles were treated using the Mendley® software to identify and remove duplicate articles, and by the JabRef® software to result in an electronic spreadsheet containing the following data: author, title, year of publication, journal, type of document and DOI / URL.

An illustrative scheme of the execution of step vi is shown in Figure 2. Through this step, the number of articles found was filtered according to the inclusion and exclusion criteria previously defined, resulting in 102 articles for analysis at the end.



Fig 2: Flowchart of the different stages of the systematic review

Source: The authors (2020).

For the application of the Methodi Ordinatio proposed by Pagani et al. (2015), it was necessary to add the number of citations for each article and the impact factor of the journal in which it was published. The number of citations was obtained by searching Google Scholar and the impact factor of the journal was identified by means of JCR 2020 (base year 2019), made available by Clarivate Analytics (2020).

3.2.1 Data analysis

The data of the articles were analyzed quantitatively, through the frequency of publications in countries, the number of citations per article, the authors with the highest number of publications and the number of articles published per year. The qualitative analysis took place by forming clusters, in which the related articles were grouped and the content was analyzed, such as keywords, methodology and results.

IV. RESULTS AND DISCUSSION

Figure 3 shows the graphs used for the quantitative analysis of the articles found, such as graph A representing the number of articles per year, graph B with the number of citations per article, and graph C illustrating the number of articles by country.



Fig 3: Quantitative Analysis Charts Group Source: The authors (2020).

Graph A showed that 52.9% of the articles published and present in the databases were published between 2018 and 2019, reinforcing the current status of industry 4.0, anxiety, depression and quality of life. Two works stood out for preceding the 21st century: Hallstrom (1984), which discusses depression in women in Sweden; and Lindgren (1996), which also addresses the depressive disorder, however it is a neuropsychological test for treatment, therefore, dealing with an article more focused on medicine.

In graph B, which shows the number of citations per article, it is possible to analyze that in the first years the number of articles provided a low number of citations, and over time, the number of citations increased. In 2010, the article by Dyrbye et al. (2010) presented the highest number of citations (766), which addressed the depression and quality of life of medical students in the United States.

The analysis of the number of articles by country, shows the countries of origin of the first authors of the articles collected. The United Kingdom, which stands out with 15 publications on the topics, is recognized for research in mental health and for being one of the major industrial hubs since the beginning of industrialization. the second country with the largest number of publications on the subject was the United States of America (USA) with 9 articles, and like the United Kingdom, the country presents a high technological technological advance, therefore, these two countries were expected among the first of publication number.

The top ten authors with the highest InOrdinatio publications are represented in Table 4. Through this table it is possible to identify that 70% of the articles with the highest InOrdinatio indexes were published in 2020 and 30% correspond to the 2018 publications.

Author	Title	Year	Journal/Proceedings	InOrdinatio
Beier, G., Ullrich, A., Niehoff, S., Reißig, M. and Habich, M.	Procurement 4.0: factors influencing the digitisation of procurement and supply chains	2018	Business Process Management Journal	38390,081
Bienhaus, F. and Haddud, A.	Investigation of T4 and T6 heat treatment influences on relative density and porosity of AlSi10Mg alloy components manufactured by SLM	2020	Computers and Industrial Engineering	37330,005
Bodiako, A.V.	Commercial ICT smart solutions for the elderly: State of the art and future challenges in the smart furniture sector	2020	Electronics (Switzerland)	34400,003
Gingerich, K., Ding, IJ., Lin, SK., Grenčíková, A.,	Critical success factors for integrating artificial intelligence and robotics	2020	Digital Policy, Regulation and Governance	34400
Bravi, L, Murmura, F. and Santos, G.	Converting maintenance actions into standard symbols for Augmented Reality applications in Industry 4.0	2018	Computers in Industry	34380,037
Chen, HL. and Chen, YJ.	Open innovation session as a tool supporting innovativeness in strategies for high-tech companies in the Czech Republic	2018	Economies	34380,003
Chiarini, A.	Scopus scientific mapping production in industry 4.0 (2011–2018): a bibliometric analysis	2020	International Journal of Production Research	33120,011
Dewi, R.S., Alhabsji, T., Arifin, Z. and Abdillah, Y.	The Ability of Project Managers to Implement Industry 4.0-Related Projects	2020	IEEE Access	33120,002
Dewi, D.P., Soekopitojo, S., Larasati, A., Kurniawan, M.F. and Hartanti, E.R.S.	The promotion of technology acceptance and work engagement in industry 4.0: From personal resources to information and training	2020	International Journal of Environmental Research and Public Health	33120,001
Dhanabalan, T. and Sathish, A.	Made in China 2025 and manufacturing strategy decisions with reverse QFD	2020	International Journal of Production Economics	33120,001

Table 4: Main authors and their InOrdinatio index

Source: The authors (2020).

The article by Beier et al. (2018) present 81 citations and is the article with the highest InOrdinatio index (38,390,081). This work relates industry 4.0 with factors that influence the digitalization of commerce, with daily support and administrative tasks, in addition to supporting the decision-making process.

Among the ten articles with the highest InOrdinatio index, none were related to anxiety, depression or quality of life, but all are related to industry 4.0 and therefore published in journals with a high impact factor and a high number of citations. In addition, there was no author who published more than one article on the topic among the data collected in this period.

Through graphics D and E, shown in Figure 4, it is possible to analyze the impact factor of journals in relation to the average citations of the collected articles, and the articles that presented the InOrdinatio above the index average (7,320).



Fig 4: Set of graphics referring to InOrdinatio Source: The authors (2020).

When analyzing graph D, it was found that journals with an impact factor between 3302 and 3831 have higher average citations, than journals with a very high impact factor, or with zero impact factor.

The InOrdinatio index was used to prioritize the reading of articles with higher index values, as they have greater impact and relevance. From this, analyzing Graph E, the articles can be divided into above average of the InOrdinatio value and below the average value of the index. After analysis, it was identified that most articles are below the average value, therefore, a minority represent a higher value of citations and publications in journals with a high impact factor.

Figure 5 groups the graph F that represents the clusters of the consolidated groups and the graphs G, H and I

referring to the subcategory formed when analyzing the clusters.





4.1 Analysis of industry 4.0 cluster

When analyzing the graph F it is possible to identify that most of the works found are related to industry 4.0. Of these works, 25% belong to the Innovation subcategory. Rady et al. (2019) worked with infrastructure and technological development in the food industry, in addition, Rady et al. (2019), Perisa (2019) and Chiang (2019) studied the use of sensors in the industry.

In the maintenance subcategory, Garcia et al. (2019), Scurati et al. (2018), Attanasio et al. (2017) worked with maintenance processes for manufacturing. Scurati used augmented reality to standardize symbols and convert maintenance actions.

Regarding the materials subcategory, Majeed (2019) worked with iron alloys and the best manufacturing techniques, studying the parameters and conditions of heat treatment for the density and prosodity of the alloy, and Suárez-Macías (2020) worked with polymers of polycarbonate produced by a 3D printer.

In the medicine subcategory, Loppolo et al. (2020) for studying medicine 4.0 and its new health technologies for the use of innovation in preventive health, and Reinhardt et al. (2020) who studied the development of industry 4.0 in the pharmaceutical sector, conducted a survey of the sector in Ireland and found that 42% of respondents knew about industry 4.0, and concluded that the implementation of industry 4.0 is growing significantly in the pharmaceutical industries.

Wang et al. (2019) and Chiarini (2020) comprised the subcategory quality because they studied quality management in industry 4.0, Chiarini conducted a literature review with 75 articles, being one of the first articles of literature review on the theme of Quality 4.0, while Wang worked with China 2025, which is the industrial revolution within China, using the QFD tool and manufacturing decision strategy.

Human Resources make up one of the formed subcategories, it consists of articles that promoted leadership training, such as Dewi et al. (2020), who developed an instrument to measure the student's ability to work in a cooking program, to identify the soft skills and competencies that affect future work in industry 4.0. Brahma et al. (2020) researched a program for work executives, designed for the development of the digital work environment of industry 4.0, and the results presented challenges such as the fragmentation of work, which is due to the lack of connection between members of the same team.

4.2 Analysis of mental health cluster

In the mental health cluster, a subcategory stood out, many of the articles found were about treatments, among which we identified treatments for adults such as Castells et al. (2018), and for children, studied by Rochat et al. (2019). Within this subcategory, the study by Mohammadi et al. (2015), who studied the effect of probiotics on the mental health of a group of workers in a petrochemical sector, and their study resulted in a positive applicability of the drug in the population of workers in the industry.

There was a high incidence of articles involving treatments for depression, related to school age, such as the article by Root et al. (2019) that analyzes depression among other mental disorders in children. The articles that stood out were by Horton et al. (2011) and Kawada et al. (2010) who studied depressive symptoms and the relationship between depression and workload.

The SMT subcategory, which refers to mental health at work, highlighted the work of Rudolphi et al. (2020) and Edimansyah et al. (2008), in which they studied depression, anxiety and stress among farmers, and in the automotive industry, respectively. Padma et al. (2015) studied the health problems faced by workers in an information technology company, and Cohidon et al. (2008), studied the mental health of Toulese workers in France after the explosion at the industrial plant and affected three thousand people.

4.3 Analysis of quality of life cluster

Within the quality of life cluster, the subcategory with the largest number of studies was in the area of medicine, among them, van Dijk (2014) and Hesapçioglu et al. (2014) studied the quality of life and self-esteem of children. There have been studies on the quality of life of breast cancer survivors such as those by Kim et al. (2020), and disorders at the time of women's menopause as studied by Blume-Peytavi (2012).

The second subcategory created for the quality of life cluster was nutrition, a portion of articles presented studies on diet and food supplementation to improve quality of life, as in the study by Witte et al. (2005), Arjuna et al. (2018) and Inoue et al. (2018).

Finally, the third subcategory of this cluster is quality of life at work (QWL), within which the work of Chattopadhyay et al. (2014), Choi et al. (2012) and Andersen et al. (2002), who worked on the quality of life of workers at an iron sponge plant, engineers, and health problems resulting from repetitive work, respectively.

V. CONCLUSION

Depressive and anxious disorders have been under discussion for decades, and remain a topic of debate in several areas, as well as industry. The human presence within the industry is facing an adaptation in the midst of automation, the collaborators who go through this transition, will need to be trained more and more to the new technologies, and will be subject to go through stressful factors, which can trigger anxiety disorders and depressive.

This article sought to work on the axes of industry 4.0, anxiety and depression, and quality of life, to analyze whether there is any connection between them in the literature, the new industrial revolution is in evidence in the academic area, and mental health has become a concern during the 21st century, in this way, the impact that industry 4.0 has on the mental health of its collaborators was not documented in scientific articles searched by the databases that compose this research, presenting a gap for future works.

In this literature review work, the researched databases, which still have a high academic value and reliability, do not include all the research that could address the themes. In addition to the databases, the restrictions and criteria defined may be a limitation, since all files that are not scientific articles have been removed.

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Basic sciences applied to Bioengineering and its relations with the COVID-19 Pandemic

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Abstract— Recently, the experiences of countries affected by the new coronavirus, SARS-CoV-2, better known as COVID-19, as well as the evolution of the disease and the number of deaths in the world, have generated evident changes and repercussions on a global scale. Many advances have occurred, but there are still significant challenges facing the government, scientific and clinical communities. In view of this global scenario, it arose the need to ensure that basic research remains active, focused on improving scientific theories, through the scientific foundation provided by basic disciplines in continuing academic education. Among them, bioengineering has played an extremely important role in translating basic science research into practical applications, known as translational science, promoting precisely targeted therapies. This is due to prior and well-founded knowledge in the basic disciplines, which makes it possible to address current and emerging challenges in health and biomedical innovation

Keywords— COVID-19, Health Sciences, Bioengineering, Anatomy

I. INTRODUCTION

The basic sciences constitute a set of elementary and fundamental disciplines for the training of professionals in different areas of knowledge. Its broad spectrum makes its scope almost borderless, providing theoretical-practical foundation for future professional activities [1].

These basic subjects are generally available in the first years of undergraduate courses, and with the new curricular guidelines they can be distributed throughout the duration of the course to teach the student in an integrated manner [2].

Among the courses, biological engineering or also called bioengineering involves interdisciplinary activities that integrate engineering science with biomedical science and clinical practice, in order to develop new systems, equipment and devices that assist in the treatment of diseases or in the improvement of quality of life [3] (Fig. 1).

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Fig. 1: Illustration of the interrelationship of basic bioengineering sciences combined with health technology and clinical practice. The layout elucidates the need to promote an adequate validation of the basic sciences of bioengineering, in order to improve the global training of the technical-scientific professional, followed by a contextualized view of the study of health, disease and human-environment interaction.

In recent months, humanity has been caught by a pandemic caused by the new coronavirus, severe acute respiratory syndrome coronavirus 2, SARS-CoV-2, producing repercussions on a global scale, both medical, epidemiological, as well as major social, economic, political impacts, and cultural events unprecedented in recent history [4,5].

It is in this context that the comprehensiveness of the basic bioengineering disciplines, the morphophysiological, combined with health technology made it possible to develop equipment, such as mechanical respirators, attributed to the knowledge of the anatomy of the lungs, together with the necessary calibration for the equipment to perform with the same operating parameters as the human respiratory system [6].

In addition, the search for new testing methods that add knowledge of nanobiotechnology, with greater accessibility and assertiveness of the results, has expanded the diagnostic capacity of the SARS-CoV-2 virus, in controlling the spread of the disease, especially in medical conduct, in prognosis and in patient care [7].

In fact, many advances have occurred, however, they raise new challenges, in order to obtain additional information to determine the metabolic dynamics and the timing of this SARS-CoV-2 infection, given that the virus exhibits idiosyncrasies that differentiate it from other coronaviruses previously reported [8,9].

The infection apparently occurs in the nasal passage and continues to spread to the lower airways, intestines, heart and other tissues in a way that has not been fully elucidated. Even the symptoms are unpredictable and appear to change abruptly over time, due to their effects on a wide range of tissues, as well as their progression [10].

The most recurrent symptoms already reported are severe acute respiratory infection, which causes great difficulty in breathing, fever, cough, dyspnoea, malaise, myalgia, gastrointestinal disorders and neurological complications, the most common of which are decreased ability to taste or ageusia , and low olfactory sensitivity or anosmia [11,12].

Most investigations of these impairments in the peripheral nervous system have shown bias-prone evaluation. Such fact may be related to the lack of smell and taste tests in general health examinations, and the reports of symptoms are presented by the patients themselves, which can lead to an underestimated statistical analysis of these symptoms [13].

Therefore, based on an in-depth morphophysiological knowledge about the neural systems that mediate these sensations, and possibly, as the virus affects these areas, it becomes extremely important to obtain a differential diagnosis. Considering that the integrated understanding can ensure faster and more efficient detection, through bioengineering strategies in the development of technological devices [14].

The anatomical organization of the sense of smell begins in the specialized neuroepithelium, in the upper part of the nasal cavity, by means of chemoreceptors, the olfactory cilia of the olfactory vesicles, which are small dilations of the peripheral extension of bipolar neurons. The odorant molecules come into contact with specific chemoreceptors to effect the transduction necessary for the amplification of sensory signals and the generation of action potentials in the neuron axon [15–17].

Regarding the gustatory route, the chemical substances come into contact with the taste cells, which are sensitive chemoreceptors located on taste buds distributed in the papillae of the tongue, pharynx, larynx and proximal esophagus. This interaction generates electrical potentials that lead to the release of neurotransmitters, and consequently trigger action potentials that follow the afferent fibers of the facial, glossopharyngeal and vagus nerves [15]. The possibility that SARS-CoV-2 may cause olfactory and taste disorders is certainly acceptable. However, previous data suggest that the exact mechanism of olfactory and gustatory dysfunctions requires further investigation, as they believe that there may be more than one pathophysiological pathway. Detailed clinical assessments and functional tests related to these olfactory and gustatory disorders, including the exact classification and duration of complaints, are of high priority [18].

Many prophylactic, therapeutic immunological preclinical approaches have been analyzed, among them, the accelerated search for a vaccine that induces a neutralizing effect through specific T cell responses, drugs that provide a reduction in viral load and safe devices in detection of the disease as well as its symptoms [19].

An issue that arises, however, is the need to promote the integration of scientific research and development, defining research priorities, integrating research initiatives, and promoting the development of technologies on emerging viruses [20].

As a way of promoting these efforts, it is necessary, initially, to recognize the essential role of basic sciences, not only as a list of topics to be fulfilled in the curriculum, but part of a structured experience that leads to understanding and solving complicated clinical problems or unusual, such as the disease caused by the new coronavirus.

The gravity of the situation has caused in the governmental, scientific and clinical communities, a careful attention in the basic disciplines in academic institutions, in order to achieve greater knowledge and integrate with previous experiences, and thus enable solutions.

II. FINAL CONSIDERATIONS

Bioengineering will undoubtedly accelerate the pace of research on the new coronavirus, developing viable treatment strategies, through model systems that integrate the investigation of physiological variables, such as information on how the virus spreads and how the body reacts to it, helping to understand the pathophysiology of this disease.

Thus, the impact of this area of knowledge will have far-reaching potential, if it is based on scientific and technological advances, and these necessarily tied to the contextualized basic disciplines (Fig. 1).

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Evaluation of the cytotoxicity of two endodontic cements based on calcium silicate and Pulp Canal Sealer cement in human fibroblasts

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Abstract— During the gutta-percha filling stage, the endodontic cement can extend beyond the apex, interacting directly with the periapical tissues. Thus, endodontic cements should exhibit several positive biological characteristics, such as cytocompatibility. The objective of this study was to compare the cytotoxicity of two bioceramic endodontic cements, Bio-C Sealer and TotalFill BC Sealer, and of the cement and Pulp Canal Sealer based on zinc oxide and eugenol. For this purpose, human gingival fibroblasts (FG11 and FG15) were submitted to the cell culture medium conditioned by the cements (TFBCS Group: TotalFill BC Sealer Cement; BCS Group: Bio-C Sealer Cement; PCS Group: Pulp Canal Sealer Cement), and cell viability was evaluated using the MTT assay. The test was performed 48 and 72 hours after contact with the cement extracts (1:5 dilution). Cells cultivated in DMEM medium served as control. Descriptive analysis and data submitted to the ANOVA and Tukey's test (P < 0.05) were performed using the SOSS 23 program (SPSS INC., CHICAGO, IL, USA). The results showed that the cultures submitted to the two endodontic bioceramic cements presented greater viability in relation to Pulp Canal Sealer cement (P < 0.05), for both evaluation times. Within the limitations of the methodology, it could be concluded that bioceramic cements Bio-C Sealer and TotalFill BC Sealer cement (P < 0.05), for the times of 48 and 72h.

Keywords—Bioceramic endodontic cement, Cell culture, Human gingival fibroblasts, Cytocompatibility.

I. INTRODUCTION

The success of the endodontic treatment is achieved by eliminating microorganisms from the root canal system, followed by an appropriate sealing with the obturator materials [1]. Endodontic cement is essential to seal the space between the dental wall and the obturator material, also representing the lubricating agent for filling the root canal system. During the filling stage, the perirradicular tissues may come into contact with the endodontic cements, mainly by extrusion besides the apical foramen [2]. Thus, such cements should be biocompatible and noncytotoxic to perirradicular tissues [3].

Currently, different types of endodontic cements are available: zinc oxide eugenol, resin based, containing calcium hydroxide, MTA and bioceramic based cements [4-7]. Eugenol zinc oxide based cements have a long history of successful use due to their widely demonstrated positive qualities; however, they have been shown to be cytotoxic, which has been attributed to the eugenol present in different formulations [8,9].

Recently, dicalcium silicate and tricalcium-based cements have received significant attention due to their favorable physicochemical and biological properties [10-13]. These cements present high pH, allow the release of Calcium ions and are able to form hydroxyapatite during the setting process, interacting with the dentin (infiltration of the mineral content of the cement based on bioceramics in the intertubular dentin) and forming the so-called zone of mineral infiltration [15,16].

TotalFill BC Sealer (FKG Dentaire SA, La-Chaux-defonds, Switzerland) is another cement based on calcium silicate that has demonstrated good physical and biological properties, with the capacity to release calcium ions [2]. It is composed of dicalcium silicate, tricalcium silicate, calcium hydroxide, monobasic calcium phosphate, zirconium oxide, tantalum oxide, fillers and thickeners [12-14].

Bio-C Sealer cement (Angelus, Londrina, PR, Brazil) is a ready-to-use bioceramic cement containing calcium silicates, calcium aluminate, calcium oxide, zirconium oxide, iron oxide, silicon dioxide and dispersing agent in its composition. According to the manufacturer, its bioactivity is attributed to the release of calcium ions that stimulate the formation of mineralized tissue [7]. However, until now, there are few studies evaluating its effects on periapical tissues and related cells [17].

Obturator cements should be tested for their biological properties, comprehensively and independently, by *in vitro* and *in vivo* tests, before their unlimited clinical use, in order to minimize the incidence of local and/or systemic adverse effects [2,7,10,]. From the clinical point of view, there are clear limitations in the correlation between in vitro data and clinical behavior. However, in vitro cytotoxicity tests are important to understand the biological risks of these materials [10,11,20]. This is the first study that evaluated the cytocompatibility of Bio-C Sealer cement by means of cell proliferation and viability tests in human fibroblasts.

The objective of this study was to investigate the cytocompatibility of Bio-C Sealer and TotalFill BC Sealer bioceramic cements compared with Pulp Canal Sealer cement. The null hypothesis was that there would be no difference in cytocompatibility between the tested cements.

II. MATERIALS AND METHODS

The study protocol (No. 3141789) was approved by the Research Ethics Committee of the São Leopoldo Mandic School of Dentistry, Campinas, São Paulo, Brazil (CAAE 99349218.0.0000.5374).

2.1 Cell culture

Two cell lines from FG11 and FG15 human fibroblasts cultures were obtained from the cell bank. These cells were thawed and transferred to centrifuge tubes containing 10 mL of DMEM (Sigma, St. Louis, MO, USA) and centrifuged at 336 g (grams) for 3 minutes. The supernatant was discarded and the cells were cultivated in 75 cm2 (square centimeters) culture vials (Corning Incorporated, Costar, Corning, New York, NY, USA) containing DMEM (Sigma) supplemented with 15% bovine fetal serum (Gibco), Invitrogen, Grand Island, New York, NY, USA), 100 IU/mL (international unit/ milliliters) penicillin (Invitrogen) and 50 µg/mL (microgram/militers) streptomycin (Invitrogen). In the subfluence, the culture medium was removed and 0.25% trypsin solution (Gibco) and 1 mM EDTA (millimeters) (Gibco) were added to obtain cell suspension. Next, 110 cells/mm2 (milliliter squared) were plated (in 24-well polystyrene plates (Corning Incorporated) and cultivated at McCoy's 5A (Sigma) supplemented with 10% bovine fetal serum (Gibco), 7 mM of β -glycerophosphate (Sigma), 5 µg/mL of ascorbic acid (Gibco), 100 IU/mL of penicillin (Invitrogen) and 50 µg/mL streptomycin (Invitrogen). The cultures were maintained for periods of up to 14 days and their progression was evaluated under an inverted phase microscope (Nikon, Eclipse TS100). The culture medium was changed every 3 days. During the whole culture time the cells were kept at 37°C in a humidified atmosphere containing 5% of CO2 (carbonic gas) and 95% of atmospheric air.

2.2 Conditioned medium

The endodontic cement Pulp Canal Sealer was handled at room temperature (25°C), following the instructions of its manufacturer. Samples of the handled cement and ready-to-use cements were obtained using silicone devices of 6 mm in diameter and 2 mm in height. After the prey reaction, the specimens were weighed, sterilized in ethylene oxide and kept in basal culture medium (DMEM, 15% fetal bovine serum and 1% antibiotic-antimycotic), for 24 h in an oven at 37oC, obtaining the conditioned medium.

2.3 Experimental groups and control group

Four groups were outlined, as follows:

- Control group (GC): cells cultivated in fresh medium (DMEM);
- TotalFill BC Sealer Cement Group (TFBCS): cells cultivated in environment conditioned by TotalFill BC Sealer Cement;
- Bio-C Sealer Cement Group (BCS): cells cultivated in a conditioned medium by the Bio-C Sealer;
- Pulp Canal Sealer Cement Group (PCS): cells cultivated in a conditioned medium by the Pulp Canal Sealer cement.

After this period, the plated cells (density of 110 cells/mm2) were supplemented with the conditioned medium in the proportion of 0.2 g/mL (ISO 10993), for the experiments described below.

2.4 Cytocompatibility evaluation

Cell viability analysis was performed by colorimetric 3-(4,5-dimethylthiazol-2-yl)-2,5assays with diphenyltetrazolium bromide (MTT assay). 110 cells per mm² were used in each well of the 96 thermometer wells, incubated with the tested substances for 48 and 72 hours, at 37°C. Immediately after, 10 µl of MTT solution (5 mg/mL - SIGMA) diluted in DMEM culture medium without serum was placed, adding the treated cultures and these incubated for a period of 4 hours at 37 °C. After this incubation period 100µl of 10% sodium dodecyl sulfate (SDS) and 0.01N hydrochloric acid solution were added and the experiment maintained for 1 hour at 37°C. The mitochondrial activity of the cells indicates their viability by means of an optical analysis (Optical Density - OD) [41]. For this study, this quantification was performed by a multiplate reader ELX800 (Epoch biotek instruments, inc.) at 570 nm.

2.5 Statistical analysis

Shapiro-Wilk's normality test showed a sample of normal distribution. Thus, descriptive analysis and data submitted to Tukey's ANOVA and test (P <0.05) were performed using the SPSS 23 program (SPSS INC., CHICAGO, IL, USA).

III. RESULTS

Regarding cell viability, the cultures submitted to the two endodontic bioceramic cements presented higher viability in relation to the PCS group, the times 48 hours (p = 0.001) and 72 hours (p < 0.001), not differing significantly from the GC (Table 1 and Graph 1).

Table.1: Average values and standard deviations of cellular viability according to group and time interval

Group	Time			
Group	48 hours	72 hours		
Bio-C Sealer	0,76 A	0,87 A		
Dio-C Scale	(0,05)	(0,04)		
Pulp Canal Soular	0,53 B	0,66 B		
r up Callal Sealer	(0,05)	(0,05)		
Total Fill	0,78 A	0,90 A		
Total-Till	(0,08)	(0,03)		
Control (polystyropo)	0,79 A	0,91 A		
Control (polystyrelle)	(0,05)	(0,04)		

Note: Standard deviation in brackets. Averages followed by equal letters indicate no statistically significant difference between groups within each time interval.





IV. DISCUSSION

The recognition of the need to use endodontic cements is a fact recognized in the literature [1]. However, it is valid to emphasize that these materials can be extruded to the perirradicular tissues through their communication with the root canal system, delaying the healing of these areas [21,22]. With this knowledge, it becomes evident the necessity of studies that analyze the cytocompatibility of these obturator cements by means of methodologies that can evaluate their cytotoxic behaviour, thus observing the viability of their use [23,24].

For the evaluation of the biological behavior of cements, there is a need for the use of in vitro cell culture [3]. Thus, the relevance of the use of human fibroblasts, which have the ability to simulate an in vivo tissue response, is observed [25,26].

Moreover, the moment of these evaluations becomes somewhat significant, since, in clinical practice, endodontic cements are inserted in the root canal soon after their manipulation, or even, for cements in ready-touse form, they take some time for their final prey, when they present a higher degree of cytotoxicity [27]. However, evaluations in other periods after manipulation become pertinent for monitoring possible changes in their biological behavior [7,17].

Several methodologies were recommended to evaluate in vitro the biological effects of sealing cements [2,10,16-19]. The MTT assay is capable of measuring the metabolic activity of living cells, representing a simple, reproducible and precise technique [2,7,12]. However, it is important that the majority of cells are in exponential growth phase, being pertinent to validate and complement the results of the MTT assay with other methods that can evaluate cellular structural viability, apoptosis and/or cellular necrosis [28].

There are publications regarding the in vitro cytotoxicity of several endodontic obturator cements [30-32]. Some so-called conventional cements demonstrated inadequate biological activity and high cytotoxicity in the culture, especially soon after its manipulation [33,34]. Bioceramic materials have been considered promising materials for the repair of mineralized tissues due to their excellent physical-chemical properties and biocompatibility [3,7,11,18]. The favorable biological activity of bioceramic cements may be associated with alkaline pH, higher release of Ca2+ ions and hydroxyapatite formation, as demonstrated in previous studies [10,11,20].

This study aimed to evaluate the cytocompatibility of two bioceramic cements by means of a cell viability test, in two distinct times. For these evaluations, an endodontic cement based on zinc oxide and eugenol was used for comparison. Based on the results obtained, the null hypothesis was partially rejected, since there was a difference in cytocompatibility between the tested cements, for the times of 48 and 72 hours.

From the cytocompatibility perspective evaluated by the MTT colorimetric assay, both bioceramic cements presented higher cellular viability in comparison to Pulp Canal Sealer cement, for 48 and 72h times. López-Garcia *et al.* [17] evaluated the cytocompatibility of TotalFill BC Sealer, Bio-C Sealer and AH Plus cements against human periodontal ligament stem cells, using the MTT assay, at three distinct times (24, 48 and 72 h). TotalFill BC Sealer and Bio-C Sealer were significantly less cytotoxic than AH Plus at all dilutions and for all times tested. TotalFill BC Sealer also demonstrated cytocompatibility in human periodontal ligament cells [2] and fibroblasts [35], revealing the biocompatibility of calcium silicate based cements with zirconium oxide [16,36-38].

The PCS group presented statistically inferior cellular viability in relation to all the other groups in the times of 48 and 72 hours. The Pulp Canal Sealer EWT cement demonstrated to be very cytotoxic after 24 hours in cell culture studies [10]. However, it was reported that the same cement produces a better tissue organization after subcutaneous implantation in rat connective tissues [39]. The difference may be related to the manner in which the extracts were presented to the cells and dilutions of the cements. Moreover, the severe in vitro cytotoxicity associated with zinc oxide based cements [24] was not apparent in a recent clinical study [40]. Thus, the results of in vitro cytocompatibility studies should be interpreted with caution. Da Silva et al. [35], using a threedimensional (3D) cell culture model and the MTT assay, found that EndoSequence BC Cement (Brasseler, Savannah, GA, USA) presented lower cytotoxicity compared to Pulp Canal Sealer cement. Poggio *et al.* [12] compared the cytotoxic effects of eight obturator cements (BioRoot RCS, TotalFill BC Sealer, MTA Fillapex, Sealapex, AH Plus, EasySeal, Pulp Canal Sealer, N2) in immortalized human gingival fibroblasts for a period of 24, 48 and 72 hours. The authors verified that the TotalFill BC Sealer cement, in 24h, did not present cytotoxic effect, presenting only mild cytotoxicity in 48 and 72h; Pulp Canal Sealer cement presented moderate cytotoxic activity in all tested times.

Further investigations are required using different in vitro and in vivo models to validate possible biological responses to calcium silicate endodontic cements.

V. CONCLUSION

Within the limitations of the present study, it was possible to conclude that bioceramic cements Bio-C Sealer and TotalFill BC Sealer presented higher cytocompatibility compared to Pulp Canal Sealer, for the times of 48 and 72h.

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Influence of abutment diameter for platform switching on the biomechanics of internal and external hexagon posterior implants

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Abstract— Objective: The aim of this study was to evaluate the influence of the reduction of abutment's diameter for platform switching on stress distribution of single implant with external or internal connections using three-dimensional (3D) finite element analysis. Materials and Methods: A total of 8 virtual 3D models were constructed containing one single implant ($5.0 \times 11.0 \text{ mm}$) in a mandibular segment supporting a single first molar screwed crown. The implants presented external or internal hexagon connections with UCLA abutment with different diameters: 3.8, 4.2, 4.6 or 5.0 mm. All structures were considered perfectly bonded and each model received a 200 N oblique load on the occlusal surface distributed on 8 points. The maximum tensilestress (σ_{max}) and the maximum principal elastic strain (ε_{max}) were calculated for the cortical and trabecular bones and equivalent Von Misses (σ_{vM}) for dental implant and abutment using ANSYS Workbench software. Results: The reduction of abutment diameter produced a reduction of stress values in bone tissue up to 3,6% in internal hexagon. On the other hand, the smallest abutment diameter for external hexagon connection produced the highest stress in surrounding cortical bone(53 MPa). The reduction of abutment diameter increased the stress and strain in both theabutment (up to 360%) and implant (up to 200%), regardless of implant connection. External hexagon connection presented the highest stress and strain magnitudes. Conclusion: The reduction of abutment diameter improves stress distribution in bone tissue, regardless of implant connection type. However, it increases the stresses within the implant and abutment, which could compromise their mechanical resistance.

Keywords—platform switching, dental implant, stress distribution, finite element analysis.

I. INTRODUCTION

Bone resorption close to the first thread of Osseo integrated implants is frequently observed during initial loading. The mechanism of bone resorption has been attempted to be explained by formation of the biologic width as with the periodontal tissue around natural teeth (Berglundh et Lindhe, 1996) or by the mechanical stress to the bone– implant interface (Duyck et al., 2001). The bone loss observed after prosthetic load can be expected as 1.5-2 mm in the vertical axis and 1.4 mm in the horizontal axis (Tarnow et al., 2000).

