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FOREWORD

I am pleased to put into the hands of readers Volume-8; Issue-2: 2021 (Feb, 2021) of **"International Journal of Advanced Engineering Research and Science (IJAERS) (ISSN: 2349-6495(P) | 2456-1908(O)",** an international journal which publishes peer-reviewed quality research papers on a wide variety of topics related to Science, Technology, Management and Humanities. Looking to the keen interest shown by the authors and readers, the editorial board has decided to release print issue also, but this decision the journal issue will be available in various library also in print and online version. This will motivate authors for quick publication of their research papers. Even with these changes our objective remains the same, that is, to encourage young researchers and academicians to think innovatively and share their research findings with others for the betterment of mankind. This journal has DOI (Digital Object Identifier) also, this will improve citation of research papers. Now journal has also been indexed in **Qualis (Interdisciplinary Area) (Brazilian system for the evaluation of periodicals, maintained by CAPES).**

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

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

With warm regards.

Dr. Swapnesh Taterh
Editor-in-Chief
March, 2021

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A Literature Review about Smart Contracts Technology

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***Abstract*—** *This work begins with an explanation of fundamental concepts about Bitcoin and Blockchain and then explores the main definitions of smart contracts in the updated literature, demonstrates some categories of smart contracts, explores the most widely used platforms that support smart contracts, and gives greater prominence to the Ethereum platform for its more robust characteristics regarding the creation and storage of this type of contract. It then concludes by demonstrating the advantages of smart contracts in relation to traditional contracts, as well as addressing their legal validity.*

I. INTRODUCTION

It was at the beginning of 2009 that a person or group of people named Satoshi Nakamoto released Bitcoin, a peer-to-peer solution that allows the transfer of values and payments by unconventional means [1]. This technology was primarily restricted to the universe of system programmers, but over the years it has gained popularity and attracted the attention of diverse institutions such as banks, governments, among others [2]. Currently, the basic technology for Bitcoin, Blockchain, considered disruptive, has several utilities, among them data storage, digital asset transfer and transaction management, through a decentralized computer architecture. Another technology that has emerged in the blockchain field is intelligent contracts, or smart contracts, which work by automating contractual clauses through triggers created in software. These triggers previously created and configured can be, for example, specific dates, where certain terms of a contract will be executed.

II. BITCON AND BLOCKCHAIN

In 2008, Satoshi Nakamoto, possibly a pseudonym under which one or more people remain anonymous, expressed the need to create a more secure and reliable payment system, using proof of trust based on cryptography, and dispensing with the use of third parties, such as banking institutions, for its operation, is to say, a transfer of values could be made directly between those interested, without the need for an intermediary [1]. Launched in 2009, the Bitcoin open source technology allows value transfers to occur through the use of bitcoin cryptocurrency, generated by the system itself, with a public blockchain managing and storing transactions, and aiming at reducing fees, such as those applied by banks, and facilitating negotiations at the international level. Bitcoin was the first decentralized cryptocurrency to be created and the nodes connected to its blockchain use a proof-of-work based consensus algorithm, formed by rules that define how the blocks containing the transactions will be added to the existing blockchain. These nodes, which are computational devices participating in the Bitcoin network, that is, the public blockchain that maintains it, need to solve a computational challenge to have the right to add a new transaction block to the current blockchain, being rewarded with bitcoins when they do so, in a process called cryptocurrency mining [3]. Another aspect of the public blockchain used for the storage of bitcoin

transactions is the immutability of their data, which ensures the legitimacy of all the information stored on the network, provides a history of operations performed and allows their auditability and traceability. In addition, Bitcoin is decentralized, allowing its users to make the validations of all transactions made, that is, the entire network can check how many bitcoins the user accounts have received or sent through a mechanism of consensus among all participants that guarantees the legitimacy of the operations [4].

III. SMART CONTRACTS

Blockchains are structures that allow several functionalities, being Bitcoin the most famous example. Due to their versatility, besides transactions involving values expressed in cryptocurrencies, these networks allow data storage, decentralized real estate registration, order tracking, among other applications, such as smart contracts, the main focus of this work. In the computing world, any assets of the physical world can have their characteristics, such as price, color, weight, owner, etc, expressed by means of software, also including the so-called intangible assets, such as rights, personal data, certificates, trademarks, among others. Blockchains serve for this purpose of safe and reliable storage of such digital assets, as well as propitiate that the relations between these assets can occur by means of computer programming, that is to say, by means of smart contracts, which serve to execute, in an automated manner, certain commands based on preestablished instructions and conditions. However, despite having the term "contract" in their title, smart contracts are not considered contracts in the legal sphere, serving only as an instrument for the execution of clauses present in the contracts themselves [5].