Several hypotheses have been proposed for these changes observed in the bone crest region. Some authors indicate the influence of the microgap present in the

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implant-abutment interface (I/P). Bacterial microleakage through the I/P interface and colonization of the internal portion of the implants leads to an inflammatory infiltrate close to the I/P interface, thus hindering bone resorption close to the bone /implant junction (Hermann et al., 2001).

Shifting to a smaller diameter seems to be promising in the prevention of bone loss The platform switching (PS) concept was introduced in the literature by in 2006(Lazzara et Porter, 2006), referring to the use of a small diameter abutment on a larger diameter implant platform. The proposed difference between implant platform and abutment is an attempt to decrease the bone loss thought three different ways: microbiologicby shifting the implant-abutment interface medially, inflammatory infiltrate is moved away from the bone and the deleterious impact of the implant-abutment microgap on the periimplant bone is reduced) (Lazzara et al., 2006); biologic by increasing the exposed horizontal area of the implant surface and allowing the connective component of biologic width to have more space to get attached preventing epithelial down-growth) (Farronato et al., 2012); and biomechanically by shifting the stress concentration area away from the cervical bone-implant interface, resulting in less post-loading bone resorption (Ackermann et al., 2020; Aslam et al., 2019; Gupta et al., 2019; Maeda et al., 2007; Maminskas et al., 2016)

The biomechanical advantage of PS suggested that the distance between the bone surfaces and implant/ abutment interface decrease the stress-concentrated area on the implant surface. The mismatch between implant and abutment to configurated a PS is not clear, studies shows that > 0.4mm mismatch can decrease the marginal bone loss. However, the current findings demonstrated that PS might risk the mechanical properties of abutments particularly of the ones with increased set-off distance and straight emergence.

The other factor may influence the distributed load on the bone is the implant connection. Internal connections have been introduced to lower or eliminate these mechanical complications and reduce stress transferred to the crestal bone(Finger et al., 2003; Norton, 1997). High strains and marginal bone loss have been found around the neck of implants with an external hexagon design(Hoshaw et al., 1994; J.-W. Lee et al., 2011). The PS and different connections have been demonstrated effectiveness in reducing stress in the periimplant bone. However, there are no studies that evaluate different mismatch between abutment and implant diameters comparing the internal and external implant connections. The aim of this study was to evaluate, through the three-dimensional finite element analysis, the influence of abutment diameter and implant connection onbone tissue, implant and prosthetic components biomechanical behavior.

II. MATERIAL AND METHODS

Eight tridimensional virtual models of a first lower molar supported by animplant were constructed. The abutment diameter (3.8, 4.2, 4.6 and 5.0) and the implant connection (internal hexagon and external hexagon) were the study factors. Oblique occlusal loadwas applied and analyzed by the finite element analysis software to obtain the maximum tensile stress (σ max) and the maximum principal elastic strain (ε max) for the cortical and cancellous bone and the von Mises stress (σ VM) for the implant, abutment and the abutment screw.

Finite Element Models Design

Computerized tomographic images of a human edentulous mandible were used for the construction of the mandibular segment with cortical and cancellous bone. Likewise, a CT scan of a human lower first molar was used to provide the DICOM images, exported to the In Vesalius software for the 3D reconstruction of the implant-retained cemented crown, according to a previously published protocol (Camargos et al., 2020).

The modeling of the two implants were obtained by a generic construction of a cylindric 5 x 11 mm internal or external hexagon connection. Likewise the modeling of the eight abutments with four different diameter and two different connections, as based on the generic UCLA abutment. A computer-aided software (Solid Works, Concord) was used for the tridimensional modeling. The four abutments diameter were3.8, 4.2, 4.6, 5.0 mmas presented in Figure 1.The metal-ceramic cemented crown had a cement layer with 0,5mm of thickness. Then, the eight CAD models were exported to Ansys Workbench 10.0 FEA software (Swanson Analysis Inc) for the finite element analysis.



Fig.1: Axial visualization of the eight experimental models in external hexagon (EH) and internal hexagon (IH) 5 x 11 mm implants and 3.8, 4.2, 4.6 and 5.0 mm abutments. Implant body and dimensions were maintained, as only the connection type, screw and abutment diameters were altered in order to increase the platform switching effect.

Material Properties and mesh formatting

All structures were considered isotropic, homogeneous and linearly elastic. The elastic modulus and Poisson's ratio were obtained from the literature and are shown in Table 1. Convergence analysis of 5% was processed, (Geng WeiXu, Weiqi Yan, 2008)achieved using a tetrahedral mesh containing 0.6 mm elements (Figure 2).

	-		
Material	Young's modulus	Poisson's ratio	Reference
Cortical bone	14.0	0.3	(Cruz et al., 2009)
Trabecular bone	1.37	0.3	(Cruz et al., 2009)
Titanium	110	0.33	(Cruz et al., 2009)
Ceramic	68.9	0.28	(Coelho et al., 2009)
Co-Cr alloy	90.0	0.28	(Sertgoz, 1997)
			(1997)

Table 1: Mechanical properties of the materials



Fig.2: Final mesh obtained after convergence analysis with 0.6 mm elements.

Interface conditions

The bone-implant interface was assumed to be perfect bonded, simulating 100% osseointegration, and the crown, abutment, and the implant were assumed to be completely bonded.

Loading and Boundary Conditions

The boundary conditions were defined by fixing the mesial and distal external surfaces of the bone segment

in all directions. The models were loaded in two steps: an initial loading using a 32N/cm to preload torque on the prosthetic screws, and the second stepwas simulated an occlusion loading by applying a 220N oblique load distributed over eight 1.5-mm² points (Figure 3). The forces were applied in the direction of normal occlusion, 45° to the cusp of the tooth.



Fig.3: Eight loading points distributed on the occlusal surface of the tooth for the oblique loading (45 degrees) of 220 N.

The maximum tensile (σ max) and the maximum principal elastic strain (ε max) for the cortical and cancellous bone and the von Mises equivalent stress (σ vM) for the implant, abutment and the abutment screw were obtained.

III. RESULTS

The results were obtained in both quantitative qualitative analysis. The quantitative data is shown in Table 2 and qualitative images are shown in Figures 4 and 5.

Groups		Cortical bone		Trabecular bone		Implant	Abutment	Screw
		σmax (MPa)	&max (μm/ μm)	σmax (MPa)	Emax(μm/ μm)	σvM (MPa)	σvM (MPa)	σvM (MPa)
	3.8	47.9	3.72	6.25	4.99	246.7	523	155
тц	4.2	49.6	3.77	6.15	4.90	192	243	244
111	4.6	48.6	3.72	6.09	4.85	191	205	241
	5.0	48.0	3.68	6.05	4.81	190	161	240
	3.8	53.1	4.01	6.91	5.22	569	739	645
БП	4.2	52.6	4.01	6.39	5.09	209	355	373
LII	4.6	51.1	3.92	6.30	5.00	194	201	231
	5.0	50.3	3.88	6.26	4.96	194	192	209

Table 2: Stress and strain values for all eight models of the study.

IH: internal hexagon; EH: external hexagon; σmax: Maximum Principal Stress; Emax: Maximum principal elastic strain ;σvM: equivalent von Mises stress.



Fig.4: Qualitative visualization of σmax (MPa) distribution on surrounding cortical bone among all experimental models. The maximum tensile stress were observed on the buccal area due to the oblique loading simulating chewing.



Fig.5: Qualitative visualization of σvM (MPa) distribution on implant among all experimental models. The maximum von Mises stress were observed on the platform area for small abutment diameters on external hexagon and on the third thread of the implant for all other models.

The lowest tensile stress values for the cortical bone(47.87 MPa) was found in the 3.8 HImodel, while the highest value was found in the 3.8 EH model (53.11 MPa), that represents an increase of 11%. The Emax for cortical bone varied from 3,68 x 10⁻³ mm/mm (5.0 IH) to 4,01 x 10⁻ ³ mm/mm (3.8 EH), which represents an increase of 9%. For trabecular bone the σ max varied from 6.05 MPa (5.0 IH) to 6,91 MPa (3.8 EH), which represents an increase around 14%. The Emax for trabecular bone varied from 4,81 x 10⁻³ mm/mm (5.0 IH) to 5,22 x 10⁻³ mm/mm (3.8 EH), which represents an increase of 8,5%. The omax stress for cortical bone was concentrated in the buccal area, as shown in Figure 4. It was observed the improvement of stress distribution on the surrounding bone area when decreasing the abutment diameter, increasing the platform switching effect, regardless of implant connection type.

For implants and abutments, it was observed an increase of the σvM stress when decreasing the abutment diameter regardless of implant connection type (Table 2).

The lowest σ vM value for implant was found in the 5.0 IH (190 MPa) and the highest in the 3.8 EH (569 MPa). That is a 200% increase. Likewise the same happened for the abutment, from 161 MPa in IH 5.0 to 740 in 3.8 EH, with a 360% of increase. As shown in Figure 5, the σ vM stress concentrated in the lingual area of the connection platform for the increased platform switching models of external hexagon implants (3.8 and 4.2). In the reduced platform switching (4.8) and regular platform (5.0) EH implants, the maximum stress was concentrated in the first tread of the implant, away from the implant/abutment interface. For the internal hexagon implants, regardless of abutment diameter, the stress also concentrated close to the third thread of the implant (Figure 5).

Considering the screw, the lower σvM stress was found in the 3.8 IH (155 MPa) and the highest in the 3.8 EH (645 MPa). The internal connection provided less stress in the screw than the external connection.

IV. DISCUSSION

The present study evaluated the effect of implant connection (internal and external hexagon) and platform switching concept (abutment diameter of 3.8, 4.2, 4.6 and 5.0) on the stress and strain magnitude and distribution on implant-supported lower molar crown. Both the study factors influenced the results of the analysis. Internal connection provided lower values for all criteria of the study. The surrounding bone tissue was less affected when internal connection was used associated with increase platform switching (3.8 IH). On the other hand, when using external connection, the implant, abutment and screw was highly affected by platform switching, with high increase in stress

The better understanding of stress and strain magnitudes and distributions around implants can enlighten the clinical findings for implant-supported restorations, as marginal bone loss around implants after surgical placement and loading inan important parameter in assessing the success of the implant fixture. The radiographic bone loss ranges of 1.5 mm during the first year, followed by 0.2 mm in subsequent years.(Tarnow et al., 2000)Bone resorption close to the first thread of Osseo integrated implants is frequently observed during initial loading. The mechanism of bone resorption has been attempted to be explained by formation of the biologic width as with the periodontal tissue around natural teeth(Berglundh et al., 1996) or by the mechanical stress to the bone– implant interface (Duyck et al., 2001).

Prevention of horizontal and vertical marginal peri-implant bone resorption during the post-loading period is necessary to maintain gingival levels.(Canullo et al., 2012) Features of the implant-abutment connection were considered to influence the biological outcomes(Hermann al., 2001) and the mechanical behavior of et implants(Hansson, 2000; Norton, 1997).The microbiological approaches involve shifting the implantabutment interface medially, moving the inflammatory infiltrate away from the bone and the deleterious impact of the implant-abutment micro gap on the peri-implant bone(Lazzara et al., 2006). The biologic consequences is the increased exposed horizontal area of the implant surface, connective component of biologic width to have more space to get attached, preventing epithelial downgrowth (Annibali et al., 2012; de Almeida et al., 2011; Farronato et al., 2012; Messias et al., 2019); and biomechanical consequences by shifting the stress concentration area away from the cervical bone-implant interface, may result in less post-loading bone resorption(Annibali et al., 2012; Gupta et al., 2019; Maeda

et al., 2007; Messias et al., 2019; Rodríguez-ciurana et al., 2009).

Considering the findings of this study, shifting to a smaller abutment diameter seems to be promising in the prevention of higher stress in the cortical bone for internal connections. Internal connections have been introduced to lower these mechanical complications and reduce stress transferred to the crestal bone (Maminskas et al., 2016; Norton, 1997).

High strains and marginal bone loss have been found around the neck of implants with an external hexagon design (Hoshaw et al., 1994; J.-W. Lee et al., 2011)maybe due to the abutment screw being responsible on its own for maintaining the fixture-abutment joint in this type of connection. The internal hexagon and the Morse taper connections have greater mechanical friction, stability, and form lock than the external hexagon joint(Caricasulo et al., 2018; Maminskas et al., 2016; Nishioka et al., 2011).All criteria evaluated in the present study presented lower values for the internal hexagon in comparison to the external hexagon.

Two studies found an increase of σvM stress for implants and abutments in the platform switching model in comparison to regular platform model(Aslam et al., 2019; Çimen et Yengin, 2012). The same pattern was observed in the present study. For obtaining the PS concept, there is a decrease of thickness in the abutment, therefore an increase of stresses is expected. Nevertheless, the current reinforced alloys used for implants and abutments enhances the survival rates, and fractures of such parts are not increased in comparison to regular implants, without PS concept (Ackermann et al., 2020; C.-T. Lee et al., 2016).

Regarding the surrounding bone tissue, the findings of the present study corroborate with a recent finite element analysis, whereas the platform switching also decreased the stress on the periimplantar area.(Aslam et al., 2019). That is expected, as the migration of the implant-abutment interface toward the center of the implant, decrease the stress concentration on the outer edge of the implant platform.

The findings of the present study should be carefully considered, as this finite element analysis has the limitation of a linear analysis.(Murakami et Wakabayashi, 2014) Despite the finite element method be considered trustworthy in biomechanical research (Cervino et al., 2020) the simplification on a linear analysis with bonded contact may jeopardize the stress and strain dissipation between parts of the assembly. Nevertheless, the bonded contact between implant and bone is considered to simulate a fully Osseo integrated implant. Therefore, future studies with non-linear analysis should be performed to better understand the biomechanics involved in the simulated systems.

V. CONCLUSION

Considering the limitation of this non-linear in silico study, the following conclusions can be drawn:

- 1. Internal hexagon connection provided lower stress and strain magnitudes
- 2. The decrease of abutment diameter resulted in lower stress for cortical bone with internal or external hexagon
- 3. There is an important increase of stress on implant, abutment and screw when reducing the abutment diameter for both connections.

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Application of Talo Palmeira do Buriti (*Mauritia Flexuosa*) for Production of Sustainable Design

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Abstract— Environmental problems are a matter of concern in all areas of knowledge. Pollution, disposal and degradation are part of the vocabulary and daily life of contemporary life. The systems of manufacture, recycling and pollution index generated by industries are in constant debate all over the world, for the search for alternatives that will solve these problems. The amount of disposal of nondegradable materials in the environment has increased steadily, and product packaging is a large part of this problem, mainly due to inappropriate disposal. In this context, the present work aims to extract nanocrystals (Poly lactic acid) from cellulose of the buriti petiole with potential for the technological production of sustainable design. To extract the dust from the buriti petiole, dry material was used, which was cut into small cubes and soaked in running water for twenty four hours. Next, the lactic acid poly (powder) was bleached, the color of the visual aspect was characterized under a microscope and the degree of water absorption was evaluated, the morphology and thermal properties of the lactic acid poly of the buriti petiole were characterized. From these results, different sustainable packaging prototypes were generated. In addition, from the buriti petiole, cellulose nanocrystalswere extracted, with the potential for the development of bio-based nanocomposites for application in the environmentally correct innovative packaging design. After this stage, mechanical tests were performed by visual inspection and traction of the biocomposites and biodesing and evaluated the biodegradation result of the biocomposites in soil and water. Therefore, the designer the technology and use in materials makes it possible to generate new options and uses of fibers, adding greater importance to the sustainability process, collaborating with the environment and better exploring the alternatives for using a certain material.

Keywords— Petitol of buriti. Nanocomposite. Biodegradable design. Nanocrystals.

I. INTRODUCTION

Environmental problems are one of the main concerns of contemporary society. The manufacturing, recycling and pollution indexes generated by industries are constantly being discussed all over the world, in search of alternatives that will solve these problems. Social innovations need to be effective in this process to create more conscious consumption by the consumer, mainly focused on actions of sustainable practices. (VEZZOLI; MANZINI, 2008).

Product packaging is part of the pollution problem, as the incorrect way of disposal causes the inability to reuse its materials. However, it is possible to reduce this impact using, for example, advanced materials research methods. (SANTOS; AGNELLI; MANRICH, 2004).

The sustainable design produced by the PLA (lactic polyacid) of the Mauritia flexuosa petiole can help reduce the impact caused on the planet through sustainable alternatives, generating demands, channeling technologies, or producing innovative materials such as biodegradable compounds, which better fit this reality, as the substitution of materials, methods and energies for cleaner production. In addition, the use of nanoscience and nanotechnology in the development of packaging has provided an improvement in physical and functional characteristics, in

addition to adding better value to the packaging. (MOORE, 2009).

An example of this proposition that fits these parameters was the study by Abdul khani et. al (2014), who used aggregated cellulose nano particles are poly (lactic acid) to generate a more resistant material with a higher rate of degradation. Azeredo (2009) also used nano particles as a resource to generate improvements in packaging in several aspects. The author points out that properties such as antimicrobial activity and the ability to immobilize enzymes, among others, can be incorporated into packaging using nano particles and benefit the use mainly in food packaging.

Developing alternatives that better contribute to the use of packaging becomes less aggressive to the environment is the challenge of the current design, in addition to combining methods and techniques that make this process possible throughout the life of these packaging. By using a biodegradable material in his product whose raw material is derived from a renewable source, the designer will bring better consequences for the post-use of this packaging in his project. (PEREIRA; SILVA, 2010).

The need to design packaging that is less aggressive to the environment has generated research and exploration in the field of materials and techniques to build a different concept in the application of these materials in the final production of this type of product. For this reason, we opted in this work to use biopolymers and natural lignocellulosic fibers. Biologically active polymers are polymers produced from raw materials derived from renewable sources such as corn, sugar cane, cellulose, chitin and others. (BRITO et al., 2011).

The biodegradation of these polymers occurs when they are used as a nutrient by a certain set of microorganisms (bacteria, fungus, algae) (BRITO et al., 2011). For this reason, biologically active polymers are more sensitive to biodegradation than conventional petrochemical polymers, although biodegradable synthetic polymers are found.

Poly (lactic acid) (PLA) is an example of this type of polymer widely used in various sectors of the industry in the manufacture of products, due to its structural characteristics, its biodegradability and excellent mechanical properties (HAMAD et al., 2015).

PLA is a thermoplastic polyester, has clarity, shine and UV stability (ALMASI et al., 2015). PLA is also applied in several studies serving as a matrix in composites, together with natural fibers and other materials, making it more resistant and more effective in specific applications. (ALMASI et al., 2015).

According to Pereira et al. (2015), lignocellulosic fibers are considered an innovation in the search for new materials because they have low cost, biodegradability, recyclability and because they are not abrasive during processing. The use of nanoscale fibers has also become attractive for the replacement of synthetic fibers, mainly in the creation of nanocomposites from these fibers. Much research has been directed towards creating high-performance packaging through them. (KHALIL; A.F; YUSRA, 2013).

Among the various natural fibers, there is Buriti fiber, which is abundant in the Amazon region of Brazil and in countries in Latin America. (LAVORATTI et al., 2013).

Buriti fiber (Mauritia Flexuosa) is widely used to create handicrafts in traditional communities (SHANLEY & MEDINA, 2005).

However, it has very interesting characteristics in its composition, besides being very light, this fiber is easy to handle and also rich in antioxidant and antibacterial properties. (KOOLEN et al., 2013).

There are other properties, for this fiber that can be combined with other materials for different and technological applications, and for creating composites. The buritizeiro is a tall palm. It is possible to explore all parts of it, such as the root, the petiole and the fruit. (SAMPAIO & CARRAZA, 2012).

From cellulose, two types of nanoreforces can also be obtained, namely: cellulose nanofibers (NFCs) and cellulose nanocrystals (NCC) (REDDY et al., 2013).

The term cellulose nanocrystals (NCC) is used to designate elongated crystalline nanofibers similar to a rod, while the designation "micro / nanofibrils" should be used to designate long, flexible micro and nanofibers (NFCs) that consist of alternating chains of cellulose crystalline and amorphous cellulose. (TONOLLI, et al., 2012).

Nanocomposites are considered the materials of the 21st century, as they can add exclusive combinations, properties that cannot be found in common composites. (CAMARGO; SATYANARAYANA; WYPYCH, 2009).

In this context, the present research used the buriti petiole as a reinforcement of the poly lactic acid as a matrix to produce biobased composites generating environmentally friendly materials in the construction of sustainable packaging. For this purpose, it is proposed with this research, to extract nanocrystals (Poly lactic acid) from cellulose of the buriti petiole with potential for the technological production of sustainable design.

II. METHODOLOGY

According to Almeida (1998), sustainability is: "meeting the needs of the present generation without affecting the ability of future generations to meet theirs". Some people today refer to the term "ecologically sustainable development" as a broad term, as it implies continued development, and insist that it should be reserved only for development activities. "Sustainability", then, today and used as a broad term for all human activities.

2.1 Research location

The research was carried out in the municipality of Imperatriz (figure 01), the second largest city in the state of Maranhão. It comprises an area with great biodiversity because it contains the dense rainforest of humid characteristics of the Amazon, stretches of savanna and pioneer formations, all marked by deforestation (SEMA, 2016).



Photos: Southwest Maranhão - Imperatriz Source: SEMA – 2016

2.2 Materials

The petit of Buriti (PB) was acquired in the village Setor Agrícola, Municipality of Governador Edison Lobão, Maranhão - Brazil. Colorless green filament with a diameter of 1.85 mm of poly (lactic acid), natural coloring (figure 02).



Fig.2: Dry buriti leaf and petiole. Source: Authors 2020.

Ten buriti petiole sticks were cut with a length of 2 meters, weighing 800g each, with an average diameter of 1.89mm of green stick. After cutting, the petiole was placed in the sun for 3 hours at an average temperature of 33 ° C. Afterwards, the outer layer (bark) was removed, leaving only the colorless filament with a diameter of 1.85mm (figure 23). Without the outer bark, the petiole was placed in the sun for another 10 days until completely dry, removing all the water.

2.3 Extraction of dust from PB and obtaining of bio-based composites (PLA / PB)

To extract the dust from the buriti petiole, the dry material was used, which was cut into small cubes and soaked in running water for 24 hours. Then it was ground using a Philips WalitaProblend Black with Gray liquifier. For the sieving of the powder, a 17 cm Jolly Plastic sieve was used, with an 18/20 mesh opening and a 0.22 wire gauge figure 03.



Fig.3: Petiole cut into cubes, Petiole soaked in running water, crushed petiole and sieved powder Source: Zilmar Soares and Ana Beatriz de Castro.

2.4 Bleaching of the buriti petiole to obtain the PLA

500g of PB powder mixed in one liter of water was used, plus 60g of alkalizing anionic surfactant, 120g of sodium carbonate, 40g of ammoniumpersulfate, 300 ml of hydrogen peroxide. The mixture was homogenized for 05 minutes in a blender and put to rest for one hour. Then it was taken to the oven for four hours at a temperature of 35° C.

After removal from the oven, the material was strained and washed with running water and taken back to the oven for five hours at the same temperature, this process was repeated three times. Figure 04 shows the PLA bleaching sequence process.

In this process, the result was the characterization of cellulose, a fibrous material that originated the foam used in the mixture of biocomposites.



Fig.4: PLA bleaching process. Source: Ana Beatriz de Castro and Zilmar Soares

2.5 Caracterização da cor e aspecto visual do PLA

Para a caracterização da cor foi utilizado peróxido de hidrogênio, Pecarbonato de sódio, Tensoativo aniônico

alcalinizante, Ammoniumpersulfato e 100 ml Laurimina óxido. O material ficou em estado de dormência por 48 horas em temperatura ambiente.

A variação da coloração dos compósitos bio baseados em relação ao PLA puro foi medida com auxílio de instrumento de medida de cor portátil (Instrutherm, model ACR- 1023). As amostras foram ensaiadas e os resultados foram obtidos através de visualização figura 05.

O processo escolhido para a obtenção PLA branqueado do pecíolo do buriti foi o processo manual, fermentação e secagem natural (ao sol), também chamado comumente artesanal. Esta nanocelulose foi aplicada pelo método de compósito polimérico à base de uma emulsão de produtos caseiros e posteriormente, o compósito foi caracterizado PLA branqueado.



Fig.5: Pó (PLA) no processo de caracterização, em diferentes cores. Fonte:Zilmar Soares e Ana Beatriz de Castro

2.6 Characterization of the color and visual aspect of the PLA

To characterize the color, hydrogen peroxide, sodium carbonate, alkalinizing anionic surfactant, ammonium dispersulfate and 100 ml laurine oxide were used. The material was dormant for 48 hours at room temperature.

The color variation of bio-based composites in relation to pure PLA was measured with the aid of a portable color measurement instrument (Instrutherm, model ACR-1023). The samples were tested and the results were obtained through visualization figure 05.

The process chosen for obtaining blanched PLA from the buriti petiole was the manual process, fermentation and natural drying (in the sun), also commonly called artisanal. This nanocellulose was applied by the polymeric composite method based on an emulsion of homemade products and later, the composite was characterized as bleached PLA.



Fig.6: Powder (PLA) in the characterization process, in different colors. Source: Zilmar Soares and Ana Beatriz de Castro

2.7 Extraction of cellulose fiber

For the extraction of the fiber it involved the purification of the petiole which consisted of the removal of the lignin. For this, 1g of sample was transferred to three bekers. To estebekers was added the solution 30 mL of 5% NaOH (w / v) for 4 hours. After that time, the sample was filtered and washed with distilled water. This procedure was repeated until the filtrate was neutralized.

The purified samples were transferred to three test tubes containing a mixture of a solution of aqueous sodium chlorite (1.7% NaClO2) and a solution of acetate buffer (27 g of NaOH and 75 ml of glacial acetic acid diluted in 1 L of water). The system was kept under reflux at 80°C for 2 h. After this time, the pulp was filtered and washed until neutral. The procedure was repeated for two times and at the end the figure 28 was dried.

The residue was washed with 200 ml of deionized water, 20 ml of 20% acetic acid and again with 200 ml of deionized water. The sample retained in the filter was taken to the sterilization and drying oven (Nova ethics, Brazil) at 105 ± 2 ° C for 24 hours. After the period in the greenhouse, the sample was placed in the desiccator until it reached room temperature transformed into thin cellulose and hemicellulose, then it was weighed on a precision scale (Mcel) figure 06.



Fig.6: Sample visualized in electron microscopy of pure PLA. Source: Ana Beatriz de Castro Silva.

To neutralize the pH over a period of 10 days, the nanocrystal particles were collected and stored in the

refrigerator. To prevent the spread of fungi in the samples, three drops of sodium hiplochlorite were added to these. After this period, the buriti petiole nanocrystals (NCPB) were observed by Tecnai G2-12 transmission electron microscopy (CCENT / UEMASUL Microscopy Laboratory) using an acceleration voltage of 80 kV. A drop of the diluted suspension of the nanocrystal solution was deposited on a carbon-coated grid. The samples were stained with lugol solution and methylene blue figures 07.



Fig.7: PLA / PB nanocrystals observed in electron microscopy. Source: Ana Beatriz de Castro Silva.

2.8 Production of biodegradable designs

In this sense, composites were produced from the buriti petiole which was called PLA / PB95%, PLA / PB97%, PLA / PB98%, PLA / PB100%, PLA / PB99% respectively. The cooking of PLA for the production of composites was obtained by the conventional method at 100° C, for 5 min. Then it was placed on a flat tray for 20 minutes, after this time, the material was cooled and placed in a dormant state for three days figures 08 and 09. After this process the composites were molded in different designs. In order to arrive at a ready model and the correct formula, eight tests (experiments) were needed figures 10.



Fig.8: Cooking of composites using the conventional method. Figure 09: Material dormancy process before the designs are produced. Figure 10: Ready design. Source: Ana Beatriz de Castro Silva

2.9 Mechanical testing of PLA in bio composite based on visual inspection

This step was followed by the advisor and cosupervisor. The main tool used in the visual rehearsal was the eyes, therefore, to assist in the analysis were used electronic magnifiers with zoom model LEZ 1080, microscopes Trinocular E200 LED Nikon achromatic flat objectives of 4.10.40 and 100x 10x field of 20mm Automatic bivolt and templates and comparator (comparator cylinder) 3x100 mm for plasticity limit tests. 2.10 Mechanical tensile test (EM)

The strain-strain strain curves were obtained with the aid of a universal testing machine EMIC DL 2000 equipped with a 20 N load cell and using a speed of 10 mm min-1. For each material, five tests were performed with different samples and the reported result was the average of the results of such tests with the respective standard deviations.

2.11 Tests with the materials produced to check the degradation time in water and soil.

Tests to verify the degradation process compared to traditional plastics, two environment models were created. The first model was characterized by an aquatic environment. The second environment was characterized by the terrestrial environment. The tests (experiments) were monitored daily, with the degradation processes between the two environments being noted and transformed into statistical data.

2.12 Evaluation of the material resulting from the biodegradation of biocoposts in garden plants.

The biocomposites used were introduced in a mini composting system, in plastic boxes with a capacity of 30 dm3, under screen conditions. The basis for preparing biocomposites consists of 98% and 95% buriti petiole powder with the additive tapioca gum at 2% and 5%.

During the elaboration period, which extended for 100 days, the biocomposites were irrigated every two days and were revolved every 30 days, days to maintain temperature, humidity and microbial activity. The biocomposites differed according to the application of percentage of additives (tapioca gum) in the growth process of plants isolated from native fungi of cerrado soil, dry leaves of vegetable were added next to the soil in which the experiment was applied.

III. RESULT AND DISCUSSION

Few studies show the potential of the buriti petiole, addressing the possibility of replacing synthetic fibers. Santos et al., (2010), investigated the microstructure and mechanical characterization of buriti fiber for use as reinforcement in polymeric composites. It obtained values of tensile strength of 684 MPa and Modulus of Elasticity of 36.26 GPa that are close to the values found in other fibers as shown in table 01.

The buriti fiber showed a density lower than the water density 0.770 g / cm3 which resulted in specific values of resistance and modulus under tension. These values are consistent with those cited by Mueller et al., (2003), for Jute fibers, flax fibers, sisal fibers. The values found by Santos et al (2010), obtained in the tensile tests, as well as the specific values, are consistent with those found in the literature for vegetable fibers most used as reinforcement in composites.

Tensile test values, as well as specific values, found in the literature for buriti fibers. Source: Santos et al. (2013).

	Buriti
Tensile strength	684
(Mpa)	
Elastic modulus	36,26
(GPa)	
Specific resistance	97,7
Specific module	5,18

Thus, the mechanical properties, surface morphology and microstructure of buriti fibers present values similar to those found in the literature for other plant fibers. The specific values obtained for the buriti fibers are interesting and justify the use for bio based composite.

Making a comparison between the composites, it is observed that the composites of materials such as aramid carbon and fiberglass dominate the aerospace, civil construction, automotive and sports industries. Glass fibers are the most used to reinforce plastics due to their low cost (compared to aramid and carbon) and reasonably good mechanical properties. However, these fibers have serious drawbacks, as shown in Table 02.

Table 02:	Comparison	between	buriti	fiber	and	gl	ass
				./			

fibers.		
	Buriti fiber	Fiberglass
Density	Low	Double buriti fiber.
Cost	Low	Low, but superior to
		the buriti fiber.
Renewable	Yes	Not
Recyclable	Yes	Not
Energy	Low	High
consumption		
CO2 neutral	Yes	Not
Abrasion for	Not	Yes
machine		

Health risk	Not	Yes	
when			
inhaled			
Elimination	Biodegradable	Non-biodegradable	
Source: LABG / UEMASUL - 2020.			

3.1 PLA with the composition of foam, and tapioca gum, colored with natural dyes.

The morphological aspects of the structure of the composition surface of the buriti PLA, in cooking, show the characteristic microstructure of the material. Through these images it is possible to observe that the fibers are composed of different types. Figures 11 and 12 illustrate the photographs of the bio-based composites, obtained from colored PLA, with the combination of the buriti powder petiole matrix in composition with the foam (fiber) and tapioca coma.





Fig.11 and 12: Bio composites based on different proportions of PLAS. Source: Ana Beatriz de Castro and Zilmar Soares

Buriti PLA fibers are elongated structures with hollow and rounded cross sections, distributed throughout the plant and can be classified according to anatomical origin such as stem fibers, leaf fibers, wood fibers and surface fibers. The petiole fibers occur in the phloem that is located in the stem's stem (CAETANO et al., 2004).

In these films it is also possible to distinguish a reinforcement phase, usually in the form of foam (fiber), and another binder (the matrix), which allows efforts to transfer throughout the entire composite working in an integrated manner.

Levy Neto and Pardini (2006) make the following definition: A composite material is a set of two or more different materials, combined on a macroscopic scale, to function as a unit, aiming to obtain a set of properties that none of the components individually presents.

The basic characteristic of composite material is two types of phases: the matrix that has the purpose of protecting its structure and the other phases against the action of the environment and, particularly, corrosion and abrasion, and the reinforcement that alters the properties of the matrix, being able to provide greater resistance (BLEDZKI AND GASSAN, 1999 & BROUTMAN, 1990).

3.2 Water absorption tests

The behavior of water absorption by PLA (powder) and foam (vibrates) can be seen in Figure 13. As expected, due to its hydrophilic characteristic, the presence of the fiber increased the tendency for water to be absorbed by the foam. In general, the higher the fiber content (CP), the greater the absorption of graphical water 01.



Fig.13: two experiments to observe the water absorption of bio-based in relation to PLA and foam. Source: Ana Beatriz de Castro and Zilmar Soares

To analyze the water absorption process, the PLA / PB 100% composite in natural color and fibrous foam was used. Analyzing the results, it can be seen that there was an increase in the volume of PLA (powder) by 8% due to the elasticity of the crystals, since the fiber has greater capillarity in relation to water, the volume increase was 4%, graphical 01. This difference between the powder and foam is related to the removal of the PLA after sifting. Another aspect observed that the presence of water increased the color of both PLA and foam, this chemical reaction occurred due to the presence of hydrogen in the water compound.



Source - Authors 2020

It is worth mentioning that the water absorption test was carried out with two samples (powder and fiber). The sample of the PLA (powder) obtained the lowest absorption of H2O, where the foam was more on the surface due to the greater amount of fibers. Thus, it can be said that increasing the amount of fibers increases the absorption of H2O. Foam (fiber), on the other hand, showed greater water absorption. According to Sousa (2016), this phenomenon occurs because the capillarity mechanism facilitates water molecules to flow along the matrix-fiber interface.

With this experiment it can be said that the bio composite produced with PLA without the fiber, becomes more elastic and increases flexibility, thus facilitating the production of bio design.

3.3 Chemical characterization of BP.

The chemical characterization of the Buriti Petiole (PB) allowed the quantification of its main constituents in table 03. Although the chemical composition of ligninocellulosic fibers varies according to the age of the wood and its place of cultivation Fengel & Wegener, (1989), the sample of petiole of buriti studied presented levels of α -cellulose, hemicellulose and lignin close to the values found by Barbosa, (2011) which were 51.29%, 18.80% and 16.37%.

Table 03:	Chemical characterization	of the	buriti
	petiole (PB).		

Matter	Teor (%)	
Cellulose	55,4	
Hemicellulose	15,5	
Total Lignin	18,2	
Holocellulose	76,1	
Ashes (minerals)	3,0	

Source: Ana Beatriz de Castro and Zilmar Soares

3.4 Bleaching of BP

The evolution of the bleaching process of PB was observed through the discoloration of the fiber using homemade chemical products figure 14.



Fig.14: artisanal bleaching process. Source: Zilmar Soares.

Figure 15 illustrates the evolution of the visual aspect of the buriti petiole (PB) during the bleaching stages. The dark coloration of BP can be attributed to the presence of lignin (ROBLES et al., 2015).



Fig.15: Photo illustrating the visual aspect of PB during the bleaching stages. Source: Ana Beatriz de Castro

Figure 15 shows the presence of fibrous material, dispersed in a solid and homogeneous, non-fibrous matrix. After chemical treatment for fiber extraction, the material showed fibrillar morphology, with long fibers and an average diameter of less than 24 micrometers.

The bleaching of buriti fibers presents a behavior similar to that observed by Clough et al.,

(1996) who observed a visible fibrous material in composites and polymers, using increasing doses of NaOH, checking long diameters and changing color for higher doses of Chemicals.

Changes in the chemical structure of the fibers can be presented as the sum of the individual components, that is, cellulose, hemicellulose and lignin. However, cellulose is more sensitive to changes than lignin (FREITAG & MORRELL, 1998).

The results showed that the increase in the chemical dosage modifies the buriti fiber making it less resistant. For higher doses of gamma irradiation in buriti fibers, the fibers become less flexible.

3.5 Nanocrystals of the buriti petiole (NCPB)

Figure 16 shows the dispersion of nanocrystals of the buriti petiole (NCPB) in different light phases. (A) Low dispersion of light. (B) Average dispersion of light. (C) concentration of light in the central part of the material. In phase (D) The effect occurred when there was a high dispersion of light by colloidal particles. In this case, it was possible to visualize the path that light takes, as these particles disperse the light rays. This observation indicates the presence of nanostructures in the dispersion. Graph 02 shows the diffractogram of dispersed nanocrystals (NCPB).



Fig.16: Dispersion of nanocrystals obtained from the buriti petiole (NCPB). Source: Ana Beatriz de Castro and Zilmar Soar**es**



Graph 02: Diffractogram of nanocrystals obtained from the buriti petiole (NCPB). Source: Zilmar Soares LABG / UEMASUL

The value found for the crystallite size was 22 Å, slightly less than the value found by Robles et al. (2015) which was 34 Å. The crystallinity result obtained from the diffractogram of graph 2 was 80% (degree of crystallinity). This value was within the expected for a morphology characterized as nanocrystal. Getting close to 60% found by (ROBLES et. Al., 2015).

From the cellulose of PB it is possible to obtain two types of nano particles: nanocrystalline cellulose and nanofibrilated cellulose. The nanofibrilated cellulose is arranged in parallel bundles organized "like spaghetti noodles", while the crystalline cellulose (or nanocrystals) with the appearance of tiny crystalline rods "resembles needles or grains of rice, but about 200 thousand times smaller in thickness", VALDEIR & ARANTES (2017).

Nanocellulose, with its high performance and versatility, is an alliance between nanotechnology, biotechnology and renewable raw material figure 17.



Fig.17: Presents the two nanocrystalline structures of PB. Source: Zilmar Soares

3.6 Production of PLA / PB composite biodesign by cooking

The bio based composites PLA / PB98% was used to produce the prototype of biodesign. For this, the cooking process was chosen, which consists of heating the material for four minutes at 100 $^{\circ}$ C. After this process, the

material was placed on a flat surface for cooling for three days. After cooling the material was transformed into different utensils, figures 18 and 19.



Fig 18 and 19, It presents the biodesigns produced in an aertesanal way with the PLA of PB. Source: Zilmar Soares and Ana Beatriz de Castro.

In this way, by processing and improving natural or composite raw materials, it is then possible to design eco-sustainable products. (MORAES, 2010).

Also according to Twede & Goddard (2010), it is possible to apply different materials to replace others. Another alternative would be to reduce the amount of material used in the manufacture of biodesign, or even make modifications to the material, creating structural combinations to improve and generate the expected performance in these products.

3.7 Mechanical testing of PLA and bio-based composite by visual inspection

Simple techniques were used to detect surface flaws and distortions in the structure, and the degree of finish and shape of the pieces. The main tool used in the visual test was the eyes, therefore, to assist in the analysis were used magnifiers, microscopes, optical projectors, templates and comparators. The result is shown in graph 3.



Graph 03: Present the flaws found in biodesign with the industrial model. F.E.I.: Failure in the internal structure. F.E.E .: External structure failures. M.I .: Internal molding. M.E .: External molding. Source: Ana Beatriz de Castro

The failures were necessary to improve the mechanical properties and hydrophobicity of cellulose nanostructures. According to Spinella et al., (2015), this result occurs due to the formation of a non-polar covalent bond between the coupling agents and the free hydroxyls of the cellulose, also improving the dispersion inside the matrix during the processing by both cooking and cooking. by thermoforming.

3.8 Mechanical testing (EM) of PLA and traction-based bio composite

The Mechanical Tensile Test is widely used to collect basic information about the strength of materials and as a material acceptance test that is done by comparing the properties determined by the test and specified adjustments in bio based composites. Graph 03 shows the curve of the tensile test of the buocomposites according to the concentration of matrix and assets. And the values are specified in table 04



Source: Authors

Table 04 - Values of mechanical properties in traction and degree of crystallinity (DRX) for pure PLA and bio based composites.

Samples	Voltage (MPa)	Alon
PLA Puro	54,12	1
PLA/BP98%	45,00	2
PLA/BP95%	43,09	1
PLA/BP90%	35,63	1

Source: Ana Beatriz de Castro

The limit of the tensile strength found for the naturally colored PLA filament was reported as 57 Mpa by Wittbrodt & Pearce, (2015). This value is very close to the value found in the present study (54,12). The elongation value, however, is well above the value found by such authors (2.35%), which reinforces the hypothesis that plasticizer was added to the filament used in the present study.

Regarding bicomposites, the tendency observed to reduce the tensile strength and reduce the elongation with the increase in the CP content is typical of composites with a weak interaction between the fiber (foam) and the matrix, which can be explained by the fact that PB did not receive any surface treatment to improve adhesion with the matrix (PORTELA et al., 2010).

Among the results reported in the references, is the increase in tensile strength and modulus by the factors of 1.45 and 1.75 respectively in PLA reinforced with synthetic cellulose fibers. With the reinforcement of burit fibers, the modulus and tensile strength were increased by the factors of 2.40 and 1.20 respectively.

Graupner et al. (2009), described the production through compression molding of PLA composites reinforced with 40% by weight of cotton fibers, hemp, kenaf (Hibiscus cannabinus) and synthetic cellulose (Liocel). In general, the results in terms of mechanical properties fell far short of those calculated using the mixtures rule.

According to the authors, it was demonstrated that high values of tensile strength in composites will only be achieved by increasing the fiber / matrix interaction. For this, the composites must have adhesion promoters, coupling agents or plasticizers.

3.9 Process of degradation of the bio-based composite

The recipe for the PB powder-based biocomposite gives a brownish color to the final product. Or natural dyes to obtain other shades in the final products. Only with bleached PB it has a slight transparency. However, all composites produced in this research and the additives included in the formulation, are natural and non-polluting.

The samples were stored in different systems (water and soil) that were collected for periods of 2, 4, 6, 8, 10 and 12 weeks, with each system containing different samples of each composition. The system was formed by Cabasins with a capacity of 600 mL where the soil prepared with pure PLA plates with composition was added. The materials were placed (glass vats) randomly in the LAB / BG - UEMASUL (for bacteriological culture with air circulation and refrigeration) maintained at a temperature of 32 ° C and the systems were removed after two, four, six, eight, ten and twelve weeks, when the degradation process was observed, figures 20 and 21.



Fig.20: Process of biodegradation of composites in weeks (soil). Source: Ana Beatriz de Castro and Zilmar Soares



Fig.21: Biodegradation process of composites in weeks (water). Source: Ana Beatriz de Castro and Zilmar Soares.

The 8-week effect on the biodegradation process in the flexible biocomposite occurred faster in the water due to the matrix and the PLA / PB / additive composites are illustrated in Figure 621. Considering the experimental errors, the incorporation of the load and the additives (coma of tapioca) did not change the rigidity of the systems. However, the effect of biodegradation on the elastic module is very significant. According to Álvaro (2017), the presence of natural additives does not change the properties in biodegraded composites, but contributes to the biodegradation process.

According to Almasi, (2014). Biodegraded composites in water practically lose their ability to resist tensile stresses. The elongation at break is less affected than the tensile strength with the addition and formation of composites, however the effect of biodegradation is severe, where the additive composites present three times less elongation than the pure PLA biodegraded in soil.

Marcia et. al (2010) states, the growing concern with the environment has been trying to develop biodegradable polymers as one of the solutions to the problem of discarding the large volume of polymeric material. In this sense, it is worth emphasizing the importance and applicability of biodegradable polymers that can be used pure, in polymeric mixtures or in composites with natural fibers.

3.10 Evaluation of the bi-compound bi-post material used as fertilizer in garden plants.

After the completion of the process of biodegradation of cups in the soil, an experiment was carried out under greenhouse conditions to evaluate the effect of adding the compounds to the soil on the vegetative development of different species. The resulting soil was a dark, sandy texture clay (22 g kg-1 of clay and 871 g kg-1 of sand)

The fertilization with organic compounds from the biodegradation of the biobased compounds did not affect the plants, on the contrary, it improved the quality of the green of its leaves. These results may suggest that the cultivated plants extracted from the soil most of the readily available nutrients of the compounds, resulting in similarity in the vegetative development of the plants grown in normal soil.

Fertilization under the organic paradigm assumes that soil fertility must be maintained or improved, using natural resources and biological activities. As far as possible, natural resources should be used, as well as organic by-products that provide the supply of nutrients, in a wide and diversified way, and should prioritize nutrients through decomposition residues, compounds and organic residues. (LIMA et al., 2011).

Decomposition materials of organic matter is the best strategy for the use of these residues, since it facilitates the handling, reduces the volume of residues and the loss of nitrogen. A well-made compost presents organic matter transformed into humus and acts on the soil, improving its structure and providing it with conditions to store more water, air and nutrients, which will feed the plants (LUCON & CHAVES, 2004

IV. CONCLUSION

The designer as a mediator of the application of the material is necessary so that new options of use are designed in products, services and technologies. Bearing in mind that each and every product, needs to pass several tests in which prove its effectiveness as well as its efficiency. The material proposed in this project was developed and had its properties evaluated to prove the possibility of use in new technologies.

Therefore, the designer the technology and use in materials makes it possible to generate new options and uses of fibers, adding greater importance to the sustainability process, collaborating with the environment and better exploring the alternatives for using a certain material. It is concluded in this research that the diverse characteristics found in the petit of buriti, makes it an innovative material and with great possibilities of new proposals of use in the industry and in the market. Because it is a material with low environmental impact and its performance appropriates differentiated values. contributing to a new type of more conscious consumption.

The data collected and presented by the buriti petiole are tools that can be used by other designers to create new product designs that meet the complex and current demands of the market, product and sustainability.

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Investigation of High-Speed Milling and High Efficiency Milling of AA6061

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Abstract—Milling is one of the most prominent machining processes employed in the realization of spacecraft mechanical hardware which vary in size, shape, material and complexity. In this work a study is carried out to compare High-Speed Milling (HSM) and High Efficiency Milling (HEM) of AA6061. The machining time, surface roughness and tool wear were determined from the investigation. From the work it was found out that the lesser machining time with better surface finish was observed while machining by HSM than that of HEM and very negligible tool wear noticed.

Keywords—Spacecraft, High-Speed Milling, High Efficiency Milling, AA6061, Machining.

I. INTRODUCTION

Spacecraft consists of several mechanical hardware which vary in materials, size, shapes, complexity etc. Stringent dimensional and geometric tolerances, and quantity restricts the realization mainly to only machining process, that too majorly milling process. Adhering to the tight launch schedules is also one of the prime requirements. Hence trade-off between quality and delivery schedule is crucial in the realization of spacecraft mechanical hardware and meeting the project schedules. In this view, exploration of advanced technologies is very crucial. Aluminium alloys constitute major part of these spacecraft hardware due to the various advantages like light weight, strength, easy machinability, corrosion resistance etc., and among various aluminium alloys, AA 6061 is most widely used for spacecraft mechanical hardware.

II. HIGH SPEED MACHINING

The history of High-Speed Machining was discussed in *King, R. I (1985)* and it was mentioned that modern aircraft structures built of Aluminium were required to be made in one piece to achieve structural integrity. Hence, idea of high-speed machining was developed in order to reduce the machining time for removing bulk of solid material. High Speed turning tests conducted for steel with ceramic tool was reported in *Ippolito, R et al. (1988)*.

Effects of machining parameters on surface finish, tool life, chip formation etc were investigated and their significance was assessed. Schulz, H., &Moriwaki, T. (1992) reviewed the key developments in high-speed machining and related fields like cutting tools and machine tools, and mentioned more than fifty percent reduction in time is achievable. High-speed machining of Aluminium aircraft structures, titanium fan blades and hardened steel dies was presented in Tlusty, J. (1993) along with highspeed grinding of gears. The advances in high-speed machining called for the development of associated machine tools and kinematics (Heisel, U., &Gringel, M. (1996)). Dewes, R. C., & Aspinwall, D. K. (1997) investigated the aspects of tool life, workpiece surface finish, dimensional accuracy and cost for machinability through high-speed machining. The selection of right tool path for high-speed machining of thin, flexible webs in Aluminium parts is discussed in Smith, S., & Dvorak, D. (1998). Han, G. C et al. (1999) developed Look Ahead Interpolation algorithm to obtain the smooth continuous motion of each axis of CNC machine tool and verified through experiments, on machine tools. The results showed the increase in machining speed. When compared with the stationary tool, results showed increase in tool life for driven rotary tool. de Lacalle, L et al., (2004) studied the effects of tool deflection on the dimensional errors in the high-speed machining of hardened steel surfaces. They

conducted the tests by applying different machining strategies. Their work explored the various practical problems encountered and to be resolved to achieve stringent dimensional accuracies. Ng, E. G et al. (2004) carried out an experiment and analysis of high-speed machining of Aluminium alloys A356-T6 for automotive applications. The tool wear, size of burr and machined surface quality were studied. Kazban, R. V et al.(2008) measured the temperature and force fields in high-speed machining of Aluminium alloy 6061-T6. They modified experimental orthogonal machining Hopkinson bar apparatus to conduct an experiment. Study showed that wear land significantly contributes to the heating of the workpiece land and is significant mechanism for residual stresses and temperature rise on finished surface.

III. HIGH EFFICIENCY MACHINING

High speed machining involves high cutting speeds and low feeds per tooth, leading to extremely short times of contact between workpiece and tool, very high frequencies of contact and high cutting temperatures [1]-[12]. The High Speed Machining calls for totally different tool design concentrating mainly on the insert type tools, where in only limited height of the tool is utilized for the machining. To efficiently utilize the entire tool length, new machining strategy was developed known as High Efficiency Machining, which calls for different tool design, machine tool architecture and machining strategies. (WitGrzesik, 2017 & High Efficiency Machining Guidebook, 2017)

Tönshoff, H. K et al.(1999) explored this very idea of High Efficiency Machining and its variation from High Speed Machining. The work reviewed the previous work and existing practices in the aerospace industry, and mentioned the requirements for High Efficiency Machining like high spindle power, machine structures, coolant system, cutting tool requirements, drive controls etc. The work also highlighted the advantages of High Efficiency Machining for aerospace components. Potentials of High Efficiency Machining was also presented. Chan, K et al.(2003) developed a high-efficiency 2.5 dimensional rough milling strategy for mould core machining. Their strategy consisted of three tool paths while first two toolpaths performed rouging operation and third one removed the staircase pattern left out by first tow tool paths. Zhao, W et al.(2004) presented an efficiency approaches to control the machining deflection while machining the thin walled aerospace jobs using high-efficiency machining strategy. They performed FEM analysis and also conducted an experiment to analyze the same, on AA 2024- T351

aluminium alloy. Increase in machining precision and decrease in machining time was observed. Xu, D. M et al.(2011) developed a high-efficiency machining tool path design of die cavities. Tool path were based on the minimum numbers of rectangular or triangular patterns to cover the roughing areas. Their work compared the traditional Z-milling and plunge milling to demonstrate the higher cutting efficiency. Their cutting simulation results and experimental results showed that, cutting efficiency of plunge roughing increased with cutting depth.

From [1]-[18] it was observed that, very limited work related to comparative study of High-speed machining versus High Efficiency Machining of aerospace components has been done. As various spacecraft mechanical hardware are fabricated using milling operation, it is proposed to investigate High Speed Milling (HSM) and High Efficiency Milling (HEM) and to the best of the authors' knowledge and literature survey, where no work was reported in the field of application of HEM to



Fig 1. CAD Model of the sample

spacecraft materials. Hence, in this work it is proposed to investigate the HSM and HEM of AA 6061, and the best strategy which reduces the machining time and increases the dimensional stability.

IV. METHODOLOGY

a. Work Material

Since majority of the spacecraft mechanical hardware are comprised of Aluminium alloys especially AA6061, investigation of HSM and HEM is carried out on AA6061. The composition and properties of AA6061 are given in Table 1 & Table 2.

Al	95.85-98.56
Mg	0.8-1.2
Si	0.4-0.8
Fe	0-0.7
Cu	0.15-0.4
Zn	0-0.25
Ti	0-0.25
Mn	0-0.15

Ti	0-0.25	
Mn	0-0.15	

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Density (g/cc)	2.7
Youngs Modulus (GPa)	68.67
Yield Strength (MPa)	276
Melting Point (⁰ C)	660
Thermal Conductivity (W/(m-K))	167
Linear Thermal Expansion Coefficient (10 ⁻⁶ K ⁻¹)	23

b. Geometry of test Part

A square block of 110mm length, 110mm width and 37.5mm height was used for carrying out milling experiments. The features which are generally encountered in the spacecraft components were considered while arriving at the internal topology of the sample piece. The CAD model of the sample piece is given in Fig 1

c. Machine tool and Cutting Tools

All experiments were conducted on DMU 650V vertical CNC Milling machine with a maximum spindle speed of 20000 rpm. A CERATIZIT insert based indexable cutter with 20mm diameter were used for HSM experiment and CERATIZIT 20 mm solid carbide end mill cutter was used for HEM experiment. For corner finishing operation 3 Flute TiN Coated Carbide End Mill cutter with 10 mm diameter was used. The details of the cutting tool are shown in Fig 2.

d. Experimental Procedure

The experiment was conducted by performing the CNC Milling operation on the workpiece material to achieve the final component as per the CAD model in Fig 1. The toolpaths for HSM and HEM were generated in UG NX

and POWERMILL software respectively. The toolpaths for HSM and HEM are given in Fig 3.



(a)



Fig 2. Geometry of Cutting tool (a) Milling Cutter (b) Carbide insert

The cutting speed range for HSM were presented in

Schulz, H., & Moriwaki, T. (1992) and same were used to calculate cutting speed for the experiment. The cutting parameters employed in this investigation for HSM were listed as follows: Cutting speed vc=1225 m/min (correspondingly, the spindle speed N was 195000 rpm), feed $f_z=0.11$ mm/tooth (correspondingly, the feed rate for three flute cutter was 6435 mm/min), axial depth of cut $a_p=0.5$ mm and radial depth of cut $a_e=6$ mm (30% of 20mm diameter cutter).

The methodology to select the cutting parameters for HEM are elucidated in [18] and same were considered for fixing the HEM cutting parameters. The cutting parameters for HEM were listed as follows: Cutting speed $v_c=251$ m/min (correspondingly, the spindle speed N was 4000 rpm), feed $f_z=0.1$ mm/tooth (correspondingly, the feed rate for two flute cutter was 800 mm/min), axial depth of cut $a_p=20$ mm and radial depth of cut $a_e=2$ mm (10% of 20mm diameter cutter).



Fig 3. CAM toolpath (a) HSM (b) HEM

Before arriving at the cutting parameters several trials were done on sample workpieces and finally above mentioned cutting parameters were finalized. The milling was carried out upto 20mm depth as per CAD model

As the main aim of the work was to compare HSM and HEM, only one set of cutting parameters were considered for the investigation. The tool wear for both HSM and HEM were measured with LEICA-M205 microscope with magnification of around 40x, periodically to ensure that maximum crater wear does not exceed 0.3mm uniform flank wear or 0.5mm localized flank wear whichever occurs first as per the standard (ISO 8688-2,1989). Total machining time for both HSM and HEM was measured from the machine control unit display.

The milled samples were degreased with acetone and then deburred before carrying out the actual measurements of the surface roughness. The surface roughness was measured on both wall and floor, to compare the results for both the strategies. The surface roughness measurement was done using Taylor Hobson Talysurf profilometer. While machining the spindle parameters were monitored through MCU display. The components while machining and finished pieces are given in Fig 4 and Fig 5 for HSM and HEM respectively.



Fig 4. HSM (a) Component under machining (b) Finished Component



Fig 5. HEM (a) Component under machining (b) Finished Component







Fig 7. Surface Roughness (Ra)

V. RESULTS AND DISCUSSIONS

a. Material Removal Rate (MRR)

The MRR for actual machining operation were determined for both HSM and HEM and results of same are illustrated in Fig 6. It is inferred from the graph that, MRR for HSM is around 13.34 % more than HEM and is due high speed and feed rate.

b. Surface Roughness (SR)

The surface roughness was measured on both walls and floor, and maximum R_a value is reported in the work and results are given in Fig 7. From the results it was observed that SR value on floor for HSM was less than that of HEM while SR values on walls was considerably high for HEM than HSM. This may be attributed to the high a_p for HEM.

c. Tool Wear

The measured tool wear (as per ISO 8688-2,1989) for both HSM and HEM strategies are presented in Fig 8 and Fig 9 respectively. For HSM of AA6061 very negligible flank wear of 35.5 microns on lengthwise and 32.8 microns on

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width wise was observed. However, for HEM no flank wear was observed but loss of coating was observed for both lengthwise and width wise. The increased axial depth of cut with less speeds and feeds compared to HSM may be the cause of loss of coating on tool.





Fig 8. HSM flank tool wear (a) Lengthwise (b) Widthwise



Fig 9. HEM flank tool wear (a) Widthwise (b) Loss of coating



Fig 10. Chips during machining (a) HSM(b) HEM

d. Chip Morphology

In HSM, the chips are continuous but shorter in length, as the cutting edge in contact with the metal during machining is short, due to the low depth of cut. In HEM, as cutting edge of the tool is utilized to its maximum optimistic length, the length of the chips is more.

VI. CONCLUSION

From the investigation, it was observed that HSM and HEM are equally capable of reducing the machining time when compared to the non-HSM regime. HSM consumes less machining time than HEM. Moreover, Surface finish on both the floor and wall were found to be better than that one done with HEM.Tool wear is not present in HEM except for loss of coating whereas negligible flank wear is present in HSM. Owing to all these, while machining of spacecraft components, selection of proper machining methodi, e HSM or HEM or combinations of these machining methods are needed to meet the requirements.

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Warehouse "Ovos da Caatinga" Production and Marketing of Eggs from Rural Hen for Sustainable Community Development in the Municipality of Juazeiro - Bahia

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Abstract— The people of the Community of Canoa, in Juazeiro - Bahia, live with natural restrictions typical of the region of the Brazilian semiarid, with scarce and irregular rains, therefore, they seek in the potentialities of the region the resources for the maintenance of life in the locality. The breeding of small animals, such as chicken, has always been an economic activity practiced by rural families in the interior of the Semiarid northeast. In search of sustainability in the Caatinga, public institutions at the federal and state level invested in the construction of a small chicken egg warehouse in the community, to receive local production and market the product in the municipality of Juazeiro.

Keywords— Entrepreneurship, Development, Sustainable, Warehousing, Eggs.

I. INTRODUCTION

This work brings a brief discussion about the processes arising in the area under study, which tends to expand with the search for the development of its products and services. In this perspective, it analyzes at the same time the conditions of these events that are still in the evolution phase, the implementation of new information and technical assistance, the feasibility of sustainability in the caatinga ecosystem enabling, social and commercial relations.

Therefore, in the Brazilian semiarid, specifically, in the Community of Canoa, municipality of Juazeiro - Bahia, the raising of chickens and the sale of eggs stands out for its importance in the generation of income, given that, this cultural organization of the community, whether it has a production capacity, management, above all, benefits for the survival of these families living in atypical conditions because of the typical soil and climate conditions of the Brazilian Northeast.

To this end, the development of this production is usually related to the financial conditions, the profile of producers and the climatic factors, however, it is necessary to emphasize that these activities have instigated major changes in the social sphere, especially in the rural area. In this way, the transformations that have been happening in this environment significantly influence the work relations, the production and commercialization strategies of family farmers groups and the use of these resources [1].

This work aimed to understand the impacts of the egg warehouse for sustainable development in the researched community, justifying the relevance of this theme by the need to build a broader view of the local economic potentialities of the Northeastern semiarid, considering understanding the dimensionality promoted by the impacts of sustainable entrepreneurial activities, always visualizing entrepreneurship as a tool for achieving and maintaining sustainable development.

Therefore, through these assumptions, this work highlights the skill of these farmers [2], comes from the sum of daily social practices of a democratic nature, resulting from the cooperation of knowledge shared between persons and groups of that community. Finally, analyzing the socioeconomic development of the community through its activities was fundamental to show the forms of persistence attributed to a sustainable productive model, collaborating for the local cultural and economic strengthening.

II. THEORETICAL REFERENCE

2.1 Entrepreneurship in Family Agriculture

To speak of entrepreneurship and its importance in family farming, it is necessary to emphasize initially that, entrepreneurship is considered a phenomenon capable of promoting economic development in a country. In Brazil, entrepreneurship began to gain ground in the middle of 1990, this term expanded mainly by the high mortality rate of small enterprises and the great economic instability arising from globalization, The large organizations needed to seek actions to acquire competitiveness, cost reduction, and to stay alive in the market [3].

To this end, the growth and diversification of entrepreneurial activities are largely due to economic crises, but it is also worth noting that opportunities do not stop arising and reinventing. Consequently, entrepreneurship is based on the idea of creation and the income generation initiative, configuring itself as a vehicle that contributes to economic growth [4], mainly, providing social and cultural benefits [5].

[6], an effective entrepreneurship policy has the power to transform any economic structure as well as people's behavior and performance of their work. However, it is essential to have a cohesive involvement between entrepreneurs and government, beforehand, understand the specificities of each region, so as to encourage and intervene in the process of rural production [4].

In this context, family farming has expressed an important role in economic development, since for more than three decades it has become increasingly stronger in Brazil, in the same way as entrepreneurship [7] [3]. The potential of family farming has been particularly

recognized by the fact that small farmers have access to a wide range of government spaces [8].

Thus, family farming has a great prominence in the rural environment, because the degree of its magnitude changes according to the regions and the natural ecosystems there. However, it has been conditioned and marked by other functions, becoming more and more common among society, gaining its place between man and nature [7]. In fact, family farming has been structured as a category of efficient public policy, which is constantly evolving from the perspective that it helps and spreads rural development, and is then seen as a social model, economic and productive for society [9].

In this way, the relationship between entrepreneurship and family farming provides not only the pooling of knowledge, but the strength of values and attitudes aimed at fostering the well-being of society as a whole, and a good entrepreneur should seek above all, the capacity to innovate and live with the insecurities of its environment [10].

Faced with this, entrepreneurship like any other area becomes significant to family farming, and the advancement of an activity is only possible when the entrepreneur plans his strategies and uses them to perform his craft. However, in the same way, the farmer must organize his ideas to develop his properties, so that they can enjoy all the available resources [11].

Starting, therefore, from these premises, and linked to the conceptions of the aforementioned authors, the development between both happens only when several variables come together in favor of the same objective. At this point, family farming has extreme relevance and just like any other organization has difficulties facing economic events. However, the family farmer has to take care of his production as a company, always using new techniques and innovations to obtain competitive advantage, as well as public policy assistance [12].

2.2 Characteristics of the Semiarid Region and the Rural Poultry

The rural environment and agriculture in the Brazilian semiarid, have been undergoing an intense process of transformation in recent decades. Faced with the changes, we highlight the rural exodus, that is, the migration of the rural population to urban areas, and the productive changes of agriculture, consequently, caused changes in the relations of farmers with the rural and urban environment, mainly, in the activities practiced and in the income. These changes bring with them debates in the economic, political, and academic milieu, among which the debate about the various activities that the family farmer, residing in the rural milieu, stands out, combines agricultural activities with non-agricultural activities in a way that complements family income and social reproduction.

The rural semiarid did not escape from the transformations. Over the years there have been changes in the agricultural base, both in public policies, in migration, in the understanding that the population and the rulers have on the climatic characteristics of the region, and in the advance of desertification, water scarcity, among other aspects that we can highlight, these changes that, in course, require a multidimensional analysis to understand the diversity of relationships involving the man of the field.

Climatic conditions oscillate in time and space, being influenced by factors, whose rainfall trends and indices, provoke the development of studies (local and regional), and the impacts tend to be higher when subjected to climatic conditions of semiaridity. Various human activities are sensitive to these meteorological and climatic irregularities in the world. Drought causes rainfall irregularities and damages to economic activities and the quality of life of populations, which consequently causes a decrease, or even a complete loss of production.

> The economy of the semi-arid region is particularly vulnerable to this phenomenon of droughts. A change in the distribution of rains or a reduction in the volume of rains that makes subsistence agriculture impossible is enough to disorganize all economic activity. Drought causes, above all, a subsistence agriculture crisis. Hence its characteristics of social calamity [13].

We can observe that, although the citation [13], is not so recent, is notorious his reflections in the current context, because each period of irregularity of the rains, occur several losses in agriculture or livestock, that reduces or keeps its production and/or its herd stagnant, and the rainfall is what determines the expansion of agricultural areas, pasture and water supply. Generally, agriculture suffers greater impacts, with deep reflections on social life, because the man of the field sees compromised his food production (corn and beans mainly). Adapting to this rigidity of the climate through the rational use of the soils of the water supplies, incorporating new technologies and innovative processes is the great challenge of today.

When we refer to caipira poultry farming [14], mentions that most productive systems come from family farming, distinguishing by the pursuit of sustainable economic and environmental developments. They also explain that chickens have characteristics that are compatible with lower resource environments and represent an important source of income for small farmers. [15], disagree that in the sphere of agroecology, farmers family members opted for the creation of small animals, because they have favorable conditions for climatic and natural variations of agro-ecosystems. [16], reports that socio-environmental projects seek to structure not only management, but also economic sustainability.

The development of family farming seeks through the strategies of community organizations and associations, where the management model is based on the recognition of partners on their importance and their needs, ensuring the consistent administration of processes. Thus, it is observed that in these projects the ability to learn must represent fundamental competence in each associated organization, as well as the development of a flexibility profile, where each one is willing to change his routine. Thus, the management of boundaries and borders must be firm, preserving internal aspects of each of the associates, however, adjusting the processes of common interest as emphasized [16].

[17], demonstrates that socio-environmental projects point to a management of alliances respecting the respective borders with a structure serving as a guideline for all processes. The structure basically considers the following points: avoiding generalized solutions, seeking the answer and the appropriate procedure for each case; focus attention on really existing issues guaranteed full focus on reality; develop criteria to measure achievements and successes; be compatible with existing systems, aiming at integrated management; be accessible and easy to understand, seeking to be part of the daily life of each farmer.