The term smart contracts was coined by Nick Szabo in 1994. This researcher defined smart contracts as computerized transaction protocols that execute contract terms [6]. For other authors, smart contracts are software originally designed to use the reliable computational features of a blockchain network in order to automatically implement conditions that two parties can agree to when they sign a contract in an untrusted environment [7]. Another definition is that smart contracts are computer programs that can be executed in a network of mutually trusted nodes, such as the blockchain, without the intermediation of a trusted authority, and that, due to their resistance to manipulation, such "smart contracts" are useful in several scenarios, especially in those that require money transfers in respect of certain rules agreed by those involved, such as in financial services [3]. Smart contracts are also considered as digital contracts that allow the creation of clauses dependent on a decentralized consensus that are tamper-proof, and are typically self-applicable through automated execution, but without the legal nature of traditional contracts and without using artificial intelligence resources [8]. In a concept closer to computing, smart contracts are, in short, small programs that aim to automate tasks based on conditional "if" and "then" instructions, stored and executed without intermediaries in a decentralized manner in several devices connected in a peer-to-peer network, capable of fulfilling contractual clauses [9]. Still under the context of computing, smart contracts are software that implements a logical sequence of steps according to certain clauses and rules, and consist, conceptually, of three parts: the computational code that represents the contract logic; the set of messages that the smart contract can receive and that represents the events that will activate the contract; and the set of functions that will activate the reactions foreseen by the contract logic [7].

About to the types of smart contracts, there are some categories mentioned in the literature, such as financial smart contracts, which aim at transactions involving monetary values. Some of these contracts certify the ownership of an asset of the physical world, its value, and serve to monitor negotiations involving such assets. Others, also of this financial strain, are created for collective financing (crowdfunding), receiving values from investors who have an interest in helping certain projects financially. Another use for these smart contracts has been the creation of high-yield investment programs based on Ponzi (pyramid) schemes, which receive money from interested parties with the promise of a return with interest on the amount invested as other interested parties join the project. Some of these contracts provide insurance in the face of digitally verifiable setbacks, such as a delay of a particular flight at an airport, triggering a refund transfer operation for the beneficiary. Other notarial smart contracts take advantage of the immutability of data present in blockchains to register ownership of assets and guarantee their origin. Some of these are used for document hash storage, ensuring the existence and integrity of these assets. This type of smart contract is also used for the protection of copyrights in music, art and photography files, among others, as well as to associate users public keys to their real identity. There are also smart contracts of the digital wallet category, aimed at managing cryptographic keys, sending transactions, serving as intermediaries in interaction with blockchains. Finally, there is the library category, composed of smart contracts that have functions that are implemented by other smart

contracts. These functions can be for value conversion, text conversion, etc [3].

Smart contracts can be created and maintained in several available blockchain implementations. Bitcoin, as already commented, is a solution that aims primarily at the transfer of values by means of bitcoin cryptocurrency, in a decentralized manner, using a public blockchain that registers all the transactions that have occurred. Bitcoin's infrastructure allows the use of a scripting language with limited resources, however its open model and data immutability have guided the development of other protocols that allow the creation of basic versions of smart contracts. Another platform that also works in its own blockchain and has a consensus algorithm similar to that of Bitcoin is Ethereum, whose cryptocurrency is called Ether (ETH). Ethereum allows the development of smart contracts through programming languages such as Solidity. The contracts are triggered through transactions sent to Ethereum's blockchain and the effects are validated by the network. In the Ethereum universe both users and smart contracts can send and receive cryptocurrencies ether among themselves. The Stellar platform, which also has its own blockchain, uses a consensus algorithm based on the Byzantine Agreement Protocol [10], which provides lower resource consumption to validate blocks of data in relation to the cryptographic puzzle required by Bitcoin in its validation and mining operations. Unlike Ethereum, Stellar does not have its own language for the creation of smart contracts, but allows contracts of this type to be made using the transactions that occur in its network. Besides those mentioned above, there is Lisk, which also has its own cryptocurrency and allows the creation of private blockchains, where their owners can define access privileges for third parties. In Lisk smart contracts can be made in Javascript or Node.js language and work on separate blockchains, although transactions using the contracts can be made involving the main blockchain of the platform [3].

Blockchains that support smart contracts are also called "programmable blockchains" [11], and Ethereum, among the platforms listed, has the most smart contracts in its blockchain [3]. Ethereum allows both the storage and execution of smart contracts, and because of the inherent characteristics of blockchains, it is possible to trace the operations of these contracts. As mentioned, in this platform smart contracts are written in Solidity language, which is similar to Javascript, and the structure of the code is in the format of a class, Object Oriented Programming (POO) concept. Like the Java compiler, Solidity produces bytecodes from the source code of the smarts contracts, and these bytecodes, after being stored in the blockchain of the platform, can be executed through the Ethereum Virtual Machine (EVM). To facilitate the coding of smart contracts, Solidity allows the creation of libraries and subcontracts. Subcontracts allow developers to establish object-oriented relationships between smart contracts, through, for example, inheritance and interfaces. Libraries provide code reuse and serve to encapsulate utility functions such as conversions and mathematical operations. When ready to go into production, smart contracts can be deployed on the network through a transaction sent to Ethereum's blockchain, also called a "contract creation transaction". After their deployment, smart contracts receive an address in the blockchain, and through this address it will be possible to send transactions to access the functions present in these contracts [11].