[18], the creation of hens in free-range management reduces damage to the environment, adapting easily to each ecosystem that is implanted, both in relation to its facilities and equipment, in the form of food, or medicate birds. Of course, because it can be treated in a way that rationally uses renewable natural resources, making it agroecologically correct. It is understood that creation free-range chicken in rural communities represents great potential as a component to structure local development [19], filling a market with products originating from an alternative production system and thereby serving consumers with a more natural diet, in addition to offering families that create an alternative source of income.

III. METHODOLOGY

The present work was developed in the Community of Canoa (image 01), located in the municipality of Juazeiro-BA, 54.8 km from the headquarters and 453.3 km from the

capital of the state, Salvador, with access by highways BR-407 and BR-314, where is located the Warehouse "Ovos da Caatinga".



Image 01: Location of the Canoa Community in Juazeiro -BA

Source: Google Earth (2020)

Residents of the Community of Canoa live with natural restrictions typical of the semi-arid regions of Brazil, with high temperatures and scarce and irregular rainfall. Therefore, they seek in the potentialities of the region the resources for the maintenance of life in the locality.

This study is exploratory and descriptive, with a qualitative approach, based on the phenomenological method, which is used in qualitative research, and concerns itself with the direct description of the experience as it is, where reality is constructed socially and understood in the way it is interpreted, not posing itself as unique, and may exist as many as its interpretations [20].

In this sense, it is an exploratory research because it seeks to provide greater familiarity with the problem under study, aiming to make it more explicit [20]. It is also descriptive, since it aims to clarify particularities of a given group, capturing descriptive aspects [21]. As for nature, it has a qualitative approach, seeking to understand social phenomena with the smallest possible distance from the studied environment, seeking to understand and explain the dynamics of social relations [22].

IV. RESULTS AND DISCUSSIONS

The breeding of small animals such as goat, pig and chicken has always been an economic activity practiced by rural families in the semiarid or northeastern part of Brazil. When well cared for and managed, they provide important results in the feeding and especially in the income of these families, because they are easy to manage, water consumption is relatively low and they breed quickly [23]. Chicken farming is an old practice of the residents of the Canoa Community, only 10 km away from the headquarters of Massaroca District, which had been lost because of the introduction of farm chickens, but which through various public policies, which work with productive and social character in the region, from a project executed and encouraged by the Regional Institute



of Appropriate Small Agriculture (IRPAA), was gradually resumed.

Image 02: Construction of chicken coops in joint ventures in the region

Source: Reproduction/IRPAA (2013)

In the middle of 2009, the Canoa Community received with a certain fear a chicken breeding project, where it guaranteed the implantation of henhouses, feed for a certain period and technical training. In the beginning it was difficult to find who wanted the henhouses. It was difficult to convince breeders and breeders of goat and hen farming, a very common practice in the region, to dedicate part of their time in another activity to commercial poultry and egg farming, something that happened only for the consumption of the family. Even with many uncertainties, the few who accepted the novelty, plus the IRPAA, gradually convinced other people about the activity.

The first challenges were emerging, such as: term of return on investment, difficulties in finding marketing channels, little experience with poultry breeding and variation in the cost of eggs. In face of this, most of the breeders ended up giving up the idea. The few who still believed, even with enormous difficulties, were persisting in the development of the project. As time went by, chicken breeding and egg production became significant and attracted other people in the community to give up.

With the impetus of poultry farming and egg production, public institutions at the federal and state level, in search of sustainability in the Caatinga, aiming to generate a complementary income for several families of farmers in the region, which already had their economy based on practices in the extraction and rearing of goats and sheep, invested in the construction of a small warehouse of eggs of peasant hen in the community in question, to receive the local production, to carry out the sanitization process, candling, grading, packaging, packaging and marketing of the product.

Named "Ovos da Caatinga", the warehouse (image 3) was inaugurated on February 22, 2019, budgeted with investment in structure, machinery and equipment of about R \$ 409 one thousand, through the Pro-semiarid, project executed by the Regional Development and Action Company (CAR), a public company linked to the Secretariat for Rural Development (SDR), whose resources come from loans contracted by the Government of the State of Bahia to the United Nations (UN) International Fund for Agricultural Development (FIDA). This project was advised by the IRPAA.



Image 03: Egg Warehouse "Caatinga Eggs" Source: Reproduction/SDR (2019)

The egg warehouse is the first family agriculture enterprise in the Territory Sertão do São Francisco and pioneer in the State of Bahia to receive certification through the Municipal Inspection Service (S.I.M.), issued by the Municipal Agency of Economic Development, Agriculture and Livestock (ADEAP), an agency belonging to the municipality.

Currently, 12 family farmers in their small rural farms, develop the activity of farming caipira chicken for laying, to supply the egg warehouse. Each producer has an average of 40 birds, with a weekly production of 280 eggs. The total amount of producers is 3,360 per week, or 13,440 per month, totaling 1,120 dozen monthly (Entreposto "Ovos da Caatinga", 2020).

The eggs are sold in commercial establishments of the municipality, such as horticultural plants, markets, bakeries, delicates, free trade fairs and also, by direct sale to consumers, costing R\$ 8,00 to dozen and observe an important and growing market niche in healthy eating

trends. The expectation soon is for a significant growth of producers to practice the activity, in view of this, increased production, sale of eggs, family income and improvement of the quality of life of producers and the community.

The warehouse "Ovos da Caatinga" is a reference in the region, in constant development and has been contributing significantly to the generation of employment and income, with correct and sustainable environmental practices, settlement of this population in the locality where they live, generating pride and social belonging.



Image 04. Dozen Eggs "Caatinga Eggs" Source: Reproduction/Internet (2019)

V. CONCLUSIONS

This work aims to understand the impacts of the egg store for sustainable development in the Canoe Community, and the relevance of the subject was given by the importance of the need to build a broader vision of the local economic potential of the semiarid northeast and how this practice interferes with the social, economic and environmental sustainability of such communities.

The study showed that the poultry activity has contributed to the emergence of pluriativity in the semiarid region, favoring family groups that saw in nonagricultural activities the possibility of improving the quality of life.

There are taxing situations, where the alternative found by family farmers to maintain the rural way of life is to seek other activities besides agriculture. The semi-arid region presents itself as a diversified territory with multiple faces.

Public policies, when properly and satisfactorily implemented, guarantee the well-being of communities, thus contributing to the empowerment and strengthening of people and a more sustainable development. The "Ovos da Caatinga" warehouse has been contributing in a significant way to the generation of employment and income, with correct and sustainable environmental practices, fixing this population in the place where they live, generating pride and social belonging.

The local economic potential is extensive, and entrepreneurship as a tool for achieving and maintaining sustainable development, coupled with public policies, contribute greatly to an adequate coexistence in the semiarid northeast.

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The use of *Moringa oleifera* Seeds in the Treatment Water from the Negro River for Indigenous Communities in the State of Amazonas, Brazil

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Abstract— The poor quality of water intended for human consumption is one of the problems that has led to the appearance of several human diseases. The seeds of Moringa oleifera Lam. Can be used as a sustainable and low-cost alternative for water treatment. The aim of this study was to develop alternative methods of treating water for human consumption through the use of Moringa oleifera seeds. Water samples were collected at four points along the Negro River, in the state of Amazonas, for treatment and compared to untreated samples and drinking water parameters, established by the Ministry of Health. Significant differences were observed in the following physical and chemical parameters of treated and untreated water: color, turbidity, dissolved solids total hardness, total alkalinity, electrical conductivity and ammonia content. The results suggest the possibility that moringa seeds can be used to produce better quality water for human consumption, especially in the case of people living in indigenous communities far from urban areas and without access to any type of water treatment.

Keywords—Alternative, Moringa oleifera Seeds, Natural Coagulant, Water Treatment.

I. INTRODUCTION

The poor quality of water intended for human consumption is one of the problems that has led to the emergence of numerous human diseases, whether it be the quality of water used to process and prepare food, water for personal hygiene or water for drinking. Limited access to drinking water and a shortage of clean water constitute a major challenge facing developing countries⁽¹⁾. According to a recent United Nations (UN) report, 2.1 billion people do not have drinking water in their homes⁽²⁾. The World Health Organization (WHO) estimates that almost 159 million people depend on surface water and at least 2 billion people use drinking water contaminated with feces⁽³⁾.

The Negro River in the Brazilian Amazon is one of the largest rivers in the world and the main left-bank tributary of the Solimões River, also in the Amazon. Considered the largest and best example of a blackwater river, the Negro River is the most chemically different river of all Brazilian rivers⁽⁴⁾. It contains very small quantities of minerals and is rich in organic material, which gives it its dark, typically brown, color⁽⁵⁾.

The Negro River drains five municipalities in the state of Amazonas: São Gabriel da Cachoeira, Santa Isabel do Rio Negro, Barcelos, Novo Airão and Manaus. This study was carried out in the municipality of São Gabriel da Cachoeira, which is notable for its predominantly indigenous population, who survive essentially on subsistence farming and hunting. Among the various health problems faced by the population, the most significant are inadequate water treatment and limited access to basic sanitation. Residents of the town of São Gabriel da Cachoeira drink water from artesian wells or directly from the Negro River and only have access to sodium hypochlorite in local health centers. Other inhabitants who live farther away in rural areas of the municipality along different tributaries of the Negro River (Uaupés and Içana, among others) get all their water from the river.

As the water consumed by people living in isolated, rural, indigenous communities and without access to facilities is not treated, diseases are common in this population. A viable solution to this problem would therefore be to develop a means of treating the water of the Negro River for these indigenous communities. An innovative, simple and sustainable solution would be to use the seeds of *Moringa oleifera* Lam. to purify the water in this river.

Moringa oleifera is a tropical tree native to Asia that is cultivated in Africa and Central and South America. It is one of thirteen species in the family Moringaceae (order Brassicales)⁽⁶⁾. The tree is tolerant of drought and can blossom and produce fruit under these conditions⁽⁷⁾. The species has been known in the state of Maranhão since 1950⁽⁸⁾. Flocculation of impurities in water is a typical use of crushed moringa seeds and has been the subject of scientific investigation for almost 40 years⁽⁹⁾. The seeds of the moringa tree contain soluble protein which acts as a clarifier and destabilizes particles in water^(10,11). They are used in the treatment of raw water and effluent to remove the color and turbidity and eliminate microorganisms, some of which can be vectors of disease. The process involves coagulation of the suspended matter followed by flocculation and sedimentation of these impurities⁽¹²⁾.

Considering that *Moringa oleifera* seeds act as an important coagulant agent in water treatment. Given the above, the study aimed to develop methods of water treatment of the Negro River using *Moringa oleifera* seeds.

II. MATERIALS AND METHODS

This section explores the materials and methods obtained in the five phases: Section 2.1 Field work and samples; 2.2 Treatment of water with seeds of *Moringa oleifera;* 2.3 Optimization and preparation of simplified water treatment system; 2.4 Microbiological and physicochemical analysis and 2.5 Statistical analysis.

2.1. Field work and samples

The samples were collected in the Negro river, São Gabriel da Cachoeira, in the state of Amazonas between September and December 2018. The study was approved by the Ethics Committee of the Dean of Research, Graduate Studies and Innovation (PPGI), Federal Institute Amazonas (IFAM), and received funding from PPGI. The water samples were collected in four different locations: Orla da Praia, Praia do Jaú, Cosama and Tiago Montalvo igarapé. These sites were chosen because there are indigenous communities in these areas that make extensive direct and indirect use of water. Water samples were collected at each sampling point both directly and with the aid of sterile Van Dorn bottle samplers. All samples were collected in the morning, without the presence of rain for the past 48 hours. Then, they were treated and stored at 4°C +/- 2°C.

2.2. Treatment of water with seeds of Moringa oleifera

Moringa seeds were bought at Arbocenter Comércio de Sementes Ltda (Birigui, São Paulo). Tests were initially carried out to determine the quantity of seeds needed to reduce the turbidity and apparent color of water from the Negro River (Figure 1). A simplified procedure⁽¹³⁾ for treating water with moringa seeds to improve the quality of water consumed in rural communities in the semi-arid region of Brazil was used. The first stage in the procedure was to remove the wings of the seeds while checking that the husks were neither dry nor discolored. The seeds were then crushed and ground to the consistency of a fine powder with the aid of a pestle.



Fig. 1: Tests to determine the amount of moringa seeds needed for the water clarification process Source: Santos, (2018)

A ratio of 1 g of ground seeds to 1 L of untreated water was used. The untreated water collected was first placed in a 1 L beaker, to which 1 g of ground seeds was added. The mixture was stirred vigorously with a glass rod using circular movements for 2 minutes and more slowly for a further 15 minutes. At the end of this process, the water was left standing in the beaker for around 2 hours to allow the particles in suspension to coagulate and settle to the bottom. The water was then filtered with a paper filter and funnel to remove any remnants of the suspended seed powder (Figure 2).



Fig. 2: Water being filtered with filter paper in a funnel after purification with moringa seeds Source: Santos, (2018)

2.3 Optimization and preparation of simplified water treatment system

To improve the quality of the water purified with moringa seeds, four simplified filter-based water treatment systems were developed. The filters were made with affordable components that are readily available to indigenous communities. Each filter was constructed with a 5 L drum and had different material in the various layers.

Filter 1: a layer of 100 g of gravel + a layer of 200 g of activated açaí palm (*Euterpe oleracea*) seed charcoal + a layer of 100 g of gravel.

Filter 2: a layer of 100 g of gravel + a layer of 200 g of activated açaí palm seed charcoal + a layer of 100 g of gravel + a layer of 200 g of crushed brick.

Filter 3: a layer of 100 g of gravel + a layer of 200 g of activated plant charcoal + a layer of 100 g of gravel.

Filter 4: a layer of 100 g of gravel + a layer of 200 g of activated plant charcoal + a layer of 100 g of gravel + a layer of 200 g of crushed brick.

The gravel and bricks were cleaned with running water and left to dry in direct sunlight for 48 hours. The activated charcoal was produced by high-temperature physical activation in a brick and mud kiln-furnace designed for high-temperature use. A temperature of 720 °C and heating time of 3 hours were used to produce the açaí palm seed charcoal. For the plant charcoal, which was made from coconut shell waste and wood, a temperature of 470 °C and heating time of 3 hours were used. All the filters were produced and all the water treatment experiments with moringa seeds were carried out in the chemistry laboratory on the São Gabriel da Cachoeira campus of the Federal Institute of Amazonas. However, because the facilities in the laboratory were limited, it was not possible to perform a detailed microbiological and physicochemical analysis.

2.4. Microbiological and physicochemical analysis

All the samples used (raw samples, samples purified with moringa seeds and samples processed with the simplified filter-based treatment) were analyzed at Lupa Análises Bromatológicas Ltda., a specialized sciences laboratory in Manaus, Amazonas. The microbiological and physicochemical analyses followed the American Public Health Association "Standard Methods for the Examination of Water and WasteWater". In the microbiological analysis, the presence of total coliforms and Escherichia coli was investigated. The physicochemical analysis covered sensory parameters (apparent color, odor, taste, temperature) and physicochemical parameters (pH, turbidity, total dissolved total hardness, total alkalinity, solids, electrical conductivity, total iron, chloride and ammonia). The results were compared with the values specified in Brazilian Ministry of Health directive no. 2.914/2011 and consolidated in directive no. 05/2017^(14,15).

2.5. Statistical analysis

A descriptive analysis of the results was performed and included the following measures: minimum, maximum, mean, standard deviation, coefficient of variation and quartiles⁽¹⁶⁾. The data were assessed by collection point and treatment. The five treatments were: purification with moringa seeds alone and purification with moringa seeds followed by one of four simplified filter-based systems. Each treatment was performed four times.

The non-parametric Wilcoxon-Mann-Whitney test was used to test for statistically significant differences between the results for treated and untreated samples, and the results were then compared with the values stipulated by the Brazilian Ministry of Health. A significance level of p<0.10 was used⁽¹⁷⁾. The statistical analysis was performed with software R version 3.6.1⁽¹⁸⁾ in RStudio version 1.1.463.

III. RESULTS

A total of 84 water samples were analyzed. The following variables were used: total coliforms, E. coli, pH, turbidity, total dissolved solids, total hardness, total alkalinity, electrical conductivity, total iron, chloride and ammonia. The results obtained with the applied treatments show that there was a difference in the apparent color of the water, both with the use of *Moringa oleifera* alone and with the application of the simplified filter system (Figures 3 and 4).



Fig. 3: Comparison of untreated water (left) and water treated only with moringa seeds (right). Source: Santos, (2018)



Fig. 4: Comparison of untreated water (right) and water treated with moringa seeds and TR3 (left). Source: Santos, (2018)

The water samples had five different treatments to identify the best result for each collection point. We consider a raw sample for each collection point, that is, untreated water such as (TR0). The five treatments were: treatment only with M. oleifera seeds (TR1); treatment with M. oleifera seeds and filter 1 (TR2); treatment with M. oleifera seeds and filter 2 (TR3); treatment with M. oleifera seeds and filter 3 (TR4); and treatment with M. oleifera seeds and filter 4 (TR5). All treatments were performed four times, and the values of the variables for the treated samples were compared with the corresponding values for the untreated samples (Table 1).

Table 2 shows a comparison of treated and untreated samples collected at Orla da Praia. In a Wilcoxon-Mann-Whitney test with a significance level of p<0.10, the differences in the variables pH (p = 0.098), total dissolved solids (p = 0.098), electrical conductivity (p = 0.098) and turbidity (p = 0.098) were statistically significant for TR1 while for TR2 the differences in the variables (p = 0.098),

total hardness (p = 0.089), pH (p = 0.098) and total alkalinity (p = 0.098) were statistically significant.

For TR3, the values of the variables turbidity (p = 0.098) and total hardness (p = 0.098) were significantly lower than the corresponding values for the untreated sample. The values of the variables total alkalinity (p = 0.098) and chloride (p = 0.089) were significantly higher. For TR4, only two variables had significantly different values: color (p = 0.098), for which the average was significantly lower than the value for the untreated sample, and total dissolved solids (p = 0.098), for which the value was significantly higher. For TR5, the variables with statistically significant differences in values were total hardness (p = 0.098), total dissolved solids (p = 0.098), total alkalinity (p = 0.098) and ammonia (p = 0.098), as shown in Table 2.

As for the comparison of the results of the different treatments of the water collected in Orla da Praia, with the values stipulated by the Ministry of Health of Brazil for water destined for human consumption, we identified that the pH was not within the normal values (corresponding pH to <9,5 and> 6) for none of the treatments used. In TR1 there were no statistically significant differences for electrical conductivity (p = 0.979) and ammonia (p = 1.0), while in the other treatments only ammonia showed a value that did not meet the normal values for drinking water stipulated by the Ministry of Health.

For samples collected at Praia Jaú and treated with TR1, the variables color (p = 0.098), turbidity (p = 0.098), total hardness (p = 0.098), total dissolved solids (p =0.098), total alkalinity (p = 0.098), electrical conductivity (p = 0.098) and ammonia (p = 0.098) showed statistically significant values, different from the corresponding values for untreated water. For TR2, only the differences in the variables color (p = 0.098), total dissolved solids (p =(0.098) and total hardness (p = 0.098) were statistically significant. For TR3, the differences in the variables total hardness (p = 0.098), total alkalinity (p = 0.098) and ammonia (p = 0.089) were significant. For TR4, the variables with significantly different values were total dissolved solids (p = 0.098), total alkalinity (p = 0.089), electrical conductivity (p = 0.098) and ammonia (p =0.098). For TR5, the variables pH (p = 0.098), total dissolved solids (p = 0.098) and electrical conductivity (p= 0.098) showed significant differences (Table 3).

OP	РJ	COS	TMI
01	10	005	1.011
0.00	100.00	0.00	0.00
0.00	100.00	0.00	0.00
135.00	130.00	160.00	235.00
0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00
5.00	3.13	2.87	3.48
1.74	2.26	1.87	4.52
7.00	6.00	9.00	8.00
2.40	2.64	1.39	1.34
0.38	0.30	0.32	0.35
14.00	13.00	18.00	15.00
0.24	0.00	0.28	0.00
6.87	4.67	5.17	5.67
0.41	0.43	0.62	0.45
	OP 0.00 135.00 0.00 0.00 0.00 5.00 1.74 7.00 2.40 0.38 14.00 0.24 6.87 0.41	OP PJ 0.00 100.00 0.00 100.00 135.00 130.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 5.00 3.13 1.74 2.26 7.00 6.00 2.40 2.64 0.38 0.30 14.00 13.00 0.24 0.00 6.87 4.67 0.41 0.43	OPPJCOS0.00100.000.000.00100.000.00135.00130.00160.000.000.000.000.000.000.000.000.000.000.000.000.005.003.132.871.742.261.877.006.009.002.402.641.390.380.300.3214.0013.0018.000.240.000.286.874.675.170.410.430.62

Table. 1: Values for untreated samples from each collection point.

Collection points: OP = Orla da Praia; PJ = Praia Jaú; COS = Cosama; TMI = Tiago Montalvo *igarapé*.

Variables		TR1		TR2		TR3		TR4		TR5	
	TR0	Mean	<i>p</i> -value	Mean	<i>p</i> -value	Mean	<i>p-</i> value	Mean	<i>p</i> - value	Mean	<i>p</i> -value
Color (uH)	135.00	5.18	0.125	5.08	0.098*	5.65	0.125	5.73	0.098*	6.23	0.125
pH (-)	5.00	5.53	0.098*	5.30	0.098*	5.13	0.174	5.15	0.149	5.45	0.125
Turbidity (NTU)	1.74	0.79	0.098*	0.49	0.125	0.76	0.098*	0.90	0.125	0.69	0.098*
Total dissolved solids (mg/L)	7.00	103.50	0.098*	64.75	0.125	49.00	0.125	70.75	0.098*	67.75	0.098*
Total hardness (mg/L)	2.40	2.07	0.125	2.03	0.089*	1.61	0.098*	2.57	0.625	2.18	0.098*
Total alkalinity (mg/L)	0.38	0.71	0.125	0.63	0.098*	0.48	0.098*	0.61	0.125	0.53	0.098*
Electrical conductivity	14.00 20	200.25	0.098*	136.00	0.125	06 75	5 0.125	185.25	0.125	132.00	0.125
(<i>u</i> S/cm)		209.23				90.75					0.125
Chloride (mg/L)	6.87	12.50	0.125	9.59	0.125	7.81	0.089*	13.78	0.125	11.98	0.125
Ammonia (mg/L)	0.41	2.41	0.125	1.50	0.125	3.35	0.125	2.53	0.125	3.33	0.098*

Table. 2: Comparison of parameters for treated and untreated samples collected at Orla da Praia.

Values are expressed as means. p-value (p < 0.10). *Statistically significant difference between values for treated and untreated samples.

Variables	TRO	TR1		TR2		TR3		TR4		TR5	
	110	Mean	<i>p</i> -value	Mean	<i>p</i> -value	Mean	<i>p</i> -value	Mean	<i>p</i> -value	Mean	<i>p</i> -value
Color (uH)	130.00	5.73	0.098*	7.60	0.098*	8.43	0.125	10.00	0.125	8.25	0.125
рН (-)	3.13	3.83	0.125	4.79	0.125	4.40	0.125	4.99	0.125	4.75	0.098*
Turbidity (NTU)	2.26	0.87	0.098*	0.63	0.125	0.67	0.125	0.63	0.125	0.79	0.125
Total dissolved solids	6.00	40.00	0.098*	53.75	0.098*	80.75	0.125	67.25	0.098*	88.75	0.008*
(mg/L)		49.00									0.098
Total hardness (mg/L)	2.64	1.96	0.098*	1.63	0.098*	2.08	0.098*	1.68	0.125	2.72	0.875
Total alkalinity (mg/L)	0.30	0.36	0.098*	0.35	0.125	0.48	0.098*	0.41	0.089*	0.35	0.125
Electrical conductivity	12.00	07 75	0.000#	104.05	0.105	206.75	0.125	77.75	0.000*	<u>00 75</u>	0.098*
(<i>u</i> S/cm)	13.00	91.15	0.098*	104.23	0.125				0.098*	89.75	
Chloride (mg/L)	4.67	6.98	0.125	4.99	0.625	4.60	1.000	4.65	0.854	5.07	0.125
Ammonia (mg/L)	0.43	3.80	0.098*	1.18	0.125	2.80	0.089*	2.61	0.098*	2.48	0.125

Table. 3: Comparison of parameters for treated and untreated samples collected at Praia Jaú.

Values are expressed as means. p-value (p < 0.10). *Statistically significant difference between values for treated and untreated samples.

The comparison of the results of the different treatments of the water collected at Praia Jaú and the values stipulated by the Ministry of Health of Brazil for water intended for human consumption revealed that the pH was not within the normal values for any of the treatments. Significant differences in the following physical-chemical parameters of the treated water were observed for the TR1, TR2, TR4 and TR5 treatments: color, turbidity, total dissolved solids, total hardness, total alkalinity, electrical conductivity and chloride content. In TR3 the values of electrical conductivity (p = 1.0) and ammonia (p = 0.981) were higher than the values of drinking water stipulated by the Ministry of Health. The ammonia content (p = 0.063) was similar to the normal value only for TR2. There were no statistically significant differences for ammonia for the other treatments.

For the water collected in Cosama TR1 (Table 4), the differences in the variables total alkalinity (p = 0.098), total hardness (p = 0.098) and chloride (p = 0.089) were statistically significant. For TR2, only the turbidity variable (p = 0.098) had a significantly lower value than the corresponding value for the untreated sample, while for TR3 the differences in the color (p = 0.098) and ammonia (p = 0.098) variables were statistically significant. For TR4, only total dissolved solids (p = 0.098) showed significantly different values. For TR5, the differences in only two variables were significant: color (p = 0.098) and total dissolved solids (p = 0.098) and total dissolved solids (p = 0.098).

The comparison of the variables of the samples from the Cosama collection point with the normal values for human consumption revealed that there was a significant difference in pH for treatments TR2 and TR4. TR2 resulted in values within the normal parameters for most variables, according to the values for drinking water stipulated by the Ministry of Health. In TR1 the variables color (p = 0.605) and ammonia (p = 1.0) did not differ significantly , while in TR3 only ammonia (p = 1.828) presented values above that stipulated by the Ministry of Health. Likewise, in TR4 only color (p = 1.0), turbidity (p= 1.0) and electrical conductivity (p = 1.0) and in TR5 only turbidity (p = 1.0), electrical conductivity (p = 1.0) and ammonia (p = 1.0) presented values above the parameters established by the Ministry of Health.

Table 5 shows a comparison between the treated samples and the untreated samples collected in Tiago Montalvo *igarapé*. For TR1, the values of the variables total hardness (p = 0.098) and ammonia (p = 0.098) were significantly different from those corresponding to untreated samples. For TR2, the variables total hardness (p = 0.098), electrical conductivity (p = 0.095) and ammonia (p = 0.098) showed significantly different values. For TR3 the variables with significance were: turbidity (p = 0.095), pH (p = 0.095), total dissolved solids (p = 0.098) and total hardness (p = 0.098). For TR4, the variables with significantly different values with significantly different values were turbidity (p = 0.098), total dissolved solids (p = 0.098), total dissolved solids (p = 0.098), total dissolved solids (p = 0.098), total dissolved solids (p = 0.098), total dissolved solids (p = 0.098), total dissolved solids (p = 0.098), total dissolved solids (p = 0.098), total dissolved solids (p = 0.098), total dissolved solids (p = 0.098), total dissolved solids (p = 0.098), total dissolved solids (p = 0.098), total dissolved solids (p = 0.098), total dissolved solids (p = 0.098). For TR5,

the values of the variables total hardness (p = 0.098), total alkalinity (p = 0.098) and electrical conductivity (p = 0.098) showed significant differences in relation to the corresponding values for untreated water.

Variables	TRO	TR1		TR2		TR3		TR4		TR5	
v unuoros	110	Mean	<i>p</i> -value	Mean	<i>p</i> -value	Mean	<i>p</i> -value	Mean	<i>p</i> -value	Mean	<i>p</i> -value
Color (uH)	160.00	20.50	0.125	9.90	0.125	5.95	0.098*	66.25	0.125	12.75	0.098*
pH (-)	2.87	5.39	0.125	6.30	0.125	4.68	0.125	7.42	0.125	5.41	0.125
Turbidity (NTU)	1.87	0.87	0.125	0.34	0.098*	0.56	0.125	4.38	0.125	1.30	0.125
Total dissolved solids	9.00 4	42.00	0.125	36.00	0.125	36.75	0.125	222.00	0.098*	245.75	0.098*
(mg/L)		42.00									
Total hardness (mg/L)	1.39	1.75	0.098*	1.20	0.125	1.74	0.125	2.46	0.125	1.89	0.125
Total alkalinity (mg/L)	0.32	0.29	0.098*	0.30	0.181	0.46	0.125	3.13	0.125	0.47	0.125
Electrical conductivity	18.00 83.	02 75	0.105	66.00	0.125	71.00	0.125	453.00	0.125	490.50	0.125
(<i>u</i> S/cm)		85.75	0.125	00.00							
Chloride (mg/L)	5.17	8.60	0.098*	6.05	0.125	8.47	0.125	42.50	0.125	44.75	0.125
Ammonia (mg/L)	0.62	2.06	0.125	1.22	0.125	1.83	0.098*	1.36	0.125	2.47	0.125

Table. 4: Comparison of parameters for treated and untreated samples collected at Cosama.

Values are expressed as means. p-value (p < 0.10). *Statistically significant difference between values for treated and untreated samples.

Variables	TRO	TR1		TR2		TR3		TR4		TR5	
	INO	Mean	<i>p</i> -value	Mean	<i>p</i> -value	Mean	<i>p</i> -value	Mean	<i>p</i> -value	Mean	<i>p</i> -value
Color (uH)	235.00	5.40	0.125	4.30	0.125	6.03	0.125	6.06	0.125	5.40	0.125
pH (-)	3.48	4.47	0.125	5.58	0.125	4.39	0.098*	5.33	0.125	5.17	0.125
Turbidity (NTU)	4.52	0.17	0.125	0.22	0.125	0.48	0.098*	0.38	0.098*	0.67	0.125
Total dissolved solids	8.00	17 75	0.125	31.75	0.125	55.25	0.098*	84.00	0.098*	163.00	0.125
(mg/L)		47.75									0.125
Total hardness (mg/L)	1.34	1.68	0.098*	1.73	0.098*	1.36	0.098*	1.93	0.098*	2.10	0.098*
Total alkalinity (mg/L)	0.35	0.48	0.125	0.62	0.125	0.53	0.125	0.44	0.098*	0.54	0.098*
Electrical conductivity	15.00	02.25	0.125	70.50	0.098*	84.75	0.125	135.25	0.098*	331.75	0.000*
(<i>u</i> S/cm)	15.00 93	93.25									0.098*
Chloride (mg/L)	5.67	7.48	0.125	6.08	0.125	9.24	0.125	13.35	0.125	16.64	0.125
Ammonia (mg/L)	0.45	3.38	0.098*	1.66	0.098*	2.17	0.125	2.25	0.125	2.33	0.125

Table. 5: Comparison of parameters for treated and untreated samples collected at Tiago Montalvo.

Values are expressed as means. p-value (p < 0.10). *Statistically significant difference between values for treated and untreated samples.

Comparison of the values of the variables of the samples collected in the Tiago Montalvo *igarapé* with the

normal values established by the Ministry of Health, revealed that none of the treatments resulted in acceptable

pH values, since the pH after all treatments was significantly below the value stipulated by the Ministry of Health. Of the other variables, ammonia (p = 1.0) was not significant in any of the treatments, except TR5, for which electrical conductivity (p = 0.979) was also not significant.

IV. DISCUSSION

The process used here to treat water from the Negro River with moringa seeds is time consuming as two hours are needed to clarify the water. If less time is allowed for the purification process, the seed particles do not adsorb enough particles of dirt to acquire the necessary mass and settle under gravity. With increasing time, more dirt adheres to the seed particles, settling at the bottom and leaving clean water, which can then be decanted⁽¹⁹⁾. After various tests, it was found in the present study that optimal clarification was achieved with 1 g of moringa seed powder for every liter of untreated water. In a similar study on the purification of river water for rural communities with moringa seeds, it was shown that the minimum quantity of powder needed to reduce the turbidity of untreated water to 3 NTU (nephelometric turbidity units) was 0.25 g/L⁽¹⁹⁾. This difference can be explained by the characteristic dark color of water in the Negro River, making it necessary to add more moringa seed powder to achieve adequate clarification. Another study reported that the reduction in protein content of moringa seed from 47% to 38% after use for water purification confirms the efficacy of these seeds as a clarifying agent in water treatment. This property can be attributed to a cationic protein in the seed that neutralizes the negative charges on particles suspended in the water, which aggregate to form flocs and then settle at the bottom of the liquid⁽²⁰⁾.

In an attempt to optimize the results achieved using only moringa seeds, we implemented simplified filter systems in order to obtain better values for parameters whose values changed after treatment, such as pH. A previous study showed that treatment of water with M. *oleifera* seeds has a very limited effect on pH, alkalinity and conductivity⁽²⁰⁾. Each water sample was therefore treated with moringa seeds alone and with moringa seeds together with the filters we developed.

The results of the microbiological and physicalchemical analyzes of the untreated water samples from Praia Jaú were the only collection point where total coliforms and E. coli were present in the untreated water. After the treatments applied with the moringa seeds and the filters, there was an absence of total coliforms and E. coli in the analyzed samples. These findings are important, however, additional and more detailed studies are needed to demonstrate the effectiveness of moringa seeds in eliminating pathogens from water. Studies show that moringa seed extracts have antimicrobial properties against various bacterial pathogens, including E. coli.^(21,22).

The descriptive analysis evaluated statistically significant differences between the results of the samples from each collection point treated with each of the five treatments and the results of the untreated samples. For Orla da Praia, TR5 had the best result with statistically significant differences with a 90% confidence level for the following variables (see Table 2): total hardness (p <0.10), turbidity (p < 0.10), solids total dissolved (p < 0.10), total alkalinity (p < 0.10) and ammonia (p < 0.10). For Praia Jaú, the treatment with the greatest statistical significance was TR1. The results for only two variables (pH and chloride) were not statistically significant (p > p)0.10) (see Table 3), and all other variables had values (p < 10.10), indicating that this treatment had better significance at this collection point.

For samples collected at Cosama, there were few statistically significant differences when the results were compared with the values for untreated water. For TR1, three variables (total alkalinity, total hardness and chloride) had statistically significant differences while the other treatments only had one or two variables with statistically significant differences (see Table 4). In contrast, better results were observed for five variables with samples collected at Tiago Montalvo igarapé and purified with TR4 (see Table 5): turbidity, total dissolved solids, total hardness, total alkalinity and electrical conductivity. Also worthy of note was TR3, which resulted in a statistically significant difference for pH (p < 0.10), and TR1 and TR2, which yielded statistically significant differences for ammonia, unlike TR4. These findings suggest that by combining the components of the filters better results could be obtained.

This study consistently showed that the treatments used with the samples from the four collection points produced parameter values that were significant when compared with the corresponding values stipulated in ordinance no. 5, October 3, 2017. We found that pH and ammonia were the parameters whose values were more distant from the values for drinking water stipulated by the Ministry of Health. For most treatments, the ammonia content was above the level considered normal for drinking water, while the pH was significantly below the recommended value.

We found limited evidence of normal pH values and ammonia content for the treatments used. The ammonia
content was normal for samples collected at Praia Jaú and treated with TR2 and for samples collected at Cosama and treated with TR2 and TR4. The comparison of the variables submitted to the TR1 of the samples at the Praia Jaú collection point with the normal drinking water values established by the Ministry of Health, revealed that most of the parameters met the values stipulated in ordinance no. 5, 2017.15. These results suggest the possibility of alternative sustainable methods that can be used to treat the waters of the Rio Negro.

Various studies have shown that the use of moringa seeds together with another simplified purification process can improve the quality of surface waters used for human consumption. For example, Keogh et al.,⁽²³⁾ investigating the natural coagulant action of M. oleifera as a pretreatment for solar disinfection of water, found that the powdered seeds of this plant can be used to produce water with low turbidity and that solar disinfection helps to inactivate bacteria. Another study investigated the use of moringa seeds to purify river water for domestic use in rural communities. The author used powdered moringa seeds as a natural coagulant and flocculant to clarify turbid water and copper as an antibacterial agent⁽¹⁹⁾. An earlier study also used moringa seeds to treat surface waters by slow direct filtration in synthetic non-woven blanket filters and simple sedimentation. The authors found that the coagulant properties of moringa seeds were effective in treating surface waters both by simple sedimentation and by slow direct filtration in synthetic non-woven blanket filters⁽²⁴⁾.

Overall, our results are encouraging as they show that treatment of samples from Praia Jaú with only moringa seeds (TR1) had an effect on the microbiological parameters and most of the physicochemical parameters. The results indicate that according to accepted guidelines, water from the Negro River treated as described here is more suitable for human consumption than untreated water. Our results indicate that moringa seeds are a sustainable, low-cost alternative for treating water for human consumption in indigenous communities that drink water directly from the Negro River without any type of treatment. This alternative thus helps to meet the daily needs of these communities. Had a different study design been adopted and more samples collected, more conclusive results might have been obtained. Further studies are therefore needed to confirm the findings presented here.

One of the main strengths of this study is that treatment of water using moringa seeds is a low-cost solution that does not require electricity and can be used in municipalities in the north of the state of Amazonas. Although the plant is not typical of the region, it can adapt

to a wide variety of soils. During this study, we found that Moringa oleifera Lam. adapts to the soils found in the municipality of São Gabriel da Cachoeira, in the state of Amazonas. The use of moringa seeds may be a viable, simple solution for treating surface waters to supply the population⁽²⁵⁾. That way, better quality water for human consumption can be produced, particularly for people living in indigenous communities far from urban areas and without access to any type of water treatment.

However, our study has some important limitations. As the samples were relatively small, robust data could not be obtained. It was not possible to use a larger sample because we were limited to the funds made available under the PPGI/IFAM call for projects. Furthermore, the samples had to be sent to a specialized laboratory in Manaus for the microbiological and physicochemical analyses as the town of São Gabriel da Cachoeira does not have a laboratory where this type of procedure can be carried out and we did not have the necessary equipment to perform the analyses. Another limitation was a logistical one as the town of São Gabriel da Cachoeira is in a region that is not easily reached, making it difficult to carry out large-scale studies.

A positive feature of this study is that it was based on studies in Brazil and other countries in which the authors showed the effectiveness of moringa seeds in the treatment surface waters^(13,23,26,27,28,29). Furthermore, this study is a novel one as there are to our knowledge no studies on the use of moringa seeds with water from the Negro River in the São Gabriel da Cachoeira region. Further studies using moringa seeds to treat water from the Negro River are needed to enable comparisons to be made and the results of the present study to be validated.

V. **CONCLUSION**

This study on the use of seeds of M. oleifera act as an important coagulant and can clarify the waters of the Negro River. The results of this research show that, when water is treated with moringa seeds, there are improvements in some parameters when compared to raw water, however, needs further investigation. In addition, this study compared the results of water samples treated with filtration systems with the normal values of drinking water parameters and found significant differences, suggesting the possibility of using these systems in the treatment of water for indigenous communities. In view of the lack of studies on the use of M. oleifera seeds with water from the Negro River, we reinforce the need for further research on the subject.

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Estimation of biophysical parameters to monitor and manage pasture using a mobile application

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Abstract— This study aimed to develop a mobile solution for the estimation cover of green vegetation, pasture height, and aboveground biomass of pasture using orthogonal images. Experimental plots of Panicum sp grass were photographed in two experiments. The first experiment yielded data on plot biomass and the second experiment on pasture height. All samples were automatically georeferenced using the GPS location function of the smartphone. For green cover area, the application uses a region-growing segmentation algorithm and conversion to HSV color space (Hue, Saturation and Value) to obtain the relation of the regions where pixels average in the green matrix and compare the number of pixels classified as pasture with the total number of pixels in the image. The method for estimating height and biomass divides into two parts. The first part is the extraction of characteristics from the images using texture parameters, vegetation indexes, and information about image shadow projections. In the second part, a regression model was developed using the SVR (Support Vector Regression) technique. The model provided accuracy of 0.518 and 0.647 for the estimates biomass and pasture height, respectively.

Keywords—Mobile Application, Pasture, SVR, Computer Vision.

I. INTRODUCTION

Recent advances in agricultural technologies have increased the efficiency of daily farming operations such as planting, fertilizing, and harvesting and reduced input waste. The apparatus of geolocation technology and field precision devices in the field has enabled greater resource efficiency, thus contributing to greater savings, intelligence and sustainability. However, large scale surveys of pasture biophysical parameters is still a challenge in the sector by reason of the high cost of equipment needed to measure aspects related to plant characteristics or phenotypes, which can be explored by remote sensing. This search, according to SANTOS and YASSITEPE [1], is known by the scientific community as phenotyping bottleneck because of the gap between the quantity and quality of available genomic and phenotypic data.

Information technology has gained wide application in livestock industry, being its main driving force the search for more efficient production. The techniques that use computer vision and image processing are essential for the advancement of phenotyping technology [2].

Smartphones can integrate image capture and processing technologies, which has allowed computer vision applications. In addition, it is possible to find the geolocation of the images through the devices, store, and process the data. Mobile devices have great affordability and wide diffusion in the agricultural sector, thus, they could be a potential aid tool for extracting phenotypic information from pastures.

In this context, we propose the Capta Pasto© application as a solution to estimate a number of biophysical parameters using pasture images. The current version of the application was implemented to estimate the

following parameters: green cover; pasture height, and aboveground biomass. Given the above, the present study aimed to develop a mobile application to estimate biophysical parameters applied to the monitoring and management of pastures (*Panicum* sp.).

II. MATERIAL AND METHODS

The Android Studio 4.2 integrated development environment was used to implement the application. The algorithm was developed using Java, XML (eXtensible Markup Language) for application interface features and SQLite for database. The current Capta Pasto© version allows the estimation of the biophysical parameters green cover, pasture height, and aboveground plant biomass.

To estimate green cover, we developed an algorithm using the computer vision region-growing segmentation technique. In the first stage, the algorithm groups the neighboring pixels with similar properties, then, using the average HSV color space (hue, saturation, and value) of the regions captured in the image, it identifies the pasture and non-pasture classes. The green cover area is estimated based on the number of pixels identified as grazing class and the total number of pixels in the image (Figure 1).



Fig.1: Visual image the estimation module of the green cover estimated.

Using computer vision techniques, we extracted the information from the images. First, it was implemented the

image capture routine and calculation of the following vegetation indices: Modified a Photochemical Reflectance Index - MPRI [3]; Triangular Greenness Index - TGI [4]; Green Leaf Index - GLI [5], and the Visible Atmospherically Resistant Index - VARI [6].

$$MPRI = \frac{(G-R)}{(G+R)}$$
$$TGI = G - (0,39 \times R) - (0,61 \times B)$$
$$GLI = \frac{(2 \times G - R - B)}{(2 \times G + R + B)}$$
$$VARI = \frac{(G-R)}{(G+R-B)}$$

Where R is the image data of the red region of the light spectrum; G is the image data of the green region of the light spectrum; and B is the image data that are captured in the blue region of the light spectrum.

Some image texture attributes and information about shadow projections in the images were also extracted. With this information, a model was developed to predict the parameters of interest for the research carried out. Thus, an algorithm was implemented in the Jupyter Notebook development environment using the Support Vector Regression (SVR) computational intelligence technique in the Python programming language.

Support Vector Regression is based on a Support Vector Machine (SVM) [7], which is a machine based on supervised statistical learning. In view of the good results in research using this technique, we propose a model to predict pasture height and aboveground biomass.

For each new image captured, the application obtains the coordinates along with the selected parameter using the smartphone's GPS location function. Then, all this data is stored in the database. Figure 2 exemplifies a biomass capture by the application and Figure 3 an estimate of vegetation height.

Biomass data was extracted from 3 photographs taken with 3 different mobile devices in 30 randomly-chosen plots, totaling 90 photographs. All photographs were taken at an angle perpendicular to the canopy between 1.0 m and 1.4 m above ground. The optical images of the vegetation are from an experimental area of Embrapa Dairy Farming, municipality of Coronel Pacheco, MG, taken in February 2020, during the summer season, a period when the vegetation usually shows greater vigor.

Figure 4 shows examples of pasture photographs from the experimental plots of *Panicum* sp. grass. Samples were taken from all plots photographed in an area of 0.5 m^2 . Afterwards, the fresh weight of samples was determined and dry matter was weighed after oven drying. Then, the data of each plot was converted to kilograms per hectare (kg/ha).

Pasture height data was extracted from photographs taken with a mobile device, following the same methodological procedure used for the photographs to estimate biomass. Pasture optical images were made in 32 plots located in the municipality of Mar de Espanha, MG, in July 2020. Height of all samples photographed was measured with a metric ruler, and Pearson's Correlation coefficient sand cross-validation accuracy were estimated.



Fig.2: Visual image of the estimated biomass.



Fig.3: Visual image of the estimated height.



Fig.4: Example of photograph taken in the field.

III. RESULTS AND DISCUSSION

The application was developed using the free platform of the Android Studio software. This programming system was chosen because, according to data from IDC (International Data Corporation), Android is present in approximately 85% of smartphones [8]. The application was designed to be intuitive and friendly. The routines implemented in the application enabled good results in georeferencing the images, in the extraction of information, and storage in the database. Furthermore, the application interface allowed the user to handle, organize, and view the information generated easily.

Cover of green vegetation is an important indicator of soil degradation and soil cover [9], and is closely related to available biomass and feed conversion necessary for efficiency in animal production systems. In the present study, using the potential regression, we found Pearson's correlation of 0.664 between biomass and green cover, that is, a good indicator of the vegetation status. Figure 5 shows the scattering function and regression.



Fig.5: Scatter and regression plot between green cover and aboveground biomass.

The cross-validation method, with 6 sets, was used to analyze the SVR method of biophysical parameter estimation. Accuracy of biomass and pasture height estimates was 0.518 and 0.647, respectively. Figures 6 and 7 show the values estimated.



Fig.6: Graph view of the relationship between estimated and observed biomass.



Fig.7: Graph view of the relationship between estimated and observed height.

To further our research we intend to collect more samples at different times of the year, analyze other important parameters for pasture monitoring and management, and calculate the correlation between the parameters and other vegetation indices in the visible spectrum.

IV. CONCLUSION

The application developed enabled users to obtain information about pasture from photographs in the visible spectrum bands using a low cost, highly accessible and easily handling mobile device. The model implemented in the application provided accuracy of 0.518 for biomass and 0.647 for pasture height estimates. In addition, the application allowed data and information of the analyses to be stored, which is promising for pasture monitoring and management, and phenotyping research at various plant growth stages.

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Time and productivity in the administrator's professional life

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Abstract— The administrator is a professional responsible for managing the necessary resources to achieve the organizational objectives. Among these resources, time is characterized as irreplaceable and indispensable for any activity, so knowing how to use it is a decisive factor for productivity, which is the ratio between the resources used and the results obtained, in several areas. Thus, time management tools were developed to help achieve professional and personal goals, with emphasis on Personal Strategic Planning. For this reason, the research sought to present the impacts of time management on the activities of the professional Administrator, and for that purpose it used the bibliographic research and the Delphi methodology. It was possible to conclude that the most valued professionals are those with a generalist view, flexible and adaptable and that the environment in which they find themselves is marked by great dynamism and competitiveness; that theories of time management are based on the conscious long-term planning of activities that have a real impact on the achievement of objectives, identified after a process of self-analysis and that management experts corroborate the theories presented about personal productivity.

Keywords— Planning, productivity, time, administrator.

I. INTRODUCTION

The business organization is evaluated by its profits and by its competitive capacity in a determined market, and for this reason, its components seek the best performance and the optimization of the ways of reaching the desired ends (ALVES, 2004). This is reflected in their productivity, which is given by how much can be generated in relation to the inputs used, being determinant for organizational success or failure (MOREIRA, 2008). The organization's existence is due to the achievement of objectives, but for that, it is necessary for someone to determine them, as well as the possible ways to achieve them, and this is up to the manager or administrator (ROBBINS; JUDGE; SOBRAL, 2010).

The management professional is the one charged with the roles of "planning, organizing, directing and controlling resources to achieve organizational goals" (SILVA et. Al, 2013, p. 642), and among the resources to be managed, time is configures as the most essential, since this is an inseparable element to any feasible activity and is

characterized as limited, irreplaceable, inelastic, and that cannot be stored (JUSTINIANO, 2015).

Time is an essential factor for administration, so that, since the beginning of Scientific Administration, Taylor studied the times and movements, looking for a standard time for the execution of the factory tasks in order to "obtain the maximum performance of man at work"(SILVEIRA; SALUSTIANO, 2012, p. 72). Over the decades, many other theorists and professionals have developed and proposed different models for managing time in order to generate the best results, not only in the professional sphere, but also in the personal sphere, among which, the personal strategic planning gains more and more more prominence (NUNES et al., 2019).

Thus, it is clear that time management becomes decisive in the life and career of the management professional. Therefore, a study of time and ways of managing it provides valuable knowledge for such a dynamic and demanding profession, in addition to adding academically by generating material aimed directly at the professional administrator. Given this, the present research seeks to answer the following problem: What is the relationship between time and productivity in the professional performance of the administrator in the 21st century scenario? Thus, this work has the general objective of demonstrating the importance of time management in the activity of the professional administrator and its impact on increasing productivity within his practice in the current job market, which is subdivided into the specific objectives of presenting the profile and the scenario in question. that is the Brazilian administrator of the 21st century; explain work productivity and time management with the influence of new technologies; and to investigate the theories of time management in productivity and professional development of the administrator through the opinion of specialists in the area of Administration. The methodology chosen for the accomplishment of this study was the bibliographic research for the assimilation and review of the objects and concepts worked on and the collection of information on the theme proposed in articles and books. Then, the Delphi technique was used to confront the assertions defended in the researched material with the knowledge of experts through a form answered online, seeking consensus among them. The analyzes were done with a focus on condensing the data collected through the theoretical material and the questionnaire applied in order to answer the established objectives. The results obtained by applying the questionnaire attested to a high level of agreement by the specialists in relation to the sentences defended by the studied authors. Of the 25 statements that made up the form, the experts agree totally or partially with 21 of them, which corresponds to 84% of the total. Thus, it is concluded that the administrator must have flexibility and a generalist view for the Brazilian market, time management techniques encompass areas of professional and personal life and that are of great value in productivity and that management experts corroborate the techniques defended by authors from different areas.

II. REVIEW OF LITERATURE

The Brazilian administrator

The management process can be defined as "the logical sequencing of four stages: planning, organization, direction and control. This process is responsible for achieving organizational objectives at all levels, strategic, tactical and operational." (SILVA et. Al, 2013, p. 641). To plan is to define where one intends to go taking into account the program (when?), The budget (how much?), The procedures (how?), And the regulations and rules

(why?); Organizing means allocating people and resources and establishing what must be done, by whom it must be done, how it must be done and what needs to be done; Driving is the ability to influence people in order to achieve the established goals; and Controlling means monitoring the activities and ensuring the execution of what was planned (ARAÚJO; GARCIA, 2010).

The administrator uses these processes to exercise his function. "Administrators carry out tasks through other people. they make decisions, allocate resources and direct the activities of others in order to achieve certain objectives "(ROBBINS; JUDGE; SOBRAL, 2010, p. 03).

The contemporary market demands from the professional an increased possibility of perception and reasoning, mental manipulation of models, understanding of trends and global processes through the capacity for abstraction, concentration and accuracy, oral, verbal and visual communication (PAIVA, 1997).

For Silva et. al (2008), the world crisis of 2008 created an environment of greater competitiveness and strong competition that demands a flexible, multifunctional and multi-skilled worker profile, which is in line with what Guimarães and Évora defend (2004, p. 73) when they state that contemporary administration is driven by strategies that allow for flexibility in production processes. According to Lemos and Pinto (2008), the most valued professionals are those with a generalist profile, able to adapt to new situations, who do not reject risk, able to work under pressure, with leadership and team skills, in addition to of solidarity and ethics in achieving objectives, emphasizing behavioral aspects at the expense of specific knowledge. "Therefore, knowing how to deal with people, having emotional balance, having social sensitivity and exercising an investigative stance on their surroundings, are recognized differentials in these companies" (LEMOS; PINTO, 2008, p. 14) Silva et. al (2008, p.5) highlight that "the administration professional must be able to act in management and coordination functions at different administrative levels, developing new technologies to accompany the speed of innovations, seeking to meet the real needs in the field in which Act". According to the author, the professional must develop a systemic thinking capable of understanding the organization as a whole, as well as having specific knowledge.

"The current market requires the profile of an administrator with a generalist view, with extensive knowledge in several administrative areas, such as accounting, economics, law, environmental management and related knowledge, thus allowing the administrator to adapt more easily to the the market in the face of the intemperance's of the economy." (SILVA et. Al, 2008, p.12) In Brazil, the profession of administrator was regulated by the enactment of Law No. 4,769 on September 9, 1965. It defines the field of activity and activity competent for the administrator, as defined in Chapter II of the said law: "Art. 3rd - The professional activity of the Administrator, as a liberal profession or not, comprises: a) preparation of opinions, reports, plans, projects, arbitrations and reports, in which the application of knowledge inherent to organizational techniques is required; b) research, studies, analysis, interpretation, planning, implementation, coordination and control of work in the fields of general administration, such as administration and selection of personnel, organization, analysis, methods and work programs, budget, material and financial management, marketing management, production management, industrial relations, as well as other fields in which they unfold or to which they are connected; c) exercise of functions and positions of Administrator of the Federal, State, Municipal, Autarchic Public Service, Mixed Economy Companies, state, parastatal and private companies, in which the title of the covered position is expressed and declared. d) the exercise of functions of leadership or direction, intermediary or superior advising and consulting in organs, or their compartments, of the Public Administration or private entities, whose attributions mainly involve the application of knowledge inherent to the administration techniques; e) teaching in technical subjects in the field of administration and organization." (BRAZIL, 1965).

According to the Federal Administration Council (2015), the majority of Brazilian administration professionals are male, married and with dependents; are between 31 and 35 years old; he graduated from private universities; completed the Administration course between 2006 and 2011; has specialization in some area of Administration; »Works in large, private companies and in the industrial sector; holds the position of Management and Analyst; works in the areas of Administration and Strategic Planning; has a signed Professional Card; has an average monthly individual income of 9.2 minimum wages and is registered in CRA.

New technologies also have transformations in the world of work, which also affects management activity. "The increasing popularization of machines and computers would demand new skills from both the traditional intellectual worker and the manual worker, reducing borders and reviewing the relationships between these two positions" (LEMOS; PINTO, 2008, p. 6). Silva et. al (2008, p.12) argues that "scientific and technological development, a fundamental support, increases the complexity of the world and starts to demand a professional with competence to deal with a significant number of factors". Angeloni points out that "information technologies lead to profound organizational changes. They lead to new forms of management and, consequently, to new organizational forms." (2003, p. 20).

Time and productivity

"No goal can be achieved without consuming resources. In other words, every objective consumes resources and, therefore, has a cost, since every resource has a price "(SILVA et. Al, 2013, p. 643). Therefore, the administrator, in order to fulfill his function, must know how to deal with the resources that are available to him. Among the resources to be managed is time, since every activity requires time to be carried out (DRUCKER, 1981). Time is an impossible element to be stored, since it is limited, irreplaceable and inelastic (JUSTINIANO, 2015). "Many professionals are evaluated by the way they use it (time), objectives are defined and companies impose financial losses in case of non-compliance with deadlines" (OLIVEIRA; KRON, 2005, p. 928) Nunes et al. (2019, p. 134-135), from a military perspective, show that the misuse of time has a decisive effect on productivity, "especially for those who perform administrative work, which involves a daily mental exercise, permeated by a routine of meeting deadlines, making documents and operating computerized systems"(2019, p. 135). According to Martins and Laugeni (2012, p. 03), productivity is given by the ratio between the "result of the process" and the "resources used in the process". Moreira (2008, p. 606) argues that productivity "refers to the greater or lesser use of resources" and that its increase results in a decrease in production costs or in the services provided. "The labor productivity indicator, in general, is estimated by the ratio of physical production / hours paid in production" (CACCIAMALI; BEZERRA, 1997. p. 81). "Due to the need to obtain a better use of time (efficiency) and to achieve objectives and results (effectiveness)" (NUNES et al., 2019, p. 134), personal strategic planning gains more and more notoriety.

For Estrada et. al (2011), strategic planning aims to make the individual able to plan his personal and professional life, reconciling the available resources and, thus, achieving his goals. Osinski et. al (2013) states that planning is an effective method of organizing and controlling one's own habits and expenses in a way that allows the achievement of established goals. The plan, in turn, "must be in accordance with the needs and desires of each person, being endowed with a clear vision of the future, with objectives and action plans effective in the search for a better life" (ESTRADA et al., 2011, p. 123) "The individual who has clear objectives and goals, and organizes himself to accomplish what was previously established, will have a greater chance of achieving stability". (OSINSKI et. Al, 2013, p. 124). Nunes et. al (2019) emphasize that a change in habits, attitudes and behavior is necessary for an effective implementation of personal planning through effective time management. Justiniano (2015) highlights the necessary criteria for realistic planning, which are: analyzing the various alternatives; organize; Consult; and targeted collection of information. The author presents the planning cycle in four stages: definition of objectives; definition of priorities; disposal of low priority actions; and assessment of achievement of objectives. Good time planning avoids urgencies, which demands more time, as well as unnecessary concerns (SANTOS, 2015). "The techniques of effective time management have allowed companies to achieve greater productivity and better working conditions for their employees" (OLIVEIRA; KRON, 2005, p. 930).

GUT matrix

The GUT Matrix is a tool that has the function of "prioritizing problems, it is generally used in the analysis of risks and shows through the qualification of problems what are the priorities, aiming to minimize their impacts before the company" (TRUCOLO et al., 2016, p. 126). The acronym GUT stands for Severity, Urgency and Tendency which are the degrees by which business problems must be divided and classified (POSSI et al., 2006).

Gravidade analyzes the effects of the problem it can cause in the medium and long term if it occurs and takes into account aspects such as tasks, process, results and so on. Urgency analyzes the time that the solution of the problem must take and establish which ones must be placed as immediate and postponable. The Trend seeks to ascertain the possibilities of increasing each problem if it is not solved (TRUCOLO et al., 2016). Values from 1 to 5 must be assigned to each problem in each category and its grades must be given by the product (G) x (U) x (T) (TRUCOLO et al., 2016; PESTANA et al., 2017).

Covey's seven habits

Many theorists and professionals from various fields have looked for ways to establish methods for the elaboration of a personal strategic planning and, thus, to increase productivity and improve the use of time.

For example, Covey (2015), who brings a model composed of seven habits, based on the principles of human effectiveness, divided into three parts. The model seeks to cover all aspects of life and works with the concepts of dependence, independence and interdependence.

The goal of the model is to move from dependence to independence and thus achieve interdependence. In interdependence and that all elements communicate and cooperate with each other. "As an interdependent person, I have the opportunity to relate more deeply and significantly to others, gaining access to the potential and the immense resources of other human beings" (COVEY, 2015, p. 81).

The first part refers to the private victory - aimed at selfcontrol and the development of independence - which covers the habits of being proactive; start with an objective in mind, and put the most important first, which are respectively based on the principles of personal vision, personal leadership and personal management;

The second part refers to public victory - focused on interpersonal relationships - composed of the habits of thinking about win-win, seeking to understand before being understood and creating synergy, which are based on the principles of interpersonal leadership, empathic communication and creative cooperation;

The third part - focused on the balance between the physical, spiritual, mental and social dimensions - is based on the habit of "tuning the instrument" inspired by the principle of balanced Self-renewal.

The triad of time

The Triad of Time, proposed by Barbosa (2012), places all activities in three spheres that do not intersect: importance, urgency and circumstance. The sphere of importance covers the most significant activities, that is, those that will truly make a difference in the individual's life; the sphere of urgency covers the tasks that must be accomplished immediately, otherwise they will cause some kind of damage; and the sphere of circumstances, refers to activities arising from the circumstances and situations in which the individual is. The author argues that the ideal triad is one in which 70% of the activities are in the sphere of importance; 20%, in the urgency sphere; and 10%, circumstantial.

Also according to the author, to achieve the perfect triad, it is necessary to use a methodology that is represented by a five-pointed star, which represents the five phases:

1. Identity - Reflection necessary to define self-knowledge and thus define with propriety what is really relevant in the individual's life so as to know what his long-term goals will be. 2. Goals - "Goals give time meaning to your time, associating day-to-day activities with the realization of your dreams" (2012, p. 70).

3. Planning - Phase of defining, in writing, the path to be followed, including possible problems and intermediate steps and the definition of deadlines and resources.

4. Organization - "Organization is essential to clean up your environment and to organize the logic of the files. In addition, this phase presents strategies for the storage and sharing of information and knowledge "(2012, p. 71).

5. Execution - Phase in which the others converge. "In it, your identity is exposed to the world, your goals begin to be fulfilled, your planning is put into practice and the organization helps productivity" (2012, p. 71-72).

III. METHODOLOGY

As a way to achieve the general objective of demonstrating the importance of time management in the activity of the professional administrator and its impact on increasing productivity within his practice in the current job market, unfolded in the specific objectives of presenting the profile and the scenario in which meets the 21st century Brazilian administrator; explain work productivity and time management with the influence of new technologies; and ascertain the theories of time management in productivity and professional development of the administrator through the opinion of experts in the field of Administration, this study will use the bibliographic research in which the selected and organized readings and conclusions about the theme will be selected (MATIAS-PEREIRA, 2012) and the Delphi technique, which is "a forecasting technique, designed to know in advance the probability of future events, through the request and systematic collection of the opinion of experts in a given subject" (OLIVEIRA et al, 2008, p. 5)

As for its nature, the present study is configured as basic diagnostic research, since it seeks to generate new knowledge with a focus on drawing a panorama of a certain reality without necessarily the objective of a practical application of this knowledge (NASCIMENTO, 2016).

According to Boccato (2006, p. 266), bibliographic research consists of the search for the solution of a certain problem (hypothesis) through published theoretical references, in which various scientific contributions are analyzed and discussed. "Bibliographic research is an exploratory work, which provides the researcher with theoretical bases to assist in reflective and critical exercise on the topic under study" (NASCIMENTO, 2016, p. 6-7),

therefore, a bibliographic review is necessary to endorse knowledge about the researched items and in what way and under which and under which focus and / or perspectives the theme was explained by the scientific literature.

The Delphi technique was also used, which consists of seeking the opinion of specialists, through a structured questionnaire, about a specific phenomenon with the purpose of reaching a consensus between the parties (FERNANDES, 2010; MEYRICK, 2003; SÁFADI, 2001; DALKEY, N; HELMER, 1963; FARO, 1997). "This technique allows to obtain group consensus on a certain phenomenon. The group is composed of judges, that is, professionals effectively engaged in the area where the study is being developed." (FARO, 1997, p. 260).

The opinions expressed must be kept anonymous (LYRA, 2008) because "this is a way of guaranteeing the equality of expression of ideas, protecting trends and avoiding distortions, as there is no psychological pressure from one respondent in relation to another." (OLIVEIRA et al. 2008, p. 8). For Sackman (1975, apud. MANURETTO et al. 2013, p. 14/15), the method is configured as follows:

1. The format is typically, but not always, a 'paper and pencil' questionnaire, which can be applied via mail, in a personal interview or in an interactive or online session. The basic technique for presenting and collecting data is the formal questionnaire, structured for each case;

. The questionnaire consists of a series of items, using similar or different scales, quantitative or qualitative, according to the objectives of the study;

3. The questionnaire items can be generated by the research coordinator, by the participants, or by both;

4. The questionnaire is accompanied by some instructions, game guidelines;

5. The questionnaire is applied to the participants in two or more rounds, the participants respond to the scaled objective items and may or may not respond to open verbal requests;

6. Each moment of interaction is accompanied by some form of statistical feedback, which usually involves a measure of central tendency, some measure of dispersion, or even the distribution of the absolute frequency of the responses of each item. " (SACKMAN, 1975, apud. MANURETTO et al. 2013, p. 14/15)

According to Lyra (2008) there are four basic characteristics of the Delphi method, which are: 1) exchange of opinions and interaction between experts; 2) anonymity of the respondents' opinions and identities; 3) review of responses in the face of others obtained; 4)

tabulation and analysis of responses using a statistical standard.

Data collection took place through an online form made up of 25 statements about the performance of the Administration professional in Brazil, Personal Strategic Planning and Personal Productivity Management Tools based on the Theoretical Framework of this research, in which the statements will be answered on a scale of five options which are "Strongly disagree", "Partially disagree", "Neutral", "Partially agree" and "Strongly agree". The body of respondents is made up of professors of Administration at the Federal Institute of Education, Science and Technology from Piauí - IFPI chosen due to their notorious knowledge proven through public competition and academic contribution through their constant scientific production, configuring them as specialists in matters related to Administration.The research has a total universe of 75 professors, in that it is intended to obtain 25 responses to achieve the objectives.

IV. DATA ANALYSIS

Through an intense bibliographic search based on articles published since the 2000s, (except books and articles that had the objective of providing the necessary conceptual elements to approach the subjects worked in the research) on the role of the administrator and the reality Brazilian market for these professionals.

The research shows that the most valued professionals are those with a generalist view, capable of adapting to new situations, as their position is characterized as highly dynamic and with responsibilities in multiple functions, who know how to work as a team, without fear of risk and that it is constantly updated in relation to new technologies and market trends, and that time management directly interferes with your quality of life, both professionally and personally.

Time management techniques, as noted, are mainly based on planning the actions to be taken and prioritizing what will really have a relevant impact in achieving what was previously established. From the authors' point of view, the exact identification of what is sought in order to establish solid life goals is crucial, and this is part of selfknowledge, so that one knows what is really important to dedicate to achieve. The organization of actions allows for a better adaptation and use of available resources, and as a consequence, the enhancement of results and greater productivity. Time management can be used in various areas of an individual's life, with a focus on medium, short and long term results. A Delphi questionnaire was designed to counter the information collected by the bibliographic research with the knowledge of specialists in the field.

After applying an online questionnaire containing 25 statements about the performance of the Administration professional in Brazil, Personal Strategic Planning and Personal Productivity Management Tools, 27 responses were obtained from a universe of 75 specialists, which corresponds to 36% of the total. The answers were given in a scale ranging from "I totally disagree", "I partially disagree", "Neutral", "I partially agree" and "I totally agree".

The survey had responses from administration professors working on the IFPI (Federal Institute of Piauí) campuses, among which, Piripiri and Campo Maior had the highest number of respondents with four (4) each; Campus Teresina Central and Parnaíba had three (3), Oeiras, São João do Piauí, Advanced Campus Dirceu Arcoverde (Teresina) and Uruçuí had two (2); the Teresina Zona Sul, Pedro II, Valença, Angical and Cocal campuses had one respondent each.