With regard to the advantages of smart contracts over traditional contracts, risk reduction can be cited: due to the immutability of blockchains, smart contracts cannot be arbitrarily changed once they are issued. In addition, all transactions that are stored and executed on all distributed blockchain systems are traceable and auditable. As a result, malicious behavior such as financial fraud can be greatly mitigated; Reduced administrative and service costs: blockchains ensure the reliability of the entire system through consensus mechanisms distributed among participating devices without passing through a central intermediary or mediator, and smart contracts stored on these networks can be automatically triggered in a decentralized manner. Because of this, administration and maintenance costs can be significantly reduced; Increased efficiency of business processes: the elimination of dependence on intermediaries can significantly improve the efficiency of business processes. For example, in a blockchain used for supply chain tracking, financial settlement can occur automatically between the participants of the peer-to-peer network, once the pre-defined conditions in smart contracts are met, significantly reducing the return time of transactions [4].

In the literature, there is still no consensus whether smart contracts can have the same legal validity as traditional contracts [12], although some authors consider that this type of agreement is a form of tutelage that exempts the intervention of the Judiciary for its execution, because regardless of the subsequent will of the parties, the terms will be executed when certain conditions are reached [13]. In the legal system of several nations, contracts are instruments that create, modify or extinguish legal relations between two or more contracting parties, and transactions carried out in this context by means of smart contracts have legal effects such as those derived from classic contracts. Another requirement that must be present

in smart contracts for their legal effectiveness is the expression of the parties expression of will, which must be free and without vices. Smart contracts also have a fiduciary character, i.e. they are guarantors that the agreement will be fulfilled. In addition, they differ from traditional contracts by their purely digital nature, although they may serve to execute operations involving non-digital assets, such as real estate, immaterial rights, etc. Another peculiarity of this more modern version of the contracts is that they are fully implemented in software and have a double nature in legal terms: the smart contract code will be considered an intellectual property right at the same time as the contract will be considered a legally valid document as to what has been agreed between the parties involved. Furthermore, smart contracts increase the certainty of execution of the contractual clauses, are of a software-encumbered nature, are self-enforcing and self-sufficient, in the latter case, in that they do not require registration with intermediaries [13].

IV. CONCLUSION

As seen, the technology of smart contracts is not new, having been coined still in 2008, but it came to have greater dissemination and adhesion when establishing blockchains, like the one available on the Ethereum platform, the most used today for this type of digital agreement, although other solutions, such as the famous Bitcoin also allow its use, within certain limitations. Smart contracts, in their most basic definition, are representations in software of terms of a contract, which is executed through conditional operations present in computational algorithms. Some categories of smart contracts are listed in the literature, which take into consideration their purpose, such as financial, notarial, portfolio and library smart contracts, respectively, those aimed at value transfer operations, those for the registration of assets and immaterial rights, those that manage operations involving blockchain addresses and those that serve to create utility functions reusable by other smart contracts. In legal terms, smart contracts can be used for the creation, modification or termination of legal relationships, they are similar to traditional contracts in that they represent the expression of the will of the contracting parties, and differ from them in that they are purely digital in nature, they are fully implemented in software, and they are dual in nature in that their source code is an intellectual property right and the contract is a legally valid document. In addition, they increase the degree of certainty of their execution, ensure their result by means of software, are self-executable and self-sufficient, dispensing, in this case, with their prior registration.

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Classroom experiences in a virtual teaching environment in times of Covid-19 pandemic: Reports of experience in urgency and emergency nursing education

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***Abstract*—** *Objective: to describe some perceptions about the experience of the virtual teaching period and reflect on some of the impacts of the transition from classroom to classroom in a virtual environment in higher education in nursing that occurred during the pandemic caused by the new coronavirus. Method: this is an experience report, with participatory observation about the experiences of teachers of the Bachelor of Nursing course at Escola Superior da Amazônia (ESAMAZ), Belém, State of Pará, about the dynamics developed in the teaching-learning process in Pre-Hospital Urgency discipline, from August to December 2020. Result: In this brief report we present some perceptions of the period of virtual education that occurred during the pandemic caused by the new coronavirus. Not making exclusive use of a chronological order, we recorded facts and situations that led to the actions that guided virtual nursing classes and the impressions of this experience. Conclusion: the situations described here may corroborate with the experiences of other teachers, showing that it is not enough to use digital information and communication technologies in teaching, training, time and strategies are needed for an adequate incorporation of these technologies in nursing education.*

I. INTRODUCTION

The year 2020 began with the World Health Organization (WHO) communicating the presence of a virus that would totally change the way humanity was used to relating. This virus, called the new coronavirus (SARS-CoV-2) is responsible for causing COVID-19, and in mid-March 2020, due to the worldwide spread, it reached characteristics of a pandemic, being declared a Public Health Emergency International Interest (ESPII). In Brazil, the rate of contamination by the coronavirus has advanced rapidly. In Latin America, the first recorded case was in São Paulo, Brazil, on February 26, 2020, in which the numbers of contagion increased exponentially, with more than 170 thousand deaths[1].