Of the 25 statements presented, the experts agreed between "totally" and "partially" with 14 of them. The "Neutral" option was chosen in 100% of cases and was the most chosen option on three occasions. The disagreements occurred in four statements, and the ones that had the largest number of disagreements were statements 18 - "Our head was not made to store our priorities" in 5 (18.5%) are neutral; 12 (44.4%) partially disagree and 10 (37%) totally disagree, and 0 agree and statement 23 - "The main use of annotations (List of daily tasks) is to bring a lot of frustration and little result" in which 1 (3.7%) fully agree; 4 (14.8%) are neutral; 6 (22.2%) partially disagree and 16 (59.3%) totally disagree.

Among the statements with the highest number of concordants, we have the 4 - "The professional (of administration) must develop a systemic thinking capable of understanding the organization as a whole" - in which 23 (85.2%) totally agree; 3 (11.1%), only 1 (3.7%) is neutral and no discordant and statement 19 - "During planning, you will notice that the prioritization process is vital in your daily life", where 15 (55.6%) totally agree; 10 (37%) partially agree, 2 (7.4%) are neutral and no disagreement.

The question that had the greatest balance between the answers was 9 - "There are people who interpret proactive as a synonym for aggressive, insensitive or overly demanding" - in which 1 (3.7%) totally agrees; 6 (22.2%) partially agree; 5 (18.5%) are neutral; 8 (29.6%) partially disagree and 7 (25.9%) totally disagree, the number of

dissenters is high, but the difference between the answers varies little, especially when compared to other questions. Another that stands out for its balance was 14 - "Inefficient people experience synergy only in restricted and peripheral fields of their lives" - in which 3 (11.1%) fully agree; 8 (29.6%) partially agree; 10 (37%) are neutral; 3 (11.1%) partially disagree and 3 (11.1%) totally disagree. It is worth mentioning that in this one, the option "NEUTRAL" was the most chosen among the respondents, and the number of concordants, joining "totally agree" and "partially agree", only surpass it by one respondents, which in this case were 11.

We can imply that the theories defended by the authors and researchers were corroborated in the experts' perception, since few statements had a high number of disagreers. In 25 statements, only four were denied by respondents, which corresponds to only 16% of the total, with a consensus of agreement in 84% of cases.

V. CONCLUSION

Regarding the specific objective of presenting the profile and the scenario in which the Brazilian administrator of the 21st century finds himself, it could be inferred that the Brazilian administrator is mostly male, aged between 30 and 40 years old, has family and dependents and is registered with the CRA of his states, he works in management positions in private companies.

He finds himself in an environment of great competitiveness and competition, highly affected by technological innovations that require a keen perception of trends, generalist vision and systemic thinking, flexibility and multifunctionality, adaptability to new situations and technologies, taking on responsibilities and risks, leadership and team coordination, solidarity and ethics. His behavior stands out before his technical knowledge.

When explaining work productivity and time management with the impact of new technologies, it was observed that productivity is directly affected by the time factor, and its management interferes with the way the manager is perceived by companies, the manager in charge of several tasks. For personal and professional productivity, the planning and conscious delimitation of the activities to be carried out are focused on those that will have a significant impact in favor of the objectives intended by the individual. For the beginning of a solid planning, the individual must understand what his / her pretensions really are and what he / she really values to the point of having as a long-term life objective. Putting to the test the claims arising from the bibliographic research confronted with the knowledge of specialists, the specific objective of investigating the theories of time management in the productivity and professional development of the administrator through the opinion of experts in the area of Administration was sought. It was possible to find a consensus regarding the demands of the market regarding skills and behavior, as well as the reality of the profession. With agreement and 84% of the tested statements, it can be said that the theoretical material tends to correspond to what is found in the daily life of the professional administrator and that time management techniques are indeed versatile.

In this way, in response to the general proposal of the work, which was to demonstrate the importance of time management in the activity of the professional administrator and its impact on increasing productivity within his practice in the current job market, we have that time management interferes decisively in the performance of the administrator, as this is marked by the requirement in reaching goals and meeting deadlines and which impacts on productivity by enabling the best organization of its tasks and identification of those that are really relevant to the achievement of its short, medium and long objectives different aspects of your life.

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Characterization of Serra Fishing, (*Scomberomorus brasiliensis*, Collette, Russo & Zavalla-Camin, 1978), In The Amazon Coastline

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Abstract— The present study aims to characterize the production of Serra Scomberomorus brasiliensis fisheries from the Amazon coast, through historical analysis (1997 to 2007). The capture fishery of Serra Scomberomorus brasiliensis on the Amazon coast has great socio-economic importance in fishing communities. Landings, species production during the period, types of vessels, fishing gear were evaluated, verifying the quantity and seasonality of landings based on the database of samples from the National Center for Research and Conservation of Marine Biodiversity of the North (CEPNOR). The research is of an interdisciplinary type and the data were analyzed separately by landing with the aid of spreadsheets and the STATISTICA 7 program. Total landing numbers were observed in the Serra fishing, which totaled 12,360 landings per year. The production landed in this fishery generated a total of 15,298,019 kg of fish, of this total 6,899,516 kg corresponds to the capture of the mountain range. However, continuous studies with a more biological and ecological approach are needed to ascertain the situation of the fishing in the mountains and, therefore, the implementation of public policies aimed at the preservation and conservation of the species.

Keywords— Fisheries, Fishery Resources, Scomberomorus brasiliensis.

I. INTRODUCTION

Fishing is an activity from the beginning of the history of man in the world, in which the act of fishing allows for reliable food for different peoples, contributing significantly in times of agricultural scarcity, in the difficulties of collecting different foodstuffs (SALDANHA, 2019).

Fisheries in Brazil occupy around 800 thousand workers, including fishermen and aquaculturists, who generate 3.5 million jobs, with production of approximately 1.25 million tons of fish and Gross Domestic Product of R \$ 5 billion (SEDREZ et al , 2018).

In Brazil, commercial fishing is practiced along the entire coastline, which extends over more than 8,500 km from the coast, thus presenting high social and economic importance for a huge contingent of workers in the regions. The fishing activity is governed by Law 11,959, of June 29, 2009, which provides for the National Policy for the Sustainable Development of Aquaculture and Fisheries.

In 2010, Brazil was in 25th place among the 30 countries with the best production of fish caught both marine and continental, registered a production of 785,366 tons less than the production of 2009 with 825,164 tons (MPA, 2011).

It is important to know the fishing productive chains in order to be successful in relation to measures for ordering and managing fisheries in Brazil. As well as the development of new public policies in the management of the use of fisheries resources in a sustainable way in the country. The continuous generation of data and statistical information is necessary to boost government action and research towards the management of the sector, since the last data available on the situation of fishing in Brazil was in 2011 through the Fisheries and Aquaculture Statistical Bulletin.

The North Coast of Brazil, also called the Amazon Coast, is 2,250 km long and covers the coastal areas of the states of Pará, Amapá and Maranhão, and has great potential in fishing in general, due to the huge amount of nutrients that are it originates through the mangroves, influenced by the hydrological dynamics of the discharges from the Amazon River and facilitating the life of many aquatic organisms and consequently the exploitation of the fishing resources of these regions (MOURÃO et al., 2009).

On the northern coast of Brazil, different fishing modalities and scales are observed, for example, industrial or large-scale fishing involving vessels with sophisticated navigation and capture equipment capable of reaching distant ocean areas is easily identifiable by its specificity, purpose and economic importance, which facilitates the monitoring of this activity. Small-scale or artisanal fishing is characterized by its diversity in the use of capture methods, fishing power and purpose, it has more than one target resource and fishing power and purpose, (local, regional, national and international markets), and for this reason, they are difficult to manage (BENTES et al., 2012).

The capture fishery of the mountain range, *Scomberomorus brasiliensis* COLLETTE, RUSSO & ZAVALLA-CAMIN, 1978, on the Amazon coast has a great socio-economic importance in fishing communities. Mountain fishing presents seasonal variations in its production, observable migrations towards the northern and northeastern Brazilian hemisphere. With different fleets from several states and countries, it is verifiable that there are no management policies for saw stocks. On the coast of Pará, the species *S.brasiliensis* stood out among the species of great economic importance in 2007, being responsible for 8% of the marine / estuarine production landed in the state (ESPÍRITO-SANTO, 2012).

The coast of Pará occupies the third position in terms of landing volume of the *S. brasiliensis* mountain range, contributing 9% of the total production of the state. With regard to catch vessels of this species, most are made with small motorized vessels, using a gillnet with a mesh of 40 to 60 mm, with a maximum length around 9,000 m, and the income resulting from this fishing is on average between 0, 8 and 2.3 minimum wages (SILVA et al., 2014).

The objective of the work is to characterize the fishing of the *S. brasiliensis* mountain range from the Amazon coast through the historical analysis from 1997 to 2007, based on the database of samples from the National Center for Research and Conservation of Northern Marine Biodiversity (CEPNOR).

II. METHODOLOGY

The study area is the Brazilian Amazon Coastal Zone (ZCAB), located specifically between the mouth of the Oiapoque River in Amapá and the São Marcos Bay in Maranhão (Figure 1). Measuring about 2,250 km in length, the ZCAB is a high-energy region, in which environmental processes derived from the high discharge of continental waters loaded with particles and sediments interact (SILVA, 2019). The Amazon coast is an environment of great importance for fishing, they are the largest producers of fish originating from marine fishing, contributing with approximately 24% of national production (MPA, 2011). It covers an ecosystem of wide biodiversity of fishery resources and presents industrial and artisanal fleets that different characteristics for have their purpose (ESPÍRITO-SANTO and ISAAC, 2012).



Fig 1: Amazonian coastline with oceanic bathymetry, highlighting the extension points (Foz do Oiapoque - AP and Baia de São Marcos - MA).

Source: Silva, 2019.

The species of study Serra *S. brasiliensis*, has a neritic pelagic characteristic with coastal habits, has a tapered and thin body, relatively short head and small scales, with bluish back, silver flanks with golden dots and white ventral portion. wide distribution, occurring in the Western Atlantic, the Caribbean and Central America and reaching the southern limit of Brazil (COLLATE and RUSSO, 1984).

Primary data from 1997 to 2007 were used, obtained through the Center for Research and Management of Fisheries Resources on the North Coast (CEPNOR) by the project "Ecosystem Assessment of Demersal and Pelagic Fisheries Resources on the North and Northeast Coasts: Subsidies for Fisheries Management Sustainable.

III. RESULTS AND DISCUSSIONS

The Amazon coast includes the states of Amapá, Pará and Maranhão, has an abundance of fishing resources and adequate capacity to exploit these resources (MOURÃO, 2009). They are the largest producers of fish from marine catch fisheries, contributing approximately 24% of national production (MPA, 2011).

According to CEPNOR data, total landings in fisheries where saws occurred in the years 1997 to 2007, totaled 12.360 landings. The year with the highest number of landings was 2005 with 2.183 landings, followed by 2007 with 1,686 landings. In addition, there was a slight decline between 2005 (2.183) and 2006 (1.571), however, in general, there is a positive linear trend line with a positive correlation, where R2 = 0.73 (Graph1).

Graph1: Number of landings by the fishing fleet on the Amazon coast, from 1997 to 2007.



According to CEPNOR data, mountain fishing and its accompanying fauna on the Amazon coast showed a total production of 15.298,019 kg of fish, whereas Scomberomorus brasiliensis mountain fishing showed 6.899,516 kg of this total, 2007 was the most productive year. with a production of 3.031,781 kg, already the second and third largest production were in the years 2004 and 2003 with 1.983,001 kg and 1.940,089 kg, respectively. However, when analyzing only the production of the saw, it is noted that the most productive year was 2003 with 1.055,612.5 kg of fish and the following years there is a slight decline in the production by sawing Serra (Graph 2).





A positive linear trend line of production per year is observed, with a positive correlation where R2 is equal to 0.78. However, Serreira production has a positive linear trend in production per year with a correlation of 0.59 (Figure 5). The mountain has great socio-economic importance on the Amazon coast represented by the States of Pará, Amapá and Maranhão. In Pará, the mountain is the third in terms of landed volumes, with 9% of total production and an average of 7.793 t during the period from 1997 to 2007 (IBAMA, 2011). However, a slight decline is noted, which was also evidenced in the work of (BENITAH et al., 2014).

The municipality of Salinópolis presented the highest number of landings with 3.350 total landings, and production of 564,182 kg considered the 7th largest, in percentage generated 4% of production with an average of 168.41 kg. The municipality of São João de Pirabas was the second largest in number of landings with 2.271 and higher production among the municipalities with 7.299,861 kg, representing a percentage of 48% (Table 1).

The municipality of Augusto Correia was the third largest in landings with 1,874 landings and production of 2.095,987 kg representing 14% of production. The municipality of Bragança had a total of 1.701 landings and the second largest production with 2.404,877 kg representing 16% of production. The municipality of Curuçá represented 5% of landings and 6% of production, while the municipalities of Belém and Vigia presented 3% and 5% of landings, respectively, both with 5% production. Therefore, it is clear that the municipality that obtained the best production performance was São João de Pirabas (48%) and second in landings (18%) (Table 1). Table 1: List of municipalities by number of landings andproduction.

Counties	N°. of landings	N°. of landings%	Production (kg)	Production %	Average production (kg)
Augusto Correia	1.874	15%	2.095.987	14%	1.118,46
Belém	395	3%	721.039	5%	1.825,42
Bragança	1.701	14%	2.404.877	16%	1.413,80
Colares	35	0%	3.712	0%	106,05
Curuçá	642	5%	\$55.934	6%	1.333,23
Maracanā	304	2%	252.202	2%	829,61
Marapanim	438	4%	38.070	0%	132,58
Quatipuru	139	1%	113.297	1%	815,09
Salinópolis	3.350	27%	564.182	4%	168,41
Salvaterra	47	0%	4.919	0%	104,66
São Caetano Odivelas	267	2%	154.503	1%	578,66
São Joao Pirabas	2.271	18%	7.299.861	48%	3.214,38
Soure	160	1%	15.168	0%	94,80
Vigia	б41	5%	726.838	5%	1.133,91
Viseu	96	1%	27.431	0%	285,74
Grand total	12.360	100%	15.298.019	100%	1.238

According to the data analyzed, it was found that the small boat (Bpp) obtained the highest percentages of landing and production, 64% (7,882) and 76% (11,600,567 kg) respectively. The medium-sized boat (Bmp) presented 9% (1,114) and 17% (2,577,209 kg) of production. The Bmp presented 6,617 fishermen on its vessel and 14,257 fishing days. Despite the canoe (Can) presenting 15% (1,836) of landings, it obtained only 1% (205,064 kg) of production. The motorized canoe (Cam) obtained 8% (1,022) of landings and 3% (484,822 kg) of production (Table 2).

Thus, it is evident that the fisheries that capture the mountain range, *Scomberomorus brasiliensis*, are concentrated mainly in small vessels (Bpp, Cam, Can and Mon) totaling 80% of production, this fishery being characterized as small scale artisanal, information corroborated by Isaac et al. (2009).

Table 2: Types of vessels by quantities of landings and production (kg).

Type of vessel	№ of landings	N° of landings %	Production (Kg)	Production %	Average Production (Kg)	Production Máx. / Mín.	Production Dev. Pad.
Bin	15	0%	381.980	2%	25.465	42.037/264	16.235
Bmp	1.114	9%	2.577.209	17%	2.313	26.173/148	2.041
Bpp	7.882	64%	11.600.567	76%	1.472	16.180/ 5	1.503
Cam	1.022	8%	484.822	3%	474	714/7	642
Can	1.836	15%	205.064	1%	112	2.373/11	129
Mon	491	4%	48.378	0%	99	2.427/ 7	161
Grand total	12.360	100%	15.298.019	100%	1.238	42.037/ 5	1.814

The Serreira type gillnet is the most used fishing gear in mountain fishing, representing 78% (9,674) of landings and 69% (10,630,513) of total production. According to Mourão et al (2014), the Serreira network is made with monofilament yarn and has a mesh size ranging between 40 and 60 mm, measured between adjacent nodes (Table 3). The gillnet and line represented 9% (1,078) of shipments and 21% (3,268,226) of production. The Gozeira chain presented 9% (1,108) of landings and 3% (503,764) of production. These three types of fishing gear accounted for 93% of production and 96% of landings. According to the official data made in 2005, which obtained a total registration of 16,678 units in the three states of the north coast of Brazil, of which 5,136 (31%) work with gillnets (IBAMA, 2007) (Table 3).

Table3: Number of total landings and percentage, total production, percentage and average per gear.

Fishing Art	N° of landings	N° of landings %	Production (Kg)	Produção %	Average Production (Kg)
Arrasto Piramutaba	12	0%	381.146	2%	31.762
Boinha/Pargo	3	0%	2.479	0%	826
Caíque/Pargo	1	0%	490	0%	490
Curral	41	0%	7.887	0%	192
Curral E Rede	9	0%	1.734	0%	193
Espinhel/Bagre	69	1%	31.448	D%	456
Espinhel/Tubarão	12	0%	12.139	D%	1.012
Gozeira	1.108	9%	503.764	3%	455
Linha E Anzol	46	0%	9.417	0%	205
Manzua Peixe	6	0%	11.257	0%	1.876
Pargueira	12	0%	37.129	0%	3.094
Pargueira E Manzua Peixe	4	0%	5.770	D%	1.443
Pescadeira	166	1%	232.539	2%	1.401
Rede De Emalhar E Linha	1.078	9%	3.268.226	21%	3.032
Rede E Espinhel	118	1%	161.630	1%	1.370
Serreira	9.674	78%	10.630.513	69%	1.099
Zangaria	1	0%	452	D%	452
Grand total	12.360	100%	15.298.019	100%	1.238

Through the data, the 10 most productive species were observed in landings from 1997 to 2007 where the saw was captured. Serra Scomberomorus brasiliensis contributed (45%), Tubarão Carcharhinus (9%), Timbira Oligoplites palometa (6%), Bonito Katsuwonus pelamis (5%), Uritinga Arius proops (4%), Bijupira Rachycentron canadum (4%), Canguira Trachinotus spp. (4%), Bandeirado Bagre catfish (3%), Corvina Cynoscion microlepidotus (2%) and Coraximbora Caranx latus (2%), which achieved a combined productivity of 12,984,787 kg (80%) (Figure 2).

The mountain, between 1997 and 2007, obtained 45% of production and the remaining 55% corresponded to its accompanying fauna. In the work of Mourão et al (2014), the fauna accompanying the fishing directed to the capture of mountains had as main representatives Corvina Cynoscion microlepidotus, Bandeirado Bagre bagre, Timbiro Oligoplites palometa, Mullet Mugil curema, mackerel Scomberomorus cavalla and carcharhinus e Sphyrna (Figure 2).



Fig.2: The 10 most productive species on landings from 1997 to 2007 directed to the capture of mountains.

IV. CONCLUSION

The fishing of the *Scomberomorus brasiliensis* and the like between 1997 and 2007 totaled 12,360 landings with one of 15,298,019 kg of fish, of this total 6,899,516 kg corresponds to the capture of the saw.

The municipality of São João de Pirabas was the most productive, with 48% of production and second in landings. It is important to mention that the Bragantina Region composed of the municipalities Bragança, Augusto Correia and Viseu accounted for 30% of landings and production.

The fisheries that capture the mountain range, *Scomberomorus brasiliensis*, are mainly concentrated in small vessels (Bpp, Cam, Can and Mon) totaling 80% of production.

In the fishing of the mountains the fishing gear of the Serreira type, gillnet and line and the Gozeira type net are mainly used. The Serreira type gillnet accounted for 78% of landings and 69% of total production, the most used in mountain fishing.

Serra Scomberomorus brasiliensis contributed 45% of production in the fisheries where it occurred, and 55% of production corresponded to other species. The ten species of importance in the production after the saw were the following species: Tubarão Carcharhinus, Timbira Oligoplites palometa, Bonito Katsuwonus pelamis, Uritinga Arius proops, Bijupira Rachycentron canadum, Canguira Trachinotus spp., Bandeirado Bagre bagre, Corvina Cynoscion microlepidusus and Microlepidus.

It is evident and necessary to continue collecting production data by census of fishing landings, in addition to continuous biological and ecological studies in order to have more accurate data about fishing for this species in Brazil, especially for public policies and legislation to be implemented. that contribute to guarantee the continuous exploitation of this fishing resource, aiming at the preservation and conservation of the species, since a situation of slight decline in the production of the *Scomberomorus brasiliensis* mountain range has been observed in recent years.

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Risk Factors and Sociodemographic Characteristics of Ischemic Stroke in Brazil – A Systematic Review

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Abstract— Introduction: Ischemic stroke corresponds to 80% of cases in Brazil, which demonstrates its epidemiological importance in Brazil. The magnitude of this fact reflects the reason why stroke is considered the second leading cause of death in the world, and the leading cause of death in Brazil, in addition to being the second leading cause of cognitive losses. The main causes that promote the occurrence of ischemic stroke determine the conjuncture of risk groups. Such factors can be classified into modifiable, non-modifiable and potential risk group. Objective: The objective of this study was to systematically review the public health literature on the risk factors and sociodemographic characteristics of ischemic stroke in Brazil, by analyzing epidemiological studies conducted in Brazil. Methods: Systematized literature review conducted by searching the US National Library of Medicine (Pub Med), Scientific Electronic Library online (SCIELO), Latin American Caribbean Health Sciences Information System (LILACS), Science Direct and Embase, using the descriptors: "Isquemic stroke", "risk factors", "sociodemographic characteristics" and "Brazil". 852 articles were found, of which 11 were selected to build the review by six reviewers independently. Results: Chronic noncommunicable diseases (CNCD), such as stroke and ischemic heart disease, account for 63% or about 36 million of deaths worldwide, with emphasis on diseases of the circulatory system, diabetes, cancer and respiratory disease chronic. In Brazil, NCDs also present themselves as a health problem, corresponding to 54.0% of all deaths, in the year 2016. In the age group of 30-69 years, NCDs represented 56.1% of deaths. Conclusion: It is known today that stroke is one of the major causes of morbidity and mortality among patients, being the majority in the elderly. It is associated with CNCDs, among which we mention hypertension, diabetes and dyslipidemia. Such a disease is more common in men, blacks and those with low schooling, but in women it is more lethal, according to pre-existing data. Thus, new methodologies and analyzes need to be developed on the effects of the multiplicity of chronic diseases, which affect the elderly more intensely.

Keywords— Isquemic stroke, risk factors, sociodemographic characteristics and Brazil.

I. INTRODUCTION

Ischemic stroke is a disease resulting from an obstruction of a cerebral artery, usually resulting from fat deposits due to atherosclerosis and/or blood clotting. The decrease in neurological function occurs by blocking the circulation in a certain brain area, causing ischemia, also known as stroke. These events promote the death of nervous tissue due to lack of blood supply to the obstructed $area^{(1)}$.

Ischemic stroke is classified into three types: embolic, thrombotic and lacunar. The first is derived from small portions of matter that are released into the bloodstream and move to the cerebral arteries. The second is due to the development of a clot or thrombus inside the cerebral arteries or their branches. And finally, the third is caused by small infarcts that occur only where perforating arterioles branch directly from the great vessels. The neurological abnormalities of the stroke determine that the brain injury is opposite to the signs of motor deficit ⁽²⁾.

In Brazil, 80% of cases of stroke are classified as ischemic stroke, demonstrating its epidemiological importance in the country, resulting in the first cause of death in Brazil, besides being the second cause of cognitive loss $^{(1,3)}$.

Studies show that the individuals most affected are elderly, generally males from the black ethnic group. However, the most severe cases affect female patients, referring to a higher lethality rate than males. Other studies also show that stroke incidence and hospitalization rates emerge among young people, becoming a public health issue ^(4,5).

The main associated risk factors that increase the occurrence of ischemic stroke can be classified as modifiable, non-modifiable and potential risk group. In the first classification, the greatest relationship arises from habits such as smoking and the control of pre-existing diseases such as hypertension and diabetes mellitus. The second classification, non-modifiable risk factors, presents characteristics such as advanced age, gender and ethnicity. The potential risk group lists factors resulting from bad life habits, such as sedentariness, obesity and alcoholism. Obesity is believed to be a triggering factor for cardiovascular diseases, transfiguring it as one of the key points for risk classification models ⁽⁶⁾.

The stroke, usually resulting from the factors listed above, in addition to mortality, can generate after-effects that not only impact the individual, but also the social and economic sphere. These after-affects can compromise the individual's productivity and autonomy, and can be described and observed by the main signs and symptoms such as paresis, pain, visual deficits and motor attenuation ⁽⁷⁾.

The extent and establishment of collateral flow is determined by the affected site, severity, signs and symptoms. The main indicative signs can be listed as loss of strength, sudden headache, loss of speech, imbalance, visual changes, immediate sensitivity changes, instability, dizziness, nausea or vomiting, fatigue, and personality and mood changes ⁽⁸⁾.

As for the diagnosis, the ischemic stroke is detected by means of imaging tests that make it possible to identify the affected area of the brain, and some tests can be cited for their high degree of accuracy to confirm the mechanisms of the stroke. This set includes the following exams: computed tomography (CT), magnetic resonance imaging (MRI), electrocardiogram, echocardiogram and carotid Doppler ultrasound ⁽⁹⁾.

The objective of the present study was to systematically review the public health literature on risk factors and sociodemographic characteristics of ischemic stroke in Brazil, through analysis of epidemiological studies conducted in Brazil.

II. METHODS

This study is a systematic review, classified as exploratory and descriptive. The research was carried out in electronic databases on methods associated with RSL (Systematic Literature Review) and SMARTER (Simple Multi-Attribute Rating Technique using Exploiting Rankings) applications. The work performed is qualiquantitative. The qualitative analysis of the data is carried out intuitively and inductively during the survey of the theoretical reference. It is also quantitative by using the multicriteria method. In addition, there is also a numerical experimental study in order to simulate a selection situation of articles based on the criteria observed. From the bibliographic search, located in the databases: US Nacional Library of Medicine (Pub Med), Scientific Electronic Library on-line (SCIELO), Latin American System of Health Sciences Information (LILACS), Science Direct (Elsevier) and Embase.

The search in the databases was performed using the terminologies registered in the Health Sciences Descriptors created by the Virtual Health Library developed from the Medical Subject Headings of the U.S. National Library of Medicine, which allows the use of common terminology in Portuguese, English and Spanish. The keywords used in the Portuguese language for searching the databases were: factors, Ischemic stroke, risk sociodemographic characteristics and Brazil. As a tool to support decision making in the selection and prioritization of articles, a set of criteria were considered essential to represent the state of the art of the subject object of the research. This method has the following characteristics: (i) rigorous logic allows the acceptance of the method as a decision support tool; (ii) simple to be understood and applied with results that are easy to interpret. After all, the result obtained totaled 11 (eleven) articles that contemplated the desired characteristics for the study.

III. THEORETICAL REFERENCE

According to the Brazilian Society of Cerebrovascular Diseases, the Cerebral Vascular Accident (CVA) presents great morbidity and mortality, being the main cause of death for Brazilians. All over the world, it is a disabling disease because, due to its after-affects, approximately 70% of people do not return to work and 50% become dependent on other people on the day they leave. Although it affects individuals over 60 more frequently, stroke can occur at any age, including children. Stroke has been increasing among young people, occurring in 10% of patients under 55 years and the World Stroke Organization predicts that one in six people in the world will have a stroke during their lifetime ⁽¹⁰⁾.

According to the World Health Organization (WHO), stroke refers to the rapid development of clinical signs of focal and/or global disorders of brain function, with symptoms lasting 24 hours or more, of vascular origin, causing changes in the cognitive and sensory-motor planes, according to the area and extent of the injury. The most common sign of a stroke, which occurs more frequently in the adult phase, is sudden weakness or numbness of the face, arm and/or leg, usually on one side of the body. Other frequent signs include: mental confusion, cognitive change, difficulty speaking or understanding, swallowing, seeing with one or both eyes and walking; hearing disorders; dizziness, loss of balance and/or coordination; severe headache with no known cause; decreased or loss of consciousness. A very serious injury can cause sudden death (11).

The classifications of strokes are: anoxic-ischemic (result of vasogenic failure to adequately supply the brain tissue with oxygen and substrates) and hemorrhagic (result of blood spillage into or around the structures of the central nervous system). Ischemic subtypes are lacunar, atherosclerotic and embolic, and hemorrhagic are intraparenchymal and subarachnoid⁽¹²⁾. Since the focus of this study is the ischemic stroke, the theoretical basis follows only this classification.

Ischemic stroke is a persistent focal neurological deficit, the result of ischemia followed by infarction. This event is caused by proximal obstruction of an artery by a thrombus, plunger or tumor compression. The clinical picture appears quickly due to the absence of glucose contribution to the neurons. After a few minutes of ischemia, an infarction occurs (death of the affected brain tissue). If the ischemia is reversed before the death of the neurons, the event is called transient ischemic attack ⁽¹³⁾.

The stroke begins with a series of widespread events that occur with brain ischemia, defined as a cascade of brain ischemia. The exact timing of each event depends on many variables, such as the size of the infarction, the onset and duration of the ischemia, and reperfusion efficiency ⁽¹⁴⁾.

Acute occlusion of an intracranial vessel reduces blood flow to the brain region it supplies. The degree of reduced flow is a function of collateral blood flow, and this depends on the vascular anatomy (which can be altered by the disease), the site of occlusion, and the systemic blood pressure. A decrease in cerebral blood flow to zero causes brain tissue death in 4 to 10 minutes; values < 16 to 18 mL/100 g of tissue per minute cause infarction within 1 hour; and values < 20 mL/100 g of tissue per minute cause ischemia without infarction, except when prolonged for several hours or days ⁽¹⁵⁾.

Ischemic events start with sudden or gradual brain hypoperfusion and include bioenergetic cell failure, excitotoxicity, oxidative stress, blood-brain barrier dysfunction, microvascular injury, homeostatic activation, inflammation and eventual neuronal, glial, and endothelial cell necrosis. The hematoencephalic barrier (BHE) disruption in stroke seems to depend on the aggressiveness and reperfusion response. Within the first 24 hours after a stroke, there is an increase in BHE permeability, and the greatest damage occurs between 48-72 hours after the event ⁽¹⁴⁾.

The main risk factors for strokes are divided into three groups, being the modifiable (hypertension, smoking, diabetes mellitus), non-modifiable (age, gender, race) and the potential risk group that includes sedentariness, obesity, and alcoholism ⁽¹⁶⁾.

Most of the care of stroke patients in Brazil is performed in secondary hospitals, which often do not have adequate infrastructure for full care of this type of patient (17). As part of addressing this problem, the Ministry of Health, since April 2012, has had criteria for qualification of hospital facilities wishing to implement the Stroke Emergency Care Center (CAUAVC), under the Unified Health System (SUS), through Ordinance No. 665/2012. As a way of organizing a specialized service, with a role of reference to treat this disease and articulated between federal, state, and municipal governments, these Centers, also called Stroke Units, are classified into three types (type I, II, and III), which will depend on the size and capacity of the Hospital in which it is inserted ⁽¹⁸⁾.

The Basic Health Care Network plays an important role in health promotion and disease prevention. For this, some measures are very relevant and need to be considered, such as permanent health education, people management action, formation of multiprofessional teams through the Family Health Support Centers (NASF), training community health agents and other members of Family Health Strategies (ESF), referral to trained professionals, promotion of educational campaigns with accessible language allowing the population itself to identify groups at risk and seek assistance when necessary, and stimulation of health education for groups at risk⁽¹⁶⁾.

Prevention is the primary strategy to reduce strokerelated morbidity and mortality, adequate treatment, control of risk factors, and lifestyle changes can prevent up to 50% of stroke cases. However, there are no specific recommendations or guidelines for preventing stroke in young adults. In general, prevention strategies are similar for young and elderly patients⁽¹⁹⁾.

Epidemiological research makes it possible to sensitize, raise awareness and alert health managers and health professionals to develop appropriate strategies for preventing disease, and enable health professionals, especially those in primary care, to create actions to motivate and mobilize the population at risk to promote permanent changes in living habits, and thus reduce the mortality rate from stroke ⁽²⁰⁾.

In 2002, the Registration and Follow-up System for Hypertensive and Diabetic Patients (Registration and Monitoring System for Hypertensive and Diabetics), called Hiperdia, was implemented in Brazil, which consists of the continuous follow-up of such patients, together with the basic health units of the Unified Health System (SUS), with the supply of medications and the promotion of healthy living habits. Although it has existed for almost two decades, there are still no studies that estimate the effect of the implementation of Hypertenia at the national level on the most common complication of cerebrovascular events, which is hospitalization for stroke. The estimation of this event is the main outcome indicator that directly evaluates the effects of preventive care for this morbidity. On the other hand, the proportion of hospital deaths from strokes after medical care represents an indicator of the quality of care in preand intrahospital emergency/emergency services (21).

One of the measures usually used to compare the quality of care is hospital mortality from strokes up to 30 days, which represents its effectiveness. Care in the acute phase must be timely and effective to prevent brain tissue death. In order for the stroke care to be resolutive, it is necessary to have a minimum set of technologies available at the correct time, such as the performance of computerized tomography ideally within four and a half hours after the onset of symptoms, in addition to other supports provided, in general, by specialized units. The use of imaging exams for the care of the stroke is relevant for the differential diagnosis, definition and therapeutic prescription of appropriate care. As an indicator of quality of care, hospital mortality is a preliminary screening tool to discriminate hospitals potentially at risk of providing services of inadequate quality or below the expected standard. In this assessment, an adequate risk adjustment for clinical and demographic factors of the patient is essential, since the severity profile of the case interferes with care outcomes ⁽²²⁾.

IV. RESULTS

Eight hundred and fifty-two articles were identified in the stroke databases. From this the method *Simple Multi-Attribute Rating Technique using Exploiting Rankings* (SMARTER) was chosen. Of the 852 articles found by the combination of descriptors, 42 were selected for full text reading and only 11 articles were included for descriptive data analysis. In Figure 1, we describe the strategy for selecting articles on the subject in question.



Fig.1: A search strategy for articles on interventions for caregivers of stroke survivors

Between the years 2010 and 2016, stroke mortality rates in women aged 30 to 69 decreased by 11%. This data was verified by the study Saúde Brasil 2018, conducted by the Ministry of Health. In this same period, the stroke rate decreased from 39.5 to 35.2 deaths per 100,000 female inhabitants, while Cardiac Diseases decreased from 55 to 51.6 deaths per 100,000 $^{(23)}$.

For the calculation of these figures, the study Saúde Brasil used the populations published by the Brazilian Institute of Geography and Statistics (IBGE); and for the standardized rate, the 2010 Brazilian Census. The Strategic Action Plan for Chronic Noncommunicable Diseases (NCD) has shown a reduction in deaths from the two most deadly Chronic Noncommunicable Diseases (NCDs) in the country, which

are stroke and ischemic heart disease. This action has been developed by the Ministry of Health with states and municipalities in the population ⁽²⁴⁾.

uthor/year Population Tools reference)		Tools	Results		
Assis et al., 2013	120 patients	Analysis of medical records (database)	Epileptic state, metabolic disorders and duration of disease were associated with hospital death. Epilepticus status was an independent risk factor for mortality.		
Lamb; Martins, 201	385784 patients	Analysis of medical records (database)	higher mortality comorbidities; lower mortality with adequate hospital support		
Eisen et al. 201	15833 patients	Analysis of exams And records (database)	patients with atherosclerosis, increased risk of stroke and myocardial infarction		
Kuster et al., 2015	206 patients	Application of scales	the use of scales improves treatment and decreases the risk of mortality, especially the analysis of associated vascular damage		
Lange et al., 2018	359 patients	Examination analysis	positive correlation of atherosclerosis and stroke		
Leitão et al., 2018	150 patients	Quiz	failure to know the risk of stroke in patients with atrial fibrillation; neglect		
Pedroso et al., 2017	60 patients	Analysis of and (database)	exams positive correlation between stroke and records patients with psychiatric disorders		
Perera et al., 2016	2144 patients	Analysis of medical records (database)	higher risk of stroke in patients with atrial fibrillation (women over 75 years)		
Rocha et al., 2014	120 patients	Analysis of medical records (database)	epileptic seizures increase the risk of stroke, neoplasms and dementia		

Table 1. Des	cription of	the main stud	, findings	in the	selected	articles on stroke.
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The Plan has the propagation of Basic Care as one of the main actions to confront NCD's, since in primary care one is able to solve up to 80% of health problems. The set of actions presents a result in increased access to health services, early diagnosis and treatment, as well as health promotion actions. Although there has been a fall, the two diseases remain at the top of those that kill the most women between 30 and 69 years of age ⁽²⁴⁾.

Chronic non-communicable diseases (NCD), such as stroke and ischemic heart disease, account for 63% or about 36 million of the world's deaths, especially circulatory diseases, diabetes, cancer and chronic respiratory disease. In Brazil, NCD also presents itself as a health problem, corresponding to 54.0% of all deaths in the year 2016. In the 30-69 age group, NCD represented 56.1% of deaths.

Lifestyle and living conditions influence the occurrence of chronic non-communicable diseases. The World Health Organization (WHO) includes as important NCD the chronic respiratory diseases, circulatory system diseases (cerebrovascular, cardiovascular), diabetes mellitus and neoplasms. This disease has in common a number of risk factors, which may lead to a common approach to its prevention.

V. DISCUSSION

According to Hobbs ⁽²⁵⁾, the worldwide incidence of AF (atrial fibrillation) is 1% to 2% of the total population.

Of the patients undergoing anticoagulant therapy, only 25.9% identified stroke as a risk of not adherence to treatment with AF anticoagulant. This alarming number shows us why AF patients continue to be seen frequently in stroke units, even in the face of a well known primary risk^(26,27). The crucial role of anticoagulation and adherence to AF therapy should be as evident to patients as to physicians.

The level of information should be as clear as possible. Considering the risks of anticoagulant therapy, education of patients about the disease and its risks is improve compliance essential to and reduce complications^(28,29). There is an alarming lack of knowledge about the basic concepts of AF and stroke. Studies have shown that 62.0% of patients with previous history of strokes had no knowledge about strokes as an AF complication. The lack of knowledge cannot be fully explained by the negligence of medical assistants. However, most of them did not mention the risk of strokes, so we can assume that there was a problem in communication.

Inadequate language and lack of effort in teaching patients may be interrelated. A low socioeconomic and educational level may also have contributed to low patient understanding.

Compared to other diseases, the stroke presented the highest gross hospital mortality rate (HBM) and highest *odds ratio* (OR), consistent with the severity of the diseases described in Brazilian studies. Regarding the comorbidities indexes, the highest chance of death when the congestive heart failure score (CHF score) was equal to or higher than two indicated greater severities, similar to previous studies^(30,31).

Of the Elixhauser comorbidities, the presence of low weight (OR = 1.82) stands out, as the other comorbidities had a protective effect. However, the quality of the information affects the accuracy of this type of index. In addition, pneumonia (OR = 1.49) presented a higher risk of death, but it is not possible to determine whether it was present at admission or whether it occurred during hospitalization, i.e., it was not possible to say whether it was a comorbidity or an avoidable complication. Moreover, as expected, they present a higher risk of death in elderly who used the ICU (OR = 4,095) ⁽³²⁾. This finding may express the greater severity of the case referred to the ICU. However, aspects related to access to these beds and the care process influence the use of this resource (32). In general, studies report significant association and protective effect between ICU referrals and higher chances of survival in the adult population^(33,34).

At the hospital level, the MBT was higher in public hospitals (16.7%) than in private non-profit hospitals (11.6%) and in private for-profit hospitals (10.0%). The adjustment of this indicator decreased the TMHB only in public hospitals, highlighting the importance of risk adjustment. There is great variability in the MHAQ between hospitals, which raises the hypothesis of possible problems related to the quality of hospital care. However, we need to consider the limits of this study, especially regarding the robustness of hospital mortality as an indicator of the quality of care, mainly related to the causal validity between process and outcome and the accuracy of risk adjustment^(35,36). Separating variation because of the severity of the case, the care process and the clinical performance of professionals and the organization is an even more complex task in elderly patients, in which these elements can be more imbricated^(36,37). However, this type of approach is understood as a screening tool, i.e., a warning signal that requires subsequent analysis in order to improve the effectiveness of care and, consequently, its quality^(35,38).

In addition to the analysis of factors associated with the outcome of hospital care to elderly patients, it can be used as an indicator of the effectiveness of care ⁽³⁹⁾. Despite the limits, due to lack of information, the risk adjustment model presented reasonable discrimination capacity. Moreover, the analysis indicated that the length of hospital stay, predicted the risk of death. There was a clear improvement in comparing the predictive capacity of the models with the inclusion of length of stay. A protective effect was observed for hospitalizations longer than one day, possibly related to the seriousness of the case at the time of admission or the inadequacy of emergency care, which requires strictly timely and appropriate actions.

Another important limitation refers to the structure of hospital information system (HIS), which contained only one field for secondary diagnosis record in the period studied, in addition to underreporting, coverage and quality of available data. In this study, we observed low filling of the secondary diagnosis, that is, 13.8%. This value was lower than that described by Amaral⁽⁴⁰⁾, who found registration in 19.5% of admissions in the state of Rio de Janeiro; however, our value was higher than that found by Martins⁽³⁰⁾ (5.4%) in admissions throughout Brazil. These deficiencies, mainly related to the description of comorbidities and complications, impact the analyses performed.

The use of these indices, together with the other variables, could predict in an acceptable way the hospital death of the elderly, and could be improved in the future to monitor the quality of care provided. On the other hand, despite the contribution made, the development of new research is essential to increase knowledge about the profile of hospital interventions performed in elderly patients in Brazil and their effectiveness. We found that in Brazil the number of overweight patients with the first stroke was higher than the number with normal BMI and stroke. Most of the former had less than eight years of schooling, belonged to social class C and was significantly more physically inactive. Obesity is a worldwide pandemic⁽⁴¹⁻⁴³⁾. In 2010, the Global Burden of Disease Study reported that overweight or obesity caused 3.4 million deaths, 3.9% of life years lost, and 3.8% of disability-adjusted life years worldwide (44). According to this study, 7% of Brazilian men and 21% of women were obese in 2013 (44). As expected, these findings have an impact on stroke burden.

In a previous population study conducted in Joinville, it was found that 16% (CI95% 14-19) of 601 patients with first ischemic stroke were obese in the period 2005-2006. Six years later, (period from 2012 to 2013), the prevalence of obesity in 786 patients with ischemic stroke jumped significantly to 23% (95%CI, 20-27) ⁽³⁾. This proportion is similar to our finding of 26% (95%CI, 24-29) in this study in five Brazilian cities.

Causality between obesity and stroke is debatable^(44–46). A meta-analysis of 21 cohort studies reported that the risk of ischemic stroke was 22% in overweight patients and 64% among obese. For "primary" intracerebral hemorrhage, the risk was not significant(4⁷). However, other studies demonstrated that the association with obesity was substantially reduced after the control of hypertension and diabetes variables for obesity⁽⁴⁸⁾.

The main findings in another stroke study were high prevalence of hypertension and diabetes mellitus, some connectivity problems and problems related to the recording of PoIP (ambulatory monitoring system) signals and similar profile of cardiac arrhythmias among the study groups⁽⁴⁹⁾.

The most frequent comorbidities were hypertension (84.6%) and diabetes mellitus (51.9%), with similar distribution between the groups studied and both comorbidities are also included in the CHADS2 and CHA2DS2-VASc scores. Although these scores provide simple methods to predict an individual risk of ischemic stroke, the risk estimated by these instruments represents only part of the overall risk (statistical concordance of 0.5). A recent meta-analysis showed that smoking is associated with a modest increase in AF and that quitting reduces, but does not eliminate, the risk associated with the

disease^(50,51). However, adding smoking to the score does not improve prediction of risk of stroke or TIA⁽⁵²⁾.

The comparison between Holter and PoIP monitoring results showed a higher proportion of frequent HV and SVES detected by PoIP monitoring in the AVC / AIT and control groups, which was expected for their longer monitoring period. Studies suggested that an additional 24-hour monitoring period would increase the percentage of new paroxysmal AF diagnoses in 2-4% of stroke patients^(53,54). This confirms the efficacy of prolonged outpatient ECG in patients at risk for AF and may generate clinically significant diagnostic performance⁽⁵⁵⁾.

In this study, all AF episodes lasted less than 30 seconds. Although an AF episode ≥ 30 seconds is used as a parameter for AF diagnosis, 7 some authors have suggested that short AF episodes impact the risk of stroke / TIA or systemic thromboembolism^(56,57). An important finding was the lack of difference in the prevalence of atrial arrhythmias among patients with and without stroke or TIA, with similar risk for these conditions. This finding suggests that the atrial arrhythmias detected may be an epiphenomenon. Kottkamp⁽⁵⁸⁾ and other authors⁽⁵⁹⁾ suggested the presence of thrombogenic fibrotic atrial cardiomyopathy, with risk of embolic events without causal connections with atrial arrhythmias. Contractile alterations would be responsible for the increased thrombogenic risk during sinus rhythm, in addition to interatrial block and sinus node dysfunction. Even AF ablation would not be able to impede the progression of the fibrotic process⁽⁵⁸⁾. Factors such as diabetes, hypertension, age, among others, would be involved in myocardial damage. In this sample, more than 80% of patients had hypertension and more than 50% were diabetics. The paradigm used in most studies is that the detection of AF would be only a matter of time, but even in one year of follow-up. AF is detected in less than half of the patients with stroke. This pioneering study monitored patients at similar risk of stroke and TIA, including a stroke group and a control group without the disease. The finding that the incidence of atrial arrhythmias was not different between the two groups is consistent with the hypothesis that a different factor from arrhythmia may be involved in the risk of stroke; one possibility is fibrotic atrial cardiomyopathy.

Ischemic stroke associated with AF is common: The differences in prevalence between sites and regions are mainly due to variation in the mean ages of the stroke populations. There was a strong and significant correlation between the mean age of the stroke cohort and the frequency of AF between sites. Compared to other regions,

Latin America had the lowest frequency of AF-related strokes; this probably reflects the lower mean age of the stroke population in Latin America, which was on average a decade lower than the stroke population in other regions. The assigned risk of AF for ischemic stroke in a given population is expected to be influenced by the life expectancy of the population⁽⁶⁰⁾, and this may partially explain the regional variations in the frequency of AF between high- and high-income countries in this study. This regional variability can also be partially explained by the variability in access to diagnostic tests in each center; at least hypothetically, we can assume that access to prolonged monitoring for AF is easier in high-income regions.

Recent studies published since the record show that prolonged heart rate monitoring (> 1 month) identifies additional patients with strokes that present episodes of paroxysmal AF, (61,62) that are generally brief and have uncertain pathogen relevance⁽⁶³⁾. The increase in frequency of AF-associated strokes compared to other ischemic strokes occurred despite the more widespread use of oral anticoagulants in AF patients⁽⁶⁰⁾. More than half of the strokes related to AF occurred in patients with known history of AF. Although no data on antithrombotic or anticoagulant therapy are available, this finding emphasizes the importance of optimizing stroke prevention in patients with known AF. It should be recognized that precise subtyping of stroke may not be possible in all cases, even with advanced neuroimaging and vascular imaging techniques, and that some lacunar strokes may have cardioembolic or atheroembolic sources. However, previously published data on treatment with anticoagulation in AF patients with lacunar strokes show no benefit in the use of anticoagulants when compared to treatment with antiplatelet in reducing the risk of recurrent stroke(64,65).

In a study cohort, mortality at 30 days was significantly higher in AF patients compared to nonAF patients in global regions. The findings are consistent and according to the largest randomized trials, and show a significant correlation between the mean age of stroke patients and the frequency of AF, which is statistically significant and according to several recent observational data^(60,66,67). However, the study sites represented many global regions, allowing a unique comparison of AF-associated strokes around the world.

In summary, these studies provide a unique insight into the global burden of FA-related stroke. Stroke associated with AF comprises an important subset (28%; 95% CI, 25.6-29.5) of ischemic stroke patients worldwide and is the most frequent cause of ischemic stroke in older women. These traits are potentially preventable.

The analysis of the socio-demographic characteristics of the sample allows the profile of the patients attended by a public hospital, considered the local reference center for the treatment of stroke. Thus, it was observed that the sample consisted of elderly patients, predominantly unemployed, with low income and low education and socially vulnerable. The patients presented high rates of clinical comorbidities, mainly hypertension, obesity, dyslipidemia, diabetes and smoking.

A similar profile of medical comorbidity was found in a previous study, conducted at the same hospital, which investigated the role of Chagas' disease as an independent risk factor for the occurrence of stroke⁽⁶⁸⁾. Observations of mean BMI values above 25 kg / m2 and high mean blood pressure values, despite the use of drugs, draw attention to the unsatisfactory clinical management of patients before admission. Framingham's score for the sample was calculated from the clinical variables recorded. This score was developed based on information collected from population epidemiological studies conducted over 36 years and estimates the probability of stroke from clinical information⁽⁶⁹⁾. The mean score observed was 21.27. This value indicates that the probability of stroke in 10 years is higher than 30% for men and 14% for women, and this value confirms the high risk profile for the development of stroke in this sample⁽⁷⁰⁾.

Most of the individuals observed had lacunar strokes, with predominance of lesions in the middle cerebral artery topography of the right hemisphere. NIHSS, mRS and MIF Scales were used to measure the initial severity of the ischemic event and its resulting disability. Mean results were below 5 for NIHSS and below 3 for mRS, indicating a slight stroke impact on the sample. This fact is reflected in the measurement of patient dysfunction obtained by MIF, a scale ranging from 18 (worst result) to 126 (best result) points. The mean value, 113.67, found in the sample was compatible with a mild functional deficit⁽⁷¹⁾.

Despite the slight functional impact, the evaluation through structured psychiatric interview revealed the presence of mental disorders, mainly depressive and anxiety disorders, in approximately 55% of the cases. According to other studies, depression was the most frequent psychiatric disorder^(72,73). Chemerinski and Robinson⁽⁷⁴⁾ observed that the frequency of depression among patients hospitalized during the acute phase of the stroke is approximately 22% for major depression and 17% for minor depression. In outpatient samples (ranging from 3 months to 10 years after the stroke), the frequency is approximately 23% for major depression and 35% for minor depression, while community samples exhibit mean prevalence of 13% and 10%, respectively.

Through meta-analysis the prevalence of depression at any time after the stroke was 29%. In this sense, a systematic review of Brazilian studies that evaluated the prevalence of depression after stroke in different contexts found prevalence rates ranging from 20 to 59% ⁽⁷⁵⁾. Anxiety disorders are also common after stroke. Between 25% and 50% of patients develop generalized anxiety disorder (TAG) in the first months after the stroke, with a small reduction in incidence in the following three years⁽⁷⁶⁾. Burton⁽⁷⁷⁾ reported that anxiety disorders affected 20% to 25% of patients at any time after the stroke. According to Burton⁽⁷⁷⁾, phobic disorders and TAG are the most common types of anxiety disorders after a stroke.

Considering that mental disorders negatively influence the recovery of patients after strokes and that factors associated with social vulnerability are risk factors that complicate treatment, the high frequency of depression and anxiety disorders draws attention to possible consequences that may result if patients are not identified and adequately treated, even when the functional impact of the stroke in patients is mild^(78,79). The relationship between depression after stroke and functional impairment is complex. Depressed patients have a significantly greater disability in daily life activities than eutymic individuals with equivalent neurological diseases⁽⁷⁴⁾.

VI. CONCLUSION

It is now known that stroke is one of the major causes of morbidity and mortality among patients, most of them in the elderly. It is associated with NCD, among which we mention hypertension, diabetes and dyslipidemia. This disease is more common in men, blacks and with low schooling, but in women it is more lethal, according to pre-existing data.

In Brazil, the evaluation of hospital care by means of administrative data and risk adjusted performance indicators is a little developed subject. There is also a lack of studies specifically on hospital care for the elderly.

The survey showed that the population between 30 and 69 years of age and over 70 years of age, ischemic heart disease presented the highest mortality rates in all regions of the country, both in women and men. Stroke, on the other hand, occupied the second place of the main causes of deaths among women from all regions and men from the South and Southeast, aged between 30 to 69 years.

Our data brings to light important information, from causes, motor and emotional after-effects, and the lack of information on quality of care data (both clinical and diagnostic) and hospitalization of these patients with stroke. This shows the importance of this systematic review, and of new studies that can elucidate and bring more data about this gap within the stroke studies.

Thus, new methodologies and analyses need to be developed on the effects of the multiplicity of chronic diseases, which affect the elderly more intensely. Considering this context, this work contributes to the Brazilian production, since it has analyzed the studies that deal with strokes in Brazil, gathering the available information.

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Evaluation of the Current Situation of Agricultural Production and Study on Technology Orientations in Agriculture for the North-Central Region-Vietnam in the Climate Change Background

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Abstract— The North Central Coast (NCC) is one of seven economic regions with a master plan for socioeconomic development. North Central region, Vietnam is one of seven economic regions assigned by the Government of Vietnam to make a master plan for socio-economic. Due to the geographical feature of the territory stretching, narrow and wide, sandwiched between the East Sea and the Truong Son Range, the protected area is greatly affected strongly by climate change. Extreme weather conditions (droughts, floods, etc.) occur in a short time, leading to the production of agricultural strengths of the region such as food crops (rice, maize, cassava) and cattle herds (buffaloes, cows) and industrial crops (sugarcane, tea, rubber, pepper) all fell sharply. Moreover, the application of technology to agricultural production in the region is generally not commensurate with the potential. Facing the new context of climate change and its consequences, the application of high technology of agriculture is more complicated, requiring us to choose the appropriate technology orientation. Therefore, the evaluation of the status of agricultural production and the study of priority technology orientations in agriculture in the northern central region in the context of climate change are meaningful and practical for managers in local. Research in the North Central Coast region is also an initial proposal, promising to be a premise for application of research in other localities across the country.

Keywords—North Central region, agricultural production, science and technology.

I. INTRODUCTION

The global community has shown great interest in technology orientations in the context of climate change with typical international studies such as John Smithers et al. (2001) who studied technology innovation as a strategy for climate adaptation in agriculture. Travis Lybbert and Daniel Sumner (2010) conducted technology research in climate

change agriculture and their application in developing countries including policy options for creativity and diffusion technology. Rebecca Clements et al. (2011) have studied technology for climate change adaptation such as the agricultural part, similar to the author T.A. Crane et al. (2011) have studied on the importance of understanding agricultural performance. In Vietnam, there have been several studies focusing on climate change issues in agriculture, such as: Tran Thi Minh Ha, (2011) have studied on climate change and international support for coping in the field of natural resources and environment. Some of conference in Vietnam that focus on the global climate change of Vietnam's solutions such as the second conference on global climate change of Vietnam's solutions, the draft national strategy on climate change of the Prime Minister (2011), the second seminar on global climate change adaptation solutions of Vietnam , Bui Thi Phuong Loan, (2015). The conference topic on study and develop technical process of cultivating and protecting land for major crops in the plains under the influence of climate change.

However, until now there are still not have much research on the goal of technology orientation in the field of agriculture in the North Central, Vietnam one of the agricultural countries on the world spescially for the situation of climate change. Therefore, the research on the the priority technology orientations in agriculture in the North Central region, Vietnam in the situation of climate change that could be desired to contribute to making policy recommendations that the Government and regional management agencies. can be applied to change the orientation of technology development in resluting promote regional agriculture, and ensure adaptation to climate change.

II. RESEARCH METHOD

2.1. Research area

The North Central Region, Vietnam is one of eight socioeconomic regions of Vietnam including 6 provinces: Thanh Hoa, Nghe An, Ha Tinh, Quang Binh, Quang Tri and Thua Thien Hue with a natural area of over 50,000 km². The population of about 10 million people, nearly 6 million people of working age, is considered as a region in Vietnam with a rich potential economy.

2.2. Research method

In this work, a multi-dimensional approach was used, combining sociological surveys, field surveys with analysis, synthesizing documents, between local analysis and interregional analysis. In particular, the study uses two approaches: (1) systematic, inter-regional and inter-sectoral approach; (2) participatory approach. For the research methods, the method of document analysis are used to review the previous research situation related to our research as well as build a theoretical basis related to climate change and green growth for sustainable development.

III. RESULTS AND DISCUSSION

3.1. Rationale for prioritizing technology orientation and agricultural production in the situation of climate change.

Technological orientation is defined as theories and management theory that promote the development of goods or services based on the technological potential of an individual or a collective instead of on demand. Almost every groundbreaking innovation is based on appropriate technology orientation. Most of the research to identify technology orientations, identify priority technology directions, select appropriate technologies, exploit technologies, develop technologies, apply technologies, etc. are issues that are of great interest to strategic planners, researchers, managers at all levels from national macro to regional, local, and even within an organization. At the national level, the results of researches show that countries always make a national technology strategy suitable for each stage of development such as Korea, China with the strategy of importing, adapting, imitating and mastering technology first. This is until the current technology creation strategy. In the process of developing technology strategies, the appropriateness of technology with the conditions of population, natural resources, economy, technology level, habitat, culture, and social development, politics, law, international relations always much consider and attention. In general, it could be understood that technology must be appropriate to the context of technology application.

Previous studies have proposed a number of appropriate technology-oriented grounds that we can refer to [1]:

Technology orientation according to the level of technology

In this direction, it is assumed that a wide range of technologies is available, we can select the appropriate technology according to usage needs. Technologies range from primitive or manual to advanced as well modern. This type of technology has an intermediate level between primitive technology and advanced technology.

Technology orientation based on target groups

The technology development target is the basis for selection. These target groups are arranged in order of priority, which is the basis for selecting the appropriate technology in each stage. The target group includes: (1) satisfying the smallest needs, creating jobs and enhancing living standards simultaneously; (2) increase production efficiency and competitiveness and (3) technology independence and self-reliance.

Technology orientation based on limited resources

Resources are understood the total geographical location, natural resources, the national property system, human resources, policy lines, capital and markets ... both at local and abroad can be exploited for the economic development of a territory. Resources are not immutable. It changes with time and space.

Technology orientation according to harmony

The orientation towards harmony is the desire to have technological progress through development, not revolution, which means there must be a harmony between use, adaptation, improvement, and innovation. This development needs to be sequential, no force, no pollution, no ecological imbalance, natural harmony; know how to combine domestic and imported technologies, create a fast and sustainable development, do not conflict between the country and the locality, and harmonize traditional and modern technologies, etc.

3.2. Current situation of agricultural production and technology application in agricultural production in the North Central region, Vietnam.

Regarding to analyzing the previous works, we have studied and focused on that the natural conditions as well as the socio-economic status of the coastal zone, the specific analysis of the current status of crop production in the period 2010-2015. The situation of technology application with advantages and disadvantages have been analyzed in this part.

In the 5-year period from 2010 to 2015, agricultural production in the Central Coast region, Vietnam has to face many difficulties and challenges, especially climate change causing many extreme and unusual weather phenomena. Typically, the Central Coast suffered two extremely unusual natural disasters in 2010 such as a drought lasting from June to July caused a loss of 30,000 hectares of summer-autumn rice crop and 2 strong floods next month in October, 2010 that devastated and caused heavy damage to many provinces in the region. We have found that droughts, hot weather, severe cold, damaging cold, heavy rain, tropical storms as

well as warm winters, heavy rain and floods have a great impact on agricultural production as well as the lives of people in the coastal areas. The export market for agricultural products faces many difficulties due to the demand and prices for key agricultural export products of the region have decreased. In addition, epidemics on crops and animals still occur in some places, high prices of inputs, fertilizers ... have a strong effect on activity and implementation of agricultural production plans.

In the period 2010 - 2015 under the direction of the Party Central Committee and the Government, the Central Coast region- Vietnam has implemented many guidelines and policies to arrange suitable production structure, labor between regions, ensuring food improving and enhancing people's lives, restructuring crops towards industrialization, modernization however, these solutions need to be forward to protection of ecological environment, while coping with climate change is increasing and affecting daily a strong up climate region. [3-5]

3.2.1 Current situation of agricultural production and technology application in agricultural production in the North Central region

By analyzing the available documents with the arguments from these data, we have shown: firstly, the natural conditions as well as the socio-economic status of the coastal zone; The second is the specific analysis on the current status of crop production in the period 2010-2015; On that basis, thirdly, I present the situation of technology application, both done and not done in the locality, from which shortcomings and basic solutions are drawn.

In the 5-year period from 2010 to 2015, agricultural production in the Central Highlands has to face with many difficulties and challenges, especially climate change causing many extreme and unusual weather phenomena. Typically in 2010, the Central Coast suffered two extremely unusual natural disasters: a drought lasting from June to July caused a loss of 30,000 hectares of summer-autumn rice crop and 2 strong floods. next month in October devastated and caused heavy damage to many provinces in the region. [4-5]


Fig.1: Rice production in 6 provinces in the North Central region in the period 2010-2015 (Source: GSO)

Figure 1 shows that rice production in the 6 provinces in the Central Coast region, Vietnam in 2010, 2013 and 2015 decreased more than in the remaining years. The results also show that the rice output of Thanh Hoa and Nghe An provinces is much higher than the other four remain provinces, however this change is mainly based on the large area of cultivated land in the two provinces (Thanh Hoa and Nghe An provinces).



Fig.2: Sugarcane production in Thanh Hoa and Nghe An in the period 2010-2015

(Source: compiled from statistical yearbook)

Vietnam Sugar Institute, 2016 has shown that during this period from 2010-2015, although the Nghe An's sugarcane area was heavily affected by grass buds, resulting in thousands of hectares of sugarcane suffered from serious diseases to be destroyed, but due to the development of new planting areas, the area basically remained at a stable level. In Thanh Hoa, according to the report on sugar cane production in the 2010-2015 period of the Department of Agriculture and Rural Development of Thanh Hoa Province, the province has currently the largest sugarcane production area and output in the country (the area is equal to 11.3%) and the output is 10.4% of the whole country) [4-5]. The sugar cane manufacturing industry in the period 2010 - 2015 has faced many difficulties and challenges due to some issue such as: (i) abnormal weather conditions changed completely; (ii) sugar prices decrease continuously; (iii) the sugarcane acreage, productivity and output are not stable and the sugarcane production efficiency of farmers and the sugar production efficiency of the factories have not been significantly improved. On the other hand, when Vietnam officially joins the ASEAN Free Trade Area (AFTA), the advantages and disadvantage of the sugar industry are increasingly evident, affecting the stability and development of the industry [5].

3.3. Orientation of priority technologies in agricultural production in the North Central region in the context of climate change.

3.3.1 Biotechnology

The proposed priority technology orientation for the Central Coast region, Vietnam in the situation of climate change is biotechnology. Biotechnology plays an important role in the development of the agricultural sector. Under the accelerating impact of climate change, experiences from agricultural countries show that a priority direction for the biotechnology sector is necessary. Agricultural biotechnology has only been in use since 1990, but by 2003 only 7 million farmers used biotech products (statistics from 18 developed countries) [5], and that number is even higher that folow on increase exponentially every year.

3.3.2 Automation Technology

Automation, or automatic control, is the use of multiple control systems for equipment that acts as machines, processors, circuit boards; steering and stability of autonomous machines and other applications with minimal or reduced human intervention. The biggest benefit of automation is that it saves labor, however, it is also used to save energy and materials as well as improve quality with high precision. Automation has been done by various means including mechanical, hydraulic, pneumatic, electrical, electronic and computer, often combined. Complex systems, such as modern factories, aircraft and ships, often use all sorts of techniques. Or in the agricultural field, automation is applied to cultivating and gathering machines; automatic irrigation, spraying and fertilizing systems; systems for water sensing, disease screening and calculating appropriate measures; Postharvest selective systems ...[5]

3.3.3. Information Technology

Information Technology (IT) is an engineering branch that uses computers and computer software to convert, store, protect, process, transmit, and collect. information. In Vietnam, the concept of IT is understood and defined in the Government resolution 49/CP signed on August 4, 1993: "IT is a collection of scientific methods, modern technical facilities and tools - mainly computer engineering and telecommunications - to organize the effective exploitation and use of rich and potential information resources in all fields of human and social activities "[5].



Fig.3: Application of GPS technology in agricultural production

3.3.4. Green home technology

Hi-tech greenhouses is a type of green house that applies modern and advanced CNCs and technologies on related technology fields to create an ecological environment as desired, a the most favorable ecological environment possible for plants to grow and develop; to implement highly intensive farming technologies; to minimize even the possible elimination of adverse external factors outside production; to produce agricultural products and foodstuffs that are not favored by nature (off-season), or even cannot be produced in natural environment (such as production of mushrooms in the desert); to maximize product quality productivity and production efficiency; to minimize production costs and especially to save water.

IV. CONCLUSION

In conclusion, we have achieved the general goal for research to provide orientations priority technologies within the agricultural sector focus mainly on the crop sector in the North Central region in the context of climate change. The evaluation of the status of agricultural production and the study of priority technology orientations in agriculture in the northern central region in the context of climate change are meaningful and practical for managers in local. Research in the North Central Coast region is also an initial proposal, promising to be a premise for application of research in other localities across the country.

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Review on the therapeutic activities of the Genus *Pouteria*

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Abstract— The genus Pouteria, of the Sapotaceae family, is composed of plants that have representatives with great potential to be used in herbal formulations in order to combat pathogens and treat diseases that affect human health. Triterpenes and flavonoids are the most common constituents found in this genus. Despite the various uses of these plants in folk medicine to treat fever, inflammation, skin rashes, ulcers, diabetes, diarrhea, nausea, vomiting, pain and promoting lactation. Few scientific studies proving their safety and therapeutic effectiveness. Studies found in the literature make references that the species of the genus Pouteria presents promising results as immunomodulator, antidiabetic, antioxidant, neuroprotective, hepatoprotective and antimicrobial among other actions. This genus can be better investigated for use in herbal formulations that aim to combat or treat numerous diseases, including some like cancer and diabetes that still has no cure. In view of this and in view of the increasingly frequent search for natural substances that have effective therapeutic activities, this review highlights the great biotechnological potential, as well as the main therapeutic applications of species of this genus found in the literature and to stimulate new studies on the use of these plants in the treatment and even prevention of various diseases. For this, a survey was carried out on the topic in the main sources of scientific research in the period from 2010 to 2020, leading us to conclude that this genus can be a potent ally in the search for new phytotherapy drugs of great benefit to human health.

Keywords— Fitoterapy, Pouteria, plants, Sapotaceae, treatment.