The disease caused by the coronavirus, COVID-19, was first identified in China in December 2019. On January 30, 2020, WHO declared that the COVID-19 epidemic was an ESPII, and, in March 11, 2020, a pandemic[2]. After the arrival of the coronavirus in Brazil, numerous strategic measures for disease control and prevention were taken by health authorities in different administrative spheres (federal, state and municipal governments). These strategic measures differed from one region to another in the country, however the most widespread and defended measure by the world's scientific authorities was the practice of social detachment, understood in general, both by the population and by the mass media, as social isolation[3]. SARS-CoV-2 is a new virus in the coronavirus family, causing infections that were initially reported in Wuhan, China, starting in mid-December 2019. This virus is transmitted through respiratory particles when individuals remain in close contact, especially indoors. The infectious condition caused by this virus is called Covid-19[4].

In the world, the practice of social detachment has been recommended as an effective measure for the prevention of this infection, however it has caused some impacts on the various dimensions of people's lives[3]. The social distance caused by the coronavirus pandemic, led to the temporary suspension of face-to-face classes in schools and universities, greatly changing the routine of educational institutions in Brazil and the world, bringing a great challenge to the face-to-face teaching process, prevalent in Brazil. By suspending face-to-face classes, teachers, students, coordinators, schools / universities and educational technicians were forced to adopt new attitudes and take several measures in relation to how the teaching and learning process would be conducted at this time[1].

In the meantime, several policies have been adopted by several countries in order to control the spread of the disease and contamination of their populations. In this way, the World Health Organization (WHO), the United Nations Children's Fund (Unicef) and the International Federation of Red Cross and Red Crescent Societies (IFRC) issued guidelines to maintain security in the various segments of society, including in educational settings[4].

Due to the reported facts, in Brazil, there was a need for standardization, which was carried out by the Ministry of Education and Culture (MEC) through ordinance no. 343, of March 17, 2020, allowing the substitution of face-to-face classes at the country's educational institutions, by pedagogical proposals with classes that would allow the continuity of teaching through Digital Information and Communication Technologies (TDIC)[5].

As soon as the activities of the 2020 school year began in Brazilian schools, the educational system was surprised by the need to interrupt classes. The doors of educational institutions were closed abruptly, and such suspension of classes was not provided for in educational planning. Educators, students and family members were concerned; official information was often mismatched. Many questions emerged, what was actually happening? It was in this scenario, with no expected return of face-to-face classes, that MEC proposed distance learning through the virtual environment[6].

In an increasingly connected world, where technology is linked to practically all professions and social spaces, having knowledge related to technological sciences is essential in the professional exercise of the educator. However, despite the unquestionable achievements already achieved, many challenges are still launched in the daily lives of these professionals, and many questions portray limiting conditions with regard to the understanding of technological tools[5].

Faced with the suspension of face-to-face classes, universities started to adopt classes called “remote teaching”. Here we endeavor to elucidate such terminology, understanding that the term is not the most appropriate to be used, since it reports the idea of geographical distance, in Portuguese dictionaries, for example, the word remote is treated as something that is far away in time and / or space, as something far away, which we do not consider to be the case. The most appropriate nomenclature would be Virtual Teaching, since all teaching action takes place within the virtual world, with a change of environment (face-to-face to virtual), through Digital Information and Communication Technologies, which allow contact synchronously (through videoconferences, for example). example) and / or asynchronous (using virtual learning environments), that is, there is a geographical separation, but that does not

mean that they are in "remote" or difficult to reach locations, only the actors cannot meet physically[1].

This imposes a new attitude towards the reality of Higher Education Institutions for the coming years. Universities, academic departments and university courses will need to reinvent, adapt and resignify themselves to reduce pedagogical damage and risks to public health, thus ensuring the maintenance of a high quality and safe education. In the meantime, it is up to the deliberative and planning instances of higher education institutions to make fundamental decisions that will support the conduct and decisions of teachers as to how to conduct their curricular components. Adaptations will need to be made in the institutional development plans, in the pedagogical projects of the courses and in the management of the departments, in order to find the best way to deal with the emergency situation[7].

During social isolation, some pedagogical alternatives were raised for the teacher to work in a virtual way, however some questions emerged: were the educators prepared for this type of teaching? Did we have enough resources to support this pandemic period? What would the teaching and learning process be like during social distance? Furthermore, after the pandemic, what would be the educators' learning and positioning?

The current pandemic context of Covid-19 required educational institutions to make decisions about how to deal with the processes of teaching, learning and teaching, so that the actors involved (teachers, students and staff) were protected from contamination and the spread of the virus. The suspension of face-to-face classes has led many higher education institutions to choose the use of Virtual Emergency Education, as an alternative way to continue with the school year[7].

Thus, the study aims to describe some perceptions about the experience of the virtual teaching period and reflect on some of the impacts of the transition from classroom classes to classroom in a virtual environment in higher education in nursing that occurred during the pandemic caused by the new coronavirus.

II. METHOD

It is an experience report with participatory observation about the experiences of teachers of the Bachelor of Nursing course at Escola Superior da Amazônia (ESAMAZ), Belém, State of Pará, Brazil, about the dynamics developed in the teaching-learning process in the discipline Pre-Hospital Emergency, from August to December 2020.

The descriptive method was used, for this, a critical analysis of the activities developed during the period of social isolation caused by the coronavirus pandemic, which led to the temporary suspension of face-to-face classes in schools and universities, was carried out. The discipline Pre-Hospital Urgency is a mandatory curricular component of the undergraduate nursing course, being taken in the sixth term of this teaching institution. It has a theoretical-practical character, with a total workload of 60 hours.

Due to the worsening of the pandemic in the country, the MEC published ordinance no. 343 of 17 March 2020, allowing the substitution of face-to-face classes at educational institutions in the country, for classes in virtual environments. During this period, teaching institutions were suspended from their classes[1].

Next, a personal vision built shortly after academic activities will be suspended by higher education institutions, mixing experiences acquired during lectures, conferences, short courses, round tables involving this theme and carried out during this period of social detachment. In addition to the perspectives and preparations for the beginning of classes that took place exclusively virtual in the educational institution where we teach.

The purpose of this study is not to exhaust the subject, nor to want to present these perceptions as absolute truths, but as a complementary perception to the different perspectives described from the teachers' experience during the pandemic.

III. RESULTS AND DISCUSSION

Several issues have emerged in a very short time. This short adaptation period made us reflect on how to proceed in relation to classes in the initial period of the pandemic, which methodologies should we use? What digital teaching resources could be used? How could we work with the Pre-Hospital Emergency discipline in a virtual format?

In view of the countless challenges verified for a virtual return to classes, the lack of teacher training in the use of TDIC can be considered another difficulty in this pandemic moment. It is described that many teachers were not "prepared" to use digital technologies in teaching. There are several studies in the literature that corroborate this observation[1].

It is in the midst of this scenario of profound and diverse questions that this essay proposes in order to reflect on some of the impacts of the transition from classroom to classroom in a virtual environment in higher

education in nursing that occurred during the pandemic caused by the new coronavirus. Based on an interrogative methodological proposal, we seek evidence of meanings and values that can promote resilience and coping, contributing to the reconstruction of life and the reframing of the teaching profession in the midst of the adversity of today[6].

Faced with a scenario of fear and high mortality rates, 341,048 confirmed cases of COVID-19 and 21,682 deaths on March 23, 2020 according to G1 (2020), there were several changes in the social, economic and educational spheres, directed by federal, state and municipal governments[8].

In the midst of the current pandemic, science, supported by empirical evidence, has started to gain irrefutable importance. Thus, understanding the impact of Covid-19 on Education, based on what the scientific evidence says, is relevant for society[2].

In Brazil, in March 2020, ordinance no. 343 of the MEC, which: provides for the substitution of face-to-face classes with classes in virtual media while the new coronavirus pandemic situation lasts. This first ordinance arises in order to guide the functioning of higher education, authorizing, on an exceptional basis, the substitution of classroom disciplines for classes that use digital media. The disciplines with the potential for such substitution must be defined by universities. Regarding these disciplines, Ordinance no. 345 of March 19, 2020, complements the aforementioned, prohibiting the realization of practical disciplines or laboratories[8].

The use of distance learning is supported by the current LDB (Law of Guidelines and Bases of Brazilian Education), Law No. 9,394 of 1996), in its Article 80, establishing that the "Public Power will encourage the development and placement of education programs distance learning, at all levels and modalities of education, and continuing education"[6].

Throughout history, although not to the same extent as today, several events were responsible for altering the regular functioning of teaching, for example, in 1916, a polio epidemic in the United States, produced a quarantine condition and consequent closure of institutions of teaching in the first two months of the school year. In 1990, a strike by educators in a community in Belgium paralyzed schools for almost six months. In a more recent context, in 2005, Hurricanes Katrina and Rita led to the closure of schools and the relocation of students between schools in the southern United States[2].

In view of these events, a challenge we observe is how should teachers reconcile personal / domestic activities and their teaching duties? Since these have increased substantially with virtual classes. We can say that during the period of virtual classes, we work much more than before social isolation, where we had our life routines changed.

In this context, the protagonists of this teaching-learning relationship, teachers were faced with this whirlwind of demands to be met, such as: training for the mastery of new tools, perfecting and / or reviewing their teaching and classes plans, in view of the new methodology proposed by the institutions. It should be noted, among other points, that these professionals had their life routines, in many cases, totally altered[5].

The video classes were conducted through Zoom Meetings (a public company, Nasdaq); an internet tool that allows videoconferences and audio, seminars, collaborations and conversations on mobile devices, computers, telephones and classroom systems (ZOOM, 2020), at the same time as the classes. Each day a link was created and sent to the entrance to the video class[6].

At the moment when the educational processes undergo major changes, as in this one, these questions about the inability of technological tools, about the use of differentiated methodologies from the conventional, make the teacher realize that the teaching and learning process also changes. For this reason, it is necessary to develop a training program. For when leaving the physical classroom for the virtual one, other than the usual and ancient use of traditional teaching methods, adaptations are necessary[5].

It is a fact that not all teachers had training or any previous experience with distance learning, or with the use of digital technologies as a didactic resource[6]. In the face of these challenges, were we again provoked to reflect on how we would do it now, amid the tension inherent in the moment in which we live? How to reinvent the profession itself in the midst of a crisis? How to deal with the anguish that surrounds this moment in the face of not knowing how to do, of the unknown?

In private higher education institutions, this change occurred almost immediately to the emergence of the pandemic, under the guidelines of social exclusion and decrees for the closure of teaching spaces, which led researchers to look into the perspective of understanding the impacts of abrupt change in the teaching-learning relationship. The justification of educational institutions is the logic of continuing to provide services to the student, governed by contract, as well as compliance with the academic calendar[5].

It is known that teachers have an extremely important role in conducting the teaching and learning processes,

with regard to organizing and planning the classes, content, materials that will be taught in the process of building the curricular component, deciding how the assessments will be carried out. of students and institutional self-assessments and to foresee and provide strategies to contribute to the construction of students' knowledge[1].

Regarding these actions, we understand that they are more difficult to do, when the focus is on Virtual Learning Environments, even for those teachers who are more familiar with these environments and are concerned with carrying out studies on TDIC.

We emphasize that over the years we have invested in research involving digital technologies in teaching, however we recognize that adapting to the EV model was a major challenge.

With the need for classes solely mediated by technologies, a race begins to guarantee the continuity of teaching[8]. In this sense, how to promote actions so that students are not extremely affected by EV? The challenge was to try to minimize the impacts (mainly of exclusion) of an EV for a portion of the students who could participate in the virtual classes. Here at no time do we defend the hypothesis that teachers need to be converted into Youtubers or that to teach virtual classes they must have in-depth qualification in the use of digital technologies, but that the abrupt change from a classroom environment to a virtual environment needs to be incorporated through strategies, not just the goodwill of the teacher[1].

Another challenge for teachers in this pandemic period is the fact that they participate in a process of changing their pedagogical practice, in which, on the one hand, a considerable part of students already make constant use of digital technologies, mainly through smartphones, and on the other hand, teachers who no longer had time due to their diverse academic assignments, now need to rethink the possibilities of using such technologies in their pedagogical practices[1]. Here we are not talking about the simple fact of knowing a new mobile device, or environment or application, but about thinking and rethinking how to put these resources / devices in your practice and in order to achieve the proposed and applied teaching-learning objectives.

We noticed a significant difference in the conduct of classes in this new proposal. For those who teach in private universities, the replacement of classes took place very quickly, with all theoretical components being replaced by the new format based on technology. Classes continued taking place at usual times, allowing teacher-student interaction, others based on videos made available on digital platforms. It should be noted that this second, less interactive model was widely criticized by students and was soon replaced by a real-time format, in which students with access to the platform could interact synchronously[8].

With regard to training for the proper use of technological tools for classes, teachers were guided by online tutorials and in the best scenario, universities created a support group for teachers and students[8]. We emphasize that in the higher education institution where we operate, there was a situational diagnosis, using questionnaires for teachers and students on technological accessibility to monitor the new pedagogical format.

When thinking about the curricular component that we would teach during the period of social isolation, with a 60-hour workload, in person, we had to adapt them to the new calendar proposed by the educational institution. Short time, different methodology, because we understand that we could not use the same methodological strategies carried out in the face-to-face model. So, as a teacher, what strategies should be used in this new scenario?

In the EV it was necessary to reformulate, simplify, adapt. At no time did we think that we should decrease the quality of classes, on the contrary, we were convinced that they should have elements that help students to build their knowledge during the virtual class period. It was necessary to think about short and objective activities. In addition, we consider the importance of discussing with students the co-participation in studies related to the discipline. Initially, there was a temptation to propose many activities to students, to make several additional activities available, supplementary texts for discussions relevant to the content to be addressed. However, if we did this, we would be complicating or making the process of coping with teaching and learning even more difficult, due to the exhaustion of students and the impact of social withdrawal on their resilience.

After the various questions, given the uncertainties of how to proceed during the virtual classes, we were led to reflect on which TDIC could or should be used. In this regard, we can comment below on some proposals developed during the stage of choosing digital teaching resources for our virtual classes.

Based on the understanding that it is not enough to simply transfer traditional expository classes to digital media, in which the teacher only makes the content available to students, realizing that in this format we would be promoting disinterest in students, as well as contributing to make exhausted teachers, with the mere mechanical reproduction of his expository and little motivational classes.

In this sense, reflecting on what TDIC should be used in the EV, not only involved the technological part, but mainly the pedagogical question. Before the virtual classes start at the higher education institution where we operate, we consider it important to provide personalized and individualized teaching to students so that they could build their knowledge in order to acquire the necessary skills for training, in a perspective of Active Technological Learning[1].

From this perspective, we consider that it is not an easy task to be performed, however it was possible to plan activities that allowed greater engagement with students. One of the first steps was the choice of the virtual learning environment. Understanding that there would be no time to show the functionalities of the virtual environment of our institution of higher education, as it was considered more intuitive, it opted for the Zoom package, with the availability of classes recorded on youtube for asynchronous moments, and as a classroom, for students synchronous moments.

However, it was not just about choosing the virtual environment, it was necessary to have a structured, planned teaching proposal, with clear goals, good digital resources, defining what types of interactions (synchronous or asynchronous) would occur with students.

The use of scientific articles related to the content to be addressed was a strategy that we understand to be relevant in this context. After reading, students answered questions related to the text on Google Form in virtual form and in some cases, students produced collaborative essays on the proposed articles.

The development of quizzes (through Plickers and Socrative) on content was also another digital teaching resource incorporated for synchronous activities. The idea was that students would answer the questions to work on clinical reasoning about certain contents of the curriculum, so that they would project possibilities for use in their future professions. It was possible to apply clinical case studies for asynchronous activities, which were discussed in a synchronous room, in a perspective of problematic learning.

The set of results showed the potential for teaching and learning and enabled adjustments in the continuity of the disciplines considering the limitations of the modality. It is considered that the success of the teaching and learning processes is built by a collaborative regime between those involved, especially in extraordinary situations such as the pandemic, before which there is a need to adapt teaching plans, pedagogical strategies and teaching methodologies, in addition to the importance of the partnership and co-responsibility between teachers and academics in the construction of the teaching-learning process[9].

The first classes were more difficult and challenging, since it was an unprecedented experience for students who, for example, did not know if they could interrupt their speeches or if they would have to wait until the end of the class to clear up their doubts.

The great lesson of this experience was that for an adequate teaching that promotes the participation of students, so that they build their knowledge, it is necessary to have terms: strategies, time and training. These three situations can contribute to the most effective teaching and learning process, whether face-to-face or virtual.

Contrary to old ideas and speculations about the revolution in teaching brought about by technologies, what we observed is that these means should be considered auxiliary in the teaching and learning process, not being the only ones that can transform education[1].

It is reiterated that one of the ways to make the co-responsible structure viable is to execute the pedagogical contract, where both parties can cooperatively adapt expectations, needs, objectives, participatory methodologies, evaluation processes and feedbacks, assuming co-participation in the process and results[9].

IV. CONCLUSION

In the present study, the objective was to present a brief report and reflections on the transition from classroom teaching and its adaptation to online education, with access classes in virtual environments in higher education, in order to enable the student to continue teaching, its implications in the teacher's learning process and performance in the use of digital tools, in addition to considering the positive and negative impacts of this pedagogical adaptation and possible difficulties of teachers in the use of technological devices for the continuity of classes in virtual environments.

In addition to the students' situation, observed in this experience, in the sense of feeling excluded from the process due to the lack of resources, he mobilized a close look from teaching professionals, teachers and managers, in order to plan teaching with a more comprehensive look at the variables socioeconomic conditions.

It was found that in order to obtain a good relationship between technology and user, there must be the minimum necessary training. And even those who somehow already had skills with TDIC presented difficulties in this new modality. In view of the reflections and observations

presented in this report, the model of virtual classes proved to be efficient, with successful experiences and good performance of tasks and activities as planned.

It should be noted that despite this modality being efficient, there were limitations in terms of effectiveness, considering that there was not a total of students with access to teaching / learning, due to geographical and socioeconomic limitations, a factor that compromises the quality of service provision. public and private higher education institutions.

We consider it relevant to inform that the software presented for the class model, proposed by the higher education institution, are adapted models. These tools are means of interaction that serve corporate models, with the aim of connecting employees, and improving team interaction, providing a communications alternative, and even replacing the use of e-mail. In the eyes of the researchers, very well adapted, because it allows the student, a contact with the reality of the professional corporate environment.

Finally, it is also worth considering that in this teaching / learning process, the teacher may be affected by another problem, perhaps unknown, and less noticeable, that is, the frustration of not knowing and fully mastering the tool, expanding their workload in search of this competence. Even more attention is warranted, since all of this, going through the pandemic process, of total social isolation, requires emotional balance and good practices to maintain, also, physical, mental and financial health.

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Psychological distress in people facing financial hardship due to the COVID-19 pandemic in Northeastern Brazil

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***Abstract*—** *This cross-sectional study aimed to identify negative psychological symptoms related to loss of jobs and income in the beginning of the COVID-19 pandemic in 2,983 people aged 18 and over living in the state of Ceará, Northeastern Brazil. Google® Forms was used to deliver an online questionnaire containing open- and closed-ended questions about sociodemographic characteristics and psychological symptoms. Absolute and relative frequencies were calculated for all the study variables. The Chi-squared test was used to check for association between the variables with a significance threshold of 5%. Psychological symptoms were observed in people who had lost their jobs or had their pay cut during the pandemic. Regarding the interference of social isolation with routine, 67.1% (658) of those who had lost their jobs or had their pay cut said their routine changed but they were able to adjust to the new reality ($p<0.001$). In addition, 67.7% (663) showed a feeling of concern in view of the difficulties arising from the pandemic ($p<0.001$), 57.9% (567) felt irritated by the situation they were experiencing ($p<0.001$), 74.2% (727) reported changes in sleep pattern ($p<0.001$) and 71.8% (704) reported feelings of restlessness, tension or nervousness ($p<0.001$). Furthermore, 50.3% (493) of the respondents reported physical symptoms without any apparent causes, whereas 41.4% (830) did not report such symptoms ($p<0.001$). Additionally, 52.9% (518) reported difficulty concentrating on daily activities or "blanking" while 44% (882) did not report such symptoms ($p<0.001$). After summing the negative feelings reported during the pandemic, we found a gradual increase in the percentage of symptoms in people who had lost their jobs or had their pay cut ($p<0.001$). Our findings allow an understanding of the psychosocial impact of financial losses caused by measures taken to tackle the COVID-19 pandemic and can contribute to the development of strategies to minimize such impact.*

I. INTRODUCTION

The new coronavirus (SARS-CoV-2) has undoubtedly captured the world's attention and the COVID-19 pandemic is now a major public health concern. In addition to that, the world is experiencing an accelerated economic downturn with important consequences in the second decade of the 21st century (Mckee & Stuckler, 2020).

The COVID-19 pandemic has brought not only the risk of death from viral infection but also unbearable psychological pressure for people around the world (Xiao, 2020; Duan & Zhu, 2020).

In order to stop transmission of SARS-CoV-2, Brazil has introduced sanitary control and prevention measures, such as social distancing. This measure has been adopted by several countries who have required people to stay at home to reduce the impact of the disease and to flatten the virus transmission curve and thus prevent the collapse of health systems (Bezerra, Silva, Soares, & Silva, 2020; Silva & Muniz, 2020).

In the state of Ceará, in Northeastern Brazil, the first social distancing measures were introduced by a state decree on March 20, 2020, when there were already 55 confirmed cases and community transmission in the country. The decree provided for the closing of places that could have massive gatherings, mandatory quarantine for people with confirmed and/or suspected COVID-19 and the closing of borders in an attempt to slow down the spread of the disease (DOU, 2020; Brazil, 2020).

Despite these measures, the number of cases of COVID-19 continued to growin the state of Ceará, which ranked third in total number of cases, behind São Paulo and Rio de Janeiro only (Silva & Muniz, 2020).

However, some scientists have said that restrictions imposed by governments are controversial and not adequately based on evidence and that there may be psychological consequences for the population as the collateral damage from restrictions could lead to more deaths than the virus itself (Kar et al., 2020; Zhang et al., 2020).

The restrictions imposed may have negative clinical, behavioral and psychological effects on the population and hence worsen other existing pathological conditions, such as overweight due to lack of physical exercise, increased consumption of alcohol, tobacco and other drugs, decreased exposure to the sun, increased domestic violence, worsening of psychiatric illnesses, loss of jobs and pay cuts (Signorelli, Scognamiglio, & Odone, 2020; Boccia, Ricciardi, & Ioannidis, 2020).

Strong restrictive measures also have a substantial effect on the global economy, including an increase in the unemployment rate (Inter-Agency Standing Committee, 2020) and social distancing has been associated with psychological distress, symptoms of post-traumatic stress disorder, depression and higher levels of stress (Brooks et al., 2020).

Like the economic outcome of World War II, the outbreak of COVID-19 has had a damaging effect on global health systems with a cascading effect on all aspects of human life (Nicola et al., 2020). In response to the need to "flatten the curve", the recommendations to close borders, restrict travels, and quarantine announced an economic crisis even in the countries with the world's largest economies (Burkert & Loeb, 2020; Aljazeera, 2020; Buck, Arnold, Chazan, & Cookson, 2020).

The high transmissibility of SARS-CoV-2 potentializes the instability of economies worldwide, especially in Brazil, which can be observed in the fluctuations in the prices of financial assets and commodities and in exchange rates. The COVID-19 pandemic has generated a decrease in production and an increase in interest and unemployment rates and public debt. The pandemic has impacted communities, companies and organizations worldwide by affecting the global economy. In addition to being a public health concern, the pandemic is now major economic concern that is worse than the 2008 crisis and the great depression of 1930 (Ferreira & Santa Rita, 2020; Nicola et al., 2020). In China, for example, travel restrictions resulted in a significant decrease in the supply of products by Chinese factories, while consumption and use of products and services decreased due to quarantine and self-isolation policies (Yap, 2020).

The current scenario has put public managers in a difficult position where they should choose between saving people's lives or saving the local economy. The extension of social distancing measures and the closing of borders can halve the circulation of money in 2020 in the worst scenario for the SARS-CoV-2 pandemic (Silva & Muniz, 2020; OCDE, 2020).

In view of the considerations outlined above, the present study aimed to identify negative psychological symptoms related to loss of jobs and income in the beginning of the COVID-19 pandemic in people living in the state of Ceará, Northeastern Brazil.

II. MATERIAL AND METODS

This quantitative cross-sectional study was conducted with data collected via Whatsapp and Instagram over a period of 72 hours (10th, 11th and 12th of April 2020).We used

Google® Forms to deliver an online questionnaire containing open- and closed-ended questions about sociodemographic characteristics (age, gender, marital status, level of education, household income, employment status and number of people living in the household) and psychological symptoms