I. INTRODUCTION

Since antiquity, medicinal plants and their derivatives, such as essential oils, have been used to treat various diseases. In the last decades, the search for alternative therapies has been gaining strength and studies have been done to prove its effectiveness. Brazil has the largest diversified forest reserve on the planet. Many species are used for medicinal purposes and used with little or no evidence of their pharmacological properties. Medicinal plants are an important component of health care for the majority of the world's population: they constitute the main medical care for 70% to 95% of citizens in most developing countries and are increasingly used by a large number of people who reside in wealthier countries [1].

The interest in the discovery of new substances makes scientists from various areas search, in the Brazilian Flora, plant species with medicinal properties used by the population [2]. In Brazil, the Ministry of Health has sought to encourage the insertion of medicinal plants in the health system, through national policies [3]. There is worldwide interest in studying the use of different medicinal plants, from different regions, for the treatment of diseases.

Sapotaceae is a family of plants that can be found worldwide, distributed mainly in tropical and subtropical

regions, with great representation in the Amazon region and the Atlantic Forest [4,5,6]. According to Flora do Brazil 2020, 13 genus, 243 species and 26 subspecies distributed throughout Brazil have now been described, including 106 species and 02 endemic subspecies [7].

This family is made up of shrubs or trees and has alternating leaves, with little or no verticillation or opposite, simple, usually without stipules and the entire margin in general. Its inflorescence is jerky, usually in panicles or reduced to axillary fascicles. Its flowers, little showy, are unisex or bisexual and their fruits are berry type [8].

Many plants in the Sapotaceae family produce edible fruits [9]. Also, it has great relevance in the timber industry due to the properties of its wood - maçaranduba, representing a great economic value [10].

The genus *Pouteria* Aublet is the largest botanical genus belonging to the Sapotaceae family, which includes about 127 species and 8 subspecies [11]. Most species occur in South America, mainly in low-lying and humid forest regions [12]. Plants of this genus have representatives with great potential to be used in herbal formulations to combat pathogens and treat numerous diseases. Triterpenes and flavonoids are the most common constituents found in this genus. Long-chain hydrocarbons, alcohols, acids and esters are also found mainly in species that occur in dry regions, for example, Savanna. The immunomodulatory and antimicrobial actions of some species have been investigated and proven [9,13].

Despite the diverse uses of plants of this genus in folk medicine to treat fever, inflammation, skin rashes, ulcers, diabetes, diarrhea, nausea, vomiting, back pain and to promote lactation. There is little scientific evidence for most of these biological activities [9]. So more studies are needed to prove and discover their actions. The purpose of this review is to gather data on *Pouteria* species, their main therapeutic applications and to stimulate further studies on this genus in the treatment of various diseases.

II. METHODOLOGY

A survey was carried out on the theme between the years 2010 and 2020, in that period the largest number of publications on the theme were found. The main sources of scientific research were used, using the descriptors consulted in the DECs (Health Science Descriptors): Sapotaceae family; genus*Pouteria*; therapy and disease, as well as its synonyms and correspondents in Portuguese: Família Sapotaceae; gênero *Pouteria*; tratamento and doença. The main sources of research used were: PubMed, Scielo, Thieme, EBSCO Host, Journals Capes and Flora do Brasil-JBRJ (Table 1).

The analysis of the articles was carried out in three stages. The first stage was carried out by reading the title of the articles, where only those with terms related to the Sapotaceae family orgenus*Pouteria* were selected. Then, we moved on to the second stage, in which the Summary or Abstrate of the articles included in the first phase was read, among which were chosen those that mentioned some type of effective treatment for diseases using plants of the genus*Pouteria*. Finally, in the third and last stage, the full text of the articles selected in the second stage was evaluated, to elect articles that discussed the use and importance of *Pouteria* species used in the treatment of diseases and in the fight against pathogens that cause of diseases in humans.

Articles that mentioned only the empirical use of plants were excluded, in addition to studies carried out before 2010. It should also be noted that articles repeated in the databases and articles with incomplete research information were eliminated. The study ended with 32 articles, of which 20 were used in the result, as they evaluate the therapeutic activities of the genus*Pouteria* and 12 were used to compose the introduction and/or discussion.

Database	Total articles	Excluded after read- ing the abstract	Read in full	Selected
PUBMED	26	10	16	16
THIEME	3	1	2	2
EBSCO Host	2	2	0	0
SCIELO	11	2	9	9
CAPES JOURNALS	4	4	0	0
FLORA DO BRASIL- JBRJ	5	0	5	5

Table. 1: Result of the survey carried out on the topic in the main research sources

Total	51	19	32	32

Databases used to search for articles: Pubmed, Thieme, EBSCO Host, Scielo, Capes Journals and Flora of Brazil

III. RESULT AND DISCUSSION

Plants of the genus *Pouteria*, have representatives with great potential to be used in herbal formulations to combat pathogens and treat numerous diseases. Table 2 lists the authors' names in alphabetical order, the articles published from 2010 to 2020 in Brazil and worldwide, highlighting the species of the genus *Pouteria* that were studied, the part of the plant used, as well as the form used in the tests, the therapeutic activity found and the constituents that may be responsible for this activity, totaling 20 articles. It is important to note that of these, 11 articles were carried out in Brazil, reaffirming the interest of Brazilian researchers in medicinal plants and their derivatives for the treatment and prevention of numerous diseases, and 9 articles were carried out in other countries of the world.

Species	Annlightie-	Uaad	Eoren ugod	Constituert	Authone	Veen
Species	Application	Usea	r orm used	Constituent	Autnors	x ear/
		part		of the plant		Country
Pouteria ramiflo-	α-glucosidase,	leaf, stem,	hexane etha-	flavonoids,	Souza et	
ra (Mart.)	α-amylase re-	bark, fruit	nolic extracts	tannins	al.	2012
Radlk., Pouteria	duction					
torta (Mart.)						Brazil
Radlk., Pouteria						
caimito (Ruiz &						
Pav.) Radlk.						
Pouteria rami-	α-amylase re-	leaf, bark,	aqueous eth-	phenolic	Golveia	2013
flora (Mart.)	duction,	root	anolic hex-	compounds	et al.	Brazil
Radlk.	blood glucose		ane extracts	tannins,		
	6			triterpenes		
Pouteria ramiflo-	neuroprotective	leaves	ethanolic ex-	flavonoids	Da Costa	2013
ra (Mart.) Radlk.	-		tract		et al.	
						Brazil
Pouteria ramiflo-	antifungal	leaves	aqueous,	flavonoids,	Correia	
ra (Mart.)			ethanolic	catechin	et al.	2016
Radlk., Pouteria			extracts			
torta (Mart.)			extracts			Brazil
Radlk.						
Pouteria ramiflo-	α-amylase re-	leaves	hexane ex-	friedelina,	Rodrigues	2017
ra (Mart.) Radlk	duction		tract,	epi-	et al.	Brazil
			fraction -	friedelanol,		
			hexane: ethyl	taraxerol		
			acetate (Ac-			
			OEt)			
Pouteria ramiflo-	antitumor, an-	leaves	hydroal-	flavonoids	Tuttis et	2018
ra (Mart.) Radlk.	timutagenic		coholic		al.	Brazil
			conone			Diazii
			extract			

Table. 2: Survey of studies on the main therapeutic applications of the genus Pouteria

<i>Pouteria torta</i> (Mart.) Radlk.	anticancer	leaf	hexane etha- nolicaqueous extracts	 α-amyrin ace- tate, β-amyrin acetate, betu- linic acid, ur- solic acid, mixture of α- and β- friedelinol 	Elias et al.	2013 Brazil
<i>Pouteria torta</i> (Mart.) Radlk.	mutagenic	leaf	hydroeth- anolic extract	flavonoids	Costa et al.	2014 Prozil
Pouteria torta (Mart.) Radlk.	α-amylase in- hibitor, antioxidant	epicarp	aqueous extract	phenolic com- poundsflavo- noids	De Sales et al.	2017 Brazil
<i>Pouteria lucuma</i> (Ruiz & Pav.) Kuntze	anti- inflamma- tory, healing	fruit	walnut oil	linoleic acid, palmitic acid, stearic acid	Rojo et al.	2010 Chile
<i>Pouteria lucuma</i> (Ruiz & Pav.) Kuntze	antioxidant, antihypergly- cemic	fruit	fractions hy- drophilic, lipophilic	carotenoid, flavonoids, triterpenes	Fuent- ealba et al.	2015 Chile
Pouteria lucuma (Ruiz & Pav.) Kuntze	antioxidant, gas- troprotective	seed	methanolic extract	amino acids, organic acids, nucleosides, phenolic acids, tannins, flavo- noids, triterpe- noids	Guerrero- castilho et al.	2019 Chile
Pouteria sapota (Jacq.) H.E. Moore & Stearn	improves postprandial absorption	bark, seed	a mixture of methyl tert- butyl ether and methano- lextracts	carotenoids carotenoid es- ters	Chacón- Ordóñez et al.	2017 Germany
Pouteria sapota (Jacq.) H.E. Moore & Stearn	anticancer	leaf	aqueous ex- tract	polyphenols	Prabhu et al.	2018 India
Pouteria sapota (Jacq.) H.E. Moore & Stearn	antidiabetic	leaf	aqueous ex- tract, nano silver particle	polyphenols	Prabhu et al.	2018 India
Pouteria campe- chiana (Kunth) Baehni	hepatoprotec- tive, antioxi- dant	fruit	aqueous ex- tract	phenolic com- poundsflavo-	Aseervat ham et al.	2013

				noids		India
Pouteria campe-	antinocicep-	leaf	ethanolic ex-	Not	Déciga-	2016
chiana (Kunth)	tive, anti hy-		tract	mentioned	campos	Mexico
Baehni	peralgesic				et al	
Pouteria mam-	acute oral tox-	seed	aqueous hy-	coumarins,	Dutok et al	2015
mosa (L.)	icity, eye irri-		droalcoholic	saponins, phe-		
Cronquist	tability		extracts	nols, tannins		Cuba
Pouteria macro-	antioxidant	fruit	aqueous ex-	polyphenolic	Gordon et	2011
phylla (Lam.)			tract	compounds	al.	
Eyma						Brazil
Poutéria venosa	antimicrobial,	leaf, stem	ethanolic ex-	Not men-	Santos et	2015
(Mart.) Baehni	cytotoxic	bark	tract	tioned	al.	Brazil

Articles published from 2005 to 2020 in Brazil and the world, standing out as a species of the genus*Pouteria* that were studied, the part of the plant used, as well as the form used, the therapeutic application found, and the constituents that may be responsible for this activity.

In this review (20) articles were found that investigated the therapeutic activities of 09 species of the genus*Pouteria*. When we analyzed the form of preparation used in the tests, we saw that (16) articles used the crude extract (leaf, bark, stem, root, fruit, seed, epicarp, and/or seed), (01) article used walnut oil, (01) article used hydrophilic, lipophilic fractions and (02) article used crude extract and fractions (green synthesis of silver nanoparticles (AgNPs) and hexane fractions: ethyl acetate (AcOEt). The

species and the number, in addition, it is possible to see in Figure 1. The species that presented more studies, with emphasis on the *Pouteria ramiflora* (Mart.) Radlk. species with (06) studies, *Pouteria torta* (Mart.) Radlk., with (05) studies and *Pouteria lucuma* (Ruiz & Pav.) Kuntze and *Pouteria sapota* (Jacq.) HE Moore & Stearn, each presenting (03) studies.



Fig. 1: Number of articles by Pouteria species

Phytochemical analysis of some *Pouteria* species revealed the presence of compounds such as flavonoids that were linked to antitumor, antimutagenic and neuroprotective action. Polyphenols related to anticancer, antidiabetic and antioxidant activity were also found. These findings often provide a scientific basis and prove the uses of these species in traditional medicine. Table 3 highlights the popular name of the species of the genus*Pouteria* found in this review, as well as their use in traditional medicine.

Species	Popular name	Traditional use
Pouteria ramiflora (Mart.) Radlk.	curriola (curiola) do Cerrado, abiu piloso	antihyperlipidemic verminous, antifungal,
		antioxidant, dysentery, pain, in- flammation
Pouteria torta (Mart.) Radlk.	abiurana-curriola-liso, pateiro, guapeva, abiu do Cerrado	antidiarrheal, antimicrobial, anti- fungal
Pouteria caimito (Ruiz & Pav.) Radlk.	abiu, abiurana, caimito, red abiu- rana	antimicrobial, antimalarial, anti- oxidant, photoprotective, dysen- tery, pain, inflammation
Pouteria lucuma (Ruiz & Pav.) Kuntze	lucuma	anticancer, immunostimulant, an- ti-inflammatory, lowers blood pressure
<i>Pouteria campechiana</i> (Kunth) Baehni	yellow sapota	antinociceptive, anti-hyperalgesic
Pouteria sapota (Jacq.) H.E. Moore & Stearn	mamay	seborrheic, anthelmintic, digestive, dermatitis
Pouteria mammosa (L.) Cronquist	zapote ou mamey	fever, inflammation, rashes, ul- cers, nausea, vomiting, diabetes
Pouteria macrophylla (Lam.) Eyma	cutite	anti-inflammatory
Poutéria venosa (Mart.) Baehni	tuturubá, leiteiro, bapeba, black sapota	antimicrobial

Table. 3: Popular name and use in the traditional medicine of Pouteria species mentioned in this review.

Popular name and use in the traditional medicine of the species of the genus Pouteria.

We report below the main therapeutic actions found for each species:

Pouteria ramiflora (Mart.) Radlk, a species that occurs in the Brazilian Cerrado, has been studied due to its possible ability to inhibit the digestion of carbohydrates in rats with diabetes. Diabetes in animals was induced by streptozotocin and when treated with *Pouteria ramiflora* (Mart.) Radlk alcoholic extract showed an improved glycemic level, increased activity of glutathione peroxidase, decreased activity of superoxide dismutase, and reduction of lipid peroxidation. The extract of this plant exerted a neuroprotective effect against oxidative damage and myosin-Va expression and was shown to prevent neuronal loss of the hippocampus in the subfields CA3 and Hilo of diabetic rats [14].

Another study using the same species, *Pouteria ramiflora* (Mart.) Radlk revealed that the hydroalcoholic extract of the leaves of this plant presents flavonoids (my-ricetin-3-O- β -D-galactopyranoside and myricetin-3-O- α -L-ramnopyrananoside). Such extract revealed cytotoxic action in human hepatocarcinoma (HepG2) and non-tumor

primary gastric cells and also antimutagenic action, observing a significant decrease in DNA damage [15].

Rodrigues and collaborators (2017), showed that the F1 - 1/4 hexane and F2 - 1/4 hexane fractions: ethyl acetate from the crude Pouteria ramiflora (Mart.) Radlk extract showed pronounced inhibitory activities of aamylase and the ethyl acetate fraction was the most active, with 1 mg of this fraction having an antioxidant potential, in vitro, equivalent to about 150 mg of ascorbic acid. The results found show that the species in question is promising for the control of diabetes mellitus since one of the forms of treatment for the disease is through the use of amylase inhibitors [13]. The search for new therapies for the treatment and cure of diabetes *mellitus* is necessary, as this disease is one of the most common metabolic disorders, with numerous disabling secondary complications [14]. Studies show that inhibition of α -amylase activity can reduce postprandial blood glucose levels and obesity [16].

Correia and collaborators (2016), evaluated the *in vitro* antifungal activity of six species of medicinal plants

from the Brazilian Cerrado against clinically relevant *Candida* species. Among the plant species studied were *Pouteria ramiflora* (Mart.) Radlk and *Pouteria torta* (Mart.) Radlk. which showed significant inhibitory activity against *C. Tropicalis, C. krusei, C. guilliermondii* and *C. parapsilosis*. The chemical study of *Pouteria ramiflora* (Mart.) Radlk extracts revealed the presence of polyphenols (catechins and flavonoids) as main components, this is an important chemical class with antifungal activity. Considering the growing number of infections by *Candida albicans* and non-*albicans* [17], the importance of this work becomes even clearer. These results can contribute to the frequent search for new natural products with antifungal activity.

One approach to the treatment of diabetes mellitus is by inhibiting the activities of α -amylase and α glucosidase to reduce postprandial blood glucose levels and obesity. Inhibitors of these enzymes reduce postprandial hyperglycemia by slowing carbohydrate digestion and decreasing intestinal glucose absorption [16,18]. An in vitro study using aqueous extract of Pouteria ramiflora (Mart.) Radlk, Pouteria torta (Mart.) Radlk. and Pouteria caimito (Ruiz & Pav.) Radlk. showed that these extracts showed inhibitory activities about α-amylase (IC50 13.6, 7.08 and 5.67 μ g/mL, respectively) and α -glucosidase (IC50 2.58, 0.35 and 0.22 µg/mL, respectively) [18]. These results suggest the use of these plants as a potential tool for the development of new therapies for diabetes. As there is an increasing number of individuals with diabetes mellitus and its complications in the world, research on medicinal plants effective in the treatment of of this disease should be encouraged [19].

In a study where extracts of plant species from the Brazilian Cerrado were evaluated to find potential inhibitors of human salivary alpha-amylase, ethanolic extracts from *Pouteria ramiflora* (Mart.) Radlk was tested. The parts used were leaves, stems, and roots. In this study, a decrease in amylolytic activity above 95% was observed at a final concentration of 20 μ g/mL. Swiss adult male mice were treated orally with *Pouteria ramiflora* (Mart.) Radlk in studies of acute toxicity and glycemic control. Daily administration with 25, 50, and 100 mg/kg of aqueous extract of this plant for eight days can significantly reduce body weight and blood glucose level in mice [16].

The results of studies using the species *Pouteria ramiflora* (Mart.) Radlk revealed great potential for the treatment of diabetes. Diabetes *mellitus* is the most common disease in the world, about 171 million people were affected in the year 2000, and this number is likely to increase to at least 366 million by 2030. However, more studies should be done to confirm its potential for such

therapy [18]. Studies with the species in question also offers a path for researchers interested in new therapies against cancer. Also, they showed inhibitory activity against *Candida* ssp., which is very promising, since these fungi have been showing great resistance to current antifungals.

Pouteria torta (Mart.) Radlk is a perennial tree widespread in Brazil, popularly called abiu do Cerrado. The fruit and bark of this tree have been used in folk medicine as an antidiarrheal. In its chemical composition we find triterpenes, flavonoids, α - and β -amyrin, lupeol, taraxasterol, pseudotaraxasterol, cycloartenol, lanosterol, αand β -friedelinol, and acids betulinic and ursolic [6]. The aqueous and ethanol extracts from Pouteria torta (Mart.) Radlk leaves showed 94.0% and 91.0% in vitro inhibition of α -amylase [20]. It is worth mentioning that extracts obtained from various parts of this plant (leaves, stem, bark or fruit), have several biological activities, such as cytotoxicity, antifungal in vitro [6]. These results provide a scientific basis for the use of this plant in popular medicine and suggest that further studies investigate the biological activities of this species.

Studies by Elias and collaborators (2013), on *Pouteria torta* (Mart.) Radlk. intending to investigate the cytotoxic activity and the type of cell death induced by leaf extracts in human mouth squamous cell carcinoma and breast carcinoma cells showed that all the tested extracts, hexanic, ethanolic and aqueous, are cytotoxic on cell lines of cancer OSCC-3 and MCF-7, at different levels. Many types of cancer have resistance to known primary treatment and/or adjuvant therapy, besides, secondary tumors, overgrowth and metastases still prevent the full success of current therapies [21]. In this case, it is worth pointing out that new therapies are necessary to combat neoplasms, and *Pouteria torta* (Mart.) Radlk. presents itself as a promising herbal alternative in this sense.

A study evaluated the mutagenic activity of the hydroethanolic extract of *Pouteria torta* (Mart.) Radlk. in *Salmonella typhimurium* by an *in vivo* micronucleus test in peripheral blood cells of Swiss mice. The results demonstrate that the extract exhibited mutagenic activity in the tests. Mutations are related in the early stages of diseases like cancer. Therefore, the data found suggest caution in the use of this plant in folk medicine. These results demonstrate the danger of inappropriate use of natural products and reinforce the importance of studies on the mutagenicity of compounds obtained from plants [6].

Pouteria lucuma (Ruiz & Pav.) Kuntze known as "gold of the Incas" or "lucuma", is a subtropical fruit from the Andean region of Peru, Chile Ecuador. This plant has antioxidant, anti-inflammatory, antibacterial, and antifungal activities. However, specific studies on *Pouteria lucuma* (Ruiz & Pav.) Kuntze is very much included. In Peru and Chile, "lucuma" flavored ice cream is very popular, this is due to the sweet taste and wonderful flavor and aroma. Lucuma's meat pulp is rich in carbohydrates, proteins, fibers mainly in an insoluble form, b-carotene, vitamins, and minerals and its non-edible seed is rich in polyunsaturated fatty acids with attributes appreciated by the cosmetic industry in terms of skin regeneration. The study in question highlighted that the biotypes of this plant: Rosalia, Montero and Leiva lucuma have antioxidant and anti-hyperglycemic properties *in vitro*. As chemical and biological activities of this plant come from its constituents, triterpenes and flavonoids [22].

Pouteria lucuma (Ruiz & Pav.) Kuntze seeds are usually disposed of as waste from the agricultural industry. In a study, Guerrero-Castilho and collaborators (2019), found that *Pouteria lucuma* (Ruiz & Pav.) Kuntze seed extracts have moderate to high antioxidant activity and gastroprotective properties [23].

In research aimed at evaluating the effect of lucuma nut oil *Pouteria lucuma* (Ruiz & Pav.) Kuntze on the migration of fibroblasts, on angiogenesis, inflammation, and wound healing, it was observed that the lucuma nut oil contains linoleic acid (38.9%), oleic acid (27.9%), palmitic acid (18.6%), stearic acid (8.9%) and linolenic acid (2.9%). This oil promoted the evolution of migration and the expression of fibroblasts, decreased the production of nitric oxide-induced by LPS. Caudal fin regeneration was observed in zebrafish 48 hours after the caudal fin amputation and accelerated wound closure in CD-1 mice. The fruit of the species in question is very useful in Peruvian gastronomy [24], but its use for therapeutic purposes is still little explored.

Natural products are vital in the discovery of drugs with anti-neoplastic action. A study of the aqueous extract of Pouteria sapota (Jacq.) Leaves H.E. Moore & Stearn, a species also known in Central America, Mexico and in many parts of the world as "mamay", was evaluated for its cytotoxic activity. This extract in vitro activity against breast cancer cells (MCF-7) (25µg and 125µg). The antioxidant activity was also evaluated and the extract of this plant inhibitory action for the production of free radicals in all the tested tools (25µg, 50µg, 75µg and 100µg). The compounds present in *Pouteria sapota* (Jacq.) HE Moore & Stearn as quercetin have a strong cytotoxic against tumor cells, which requires that this activity be promising for new herbal medicines with anticancer properties, however, in vivo experiments must be performed for a better understanding of the mechanism [25]. A previous

study by Prabhu and collaborators (2018), demonstrated that aqueous extract from *Pouteria sapota* (Jacq.) HE Moore & Stearn and the green synthesis of silver nanoparticles (AgNPs) made from this extract, dissipate as promising for treating diabetes *mellitus*. A reduced reduction in blood sugar levels was observed in treated rats, revealing that both treatments have anti-diabetic activity [26].

Studies carried out using *Pouteria sapota* (Jacq.) H.E. Moore & Stearn dissipated, for the first time, the postprandial absorption of sapote xanthin, a carotenoid important for health, in the human bloodstream [27]. The species (*Pouteria sapota* (Jacq.) H.E. Moore & Stearn) has a lot to offer about anticancer and antidiabetic activities, this may be related to the presence of compounds such as polyphenols and carotenoids, however, it is necessary for further studies to better investigate these actions. According to Prabhu and collaborators (2017), this species has not yet been deeply studied regarding its biological activities [25].

Pouteria campechiana (Kunth) Baehni is used, mainly in Mexico and Cuba, as a medicine for liver and coronary diseases, skin disease, epilepsy, and ulcers. In a study that aimed to investigate the antioxidant and hepatoprotective effect of *Pouteria campechiana* (Kunth) Baehni fruit extract, it was observed that this plant is rich in polyphenolic and flavonoid compounds, beside, the study revealed that the fruit extract exhibiting eliminated free radicals in antioxidant models [28]. Therefore, this plant is promising for the development of new drugs with hepatoprotective and antioxidant action.

Research using four types of plants, including *Pouteria campechiana* (Kunth) Baehni, showed antihyperalgesic effects in diabetic alloxan rats, also, this preparation with plant species demonstrated a dosedependent systemic antinociceptive effect in rat formalin (1%) and also in capsaicin tests in rats (0.2%) [29]. Therefore, this species can be better investigated and it is promising for new drugs with analgesic function.

The analysis of the components of *Pouteria macrophylla* (Lam.) Eyma popularly known as cutite, originally from the Brazilian Amazon, revealed that this species is rich in hydrolyzable tannins and flavonols. To assess the antioxidant capacity of this plant, Gordon and collaborators (2011), used the total oxidant elimination capacity test (TOSC), where it was possible to observe that the species in question has excellent antioxidant activity by reducing lipid peroxidation (IC50% 0, 57) and peroxynitrite (IC50% 0.83). According to the authors, the antioxidant property of this fruit can be attributed to the phenolic content. In this

study the largest amount of total phenols was found in *Pouteria macrophylla* (Lam.) Eyma [30].

According to Dutok and collaborators (2015) the fruit of Pouteria mammosa (L.) cronquist has traditionally been used, mainly in Cuba and Costa Rica, for its medicinal properties against fever, inflammation, rashes, ulcers, nausea, vomiting and diabetes, in addition to being a rich source of nutrients. The common use of the seeds of this plant in ethnobotanical foods and medicines shows low or absent toxicity. The authors conducted a safety test to scientifically support its use in folk medicine and future drug therapies. As a result, they found that orally, the aqueous extract was not toxic to rats, unlike the 25% hydroalcoholic extract that was classified as dangerous. On the skin, both extracts could be used without irritating rabbits, however, both extracts proved to be slightly irritating in eve tests [31]. These data show us that plants and their derivatives are powerful allies in the search for new therapies that aim to combat innumerable diseases, however it is important to spread knowledge about their toxicity, since the incorrect use of these can cause serious damage to health and the death.

Santos and collaborators (2015), carried out an in vitro study that aimed to investigate the antimicrobial and cytotoxic potential of four fractions and an ethanolic extract of the species Pouteria venosa (Mart.) Baehni is an abundant species in areas of the Atlantic Forest used as a medicinal plant. The antimicrobial activity was determined by disk diffusion microbial sensitivity tests and the broth microdilution method, to determine the Minimum Inhibitory Concentration (CIM). As a result, the crude extract only showed activity in concentrations starting from (CIM 500 µg/mL). The best antimicrobial activities were seen in the fractions against S. aureus for the AcOEt fraction of the stem bark (CIM 125 µg / mL); S. pneumoniae and P. mirabilis for the AcOEt fraction of stem bark (CIM 250 µg / mL); S. epidermidis, P. aeruginosa for the AcOEt fraction of the leaves and stem bark (CIM 250 µg/mL). In disk diffusion tests, the AcOEt fractions of the leaves and stem barks showed a promising antimicrobial potential with inhibition halos (≥ 17 mm) against the strains of *S. aureus*, S. epidermidis and S. pneumoniae. They are also active in the P. aeruginosa strain, with an inhibition zone between (9 and 14 mm). The most promising fraction was the Ac-OEt of the stem bark, which is considered non-toxic and can be used in preclinical tests in vivo [32]. This study confirms that Pouteria venosa (Mart.) Baehni is an excellent antibacterial, this in satisfactory concentrations and can be used in formulations for this purpose.

The importance of plants is increasingly recognized in the formulation of medicines. Also, they already occupy a large space in gastronomy, aesthetics and wood production. The studies carried out to date with the species of the genus*Pouteria* demonstrate that they offer a wide spectrum in the treatment of diseases. However, most are still little known. In this review, *Pouteria ramiflora* (Mart.) Radlk and *Pouteria torta* (Mart.) Radlk. were plants of the genus that presented the highest number of studies evaluating their therapeutic activities in Brazil, and this may be related to geographical issues, since they are more easily found in Brazil.

IV. CONCLUSION

In summary, the genus Pouteria is proven to be effective for the treatment of numerous diseases such as diabetes, cancer and microbial diseases. Also, these plants show promising results as immunomodulators, antiinflammatory, healing, neuroprotective, antioxidant and hepatoprotective (the plants of this genus should be better investigated for these activities). It is worth mentioning that these species are potent allies in the fight against multidrug-resistant pathogens, which has been a problem mainly in the therapies of immunosuppressed patients. Its active components can later be isolated, characterized and used to develop new drugs. However, most species of this genus are still poorly known, resulting in few studies on their therapeutic activities. In this sense, this study demonstrates the therapeutic potential of the genus Pouteria and opens new paths for researchers interested in new effective therapies using herbal medicines.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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An experience of project in remote education at COVID's Pandemic: Working with technological didactic resources

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Abstract— This work is the result of the interdisciplinary project "Let's talk about COVID-19?". The objective was to develop the theme of COVID remotely, using technological didactic resources. The project was carried out with students and teachers from the 6th to the 9th years, which develops remote education in the context of the pandemic. Teachers from different curricular components made proposals for investigative questions seeking to relate the theme of COVID-19 to the skills related to each one. As a conclusion to the learning and evaluation process, students were invited to present their considerations and findings in discussion forums for each teacher. This investigative didactic experience proved to be effective in the context of remote teaching. The students got involved in their research and developed pertinent discussions, as well as resolved doubts in the discussion forums, which is an important didactic tool in this context.

Keywords—didactic experiences, remote teaching, science, technology resources.

I. INTRODUCTION

The year 2020 surprised us with a pandemic of proportions that we had not experienced before. COVID-19 caused by SARS-CoV-2 led the world to social distancing, saturated health systems and was responsible for thousands of deaths in a few months. In addition to the risk factors (defined by individual's biological issues), people are not in the same socioeconomic condition to facing the disease, having several vulnerabilities¹.

United Nations Children's Fund - UNICEF² warns that COVID-19 generates hidden victims, especially children. Away from school, they are more exposed to domestic violence, absence of contact with teachers to support them, lack of meals that intensify malnutrition, in addition to factors such as less medical assistance and philanthropic actions. From the perspective of education, technological resources were soon established to replace face-to-face classes.

This work aimed to develop the classes about theme of COVID remotely, using technological didactic resources. More specifically, promote the individual and collective health in students and their parents, as well as to relate curricular components to the context of the pandemic, for the development of critical reflections of children and adolescents in face of the information they experience.

II. METHODS

The project was developed in July 2020, with students from the Final Years of Elementary school (6th to 9th grade), in a public school of Minas Gerais, Brazil. That is in the process of remote education due to the time of the COVID-19 pandemic. In this system, students receive Tutored Study Plans for four weeks each which contains all curriculum components with texts and exercises, such as a chat for teachers explains.

To aim the objective of this research, the teachers send to the students questions relating COVID-19 and their discipline (math, science, history, etc.), as well as directions of readings and researches were proposed so that students could be taken to investigate the theme to answer the questions.

At the end was developing a discussion forum on the students' findings from the investigation of the proposed questions, via chat with teachers.

III. RESULTS AND DISCUSSION

The questions related COVID-19 to the curricular components, although some teachers have asked questions that did not have that relationship, but exclusive about to pandemic. As an example of these activities, there are the questions: Make a drawing illustrating how this period has been in people's routine. What are the precautions to protect yourself and the difficulties in this process? (Tell about your routine and your doubts about the disease) (Questions elaborated by the author).

Those questions were sent in the science curricular component, as a way for students to investigate ways of prevention, as well as rethink their habits when they were describing their routine, relating to what they discovered in their research on care to protect themselves.

This proposal follows Carvalho³, which defines "[...] it is based on the knowledge that the student brings to the classroom that he seeks to understand what the teacher is explaining or asking", therefore relating the theme to your daily life is essential for the understanding of a content.

The discussion forum was used as instrument for building knowledge and assessing the learning process. In the period which they occurred a considerable increase in the participation of students in the chat was observed. For some authors, such as Scherer⁴ (2009), the forum allows collective and individual learning, being a space open to questions and movements to a mutual understanding

These movements can be seen below, in the reproductions of some dialogues in the discussion forum of science: "Look at my routine, I believe it's nothing, I wake up, I have coffee [...] I usually do activities in the morning, after that I usually help my mother to clean up the house and go back and study" (student x); "I'm staying at home, taking care and when I need to leave, I go with a mask and take an alcohol gel" (student y).

During the forums, the students reported that they were interested in the theme and in the research they carried out to be able to answer the proposed questions. Some had doubts and were helped by colleagues and teachers in the discussion forum. In the end, they said they liked the opportunity for a discussion forum on the proposed investigation.

IV. CONCLUSION

Therefore, the results presented here contribute as a way to reduce the impacts of problems associated to the remote education at the pandemic, encouraging learning through online discussion forums, to bring teachers and students closer together. This work also contributes to the contextualization of the skills of the curricular components in relation to the pandemic. The project contributed to the possibility of a successful instrument for future actions that promote and encourage student participation and discussion in the chat or other available virtual platforms: forums and investigative experiences.

In addition, this investigative teaching experience provided a valuable opportunity for students to be able to answer questions about the pandemic, its care, routine and afflictions, having direct contact with teachers via chat to assist them.

Finally, it allowed interdisciplinarity in science education, expanding the theme of COVID-19 to all curricular components, in addition to developing a sense of research in students, fundamental to the field of building scientific knowledge.

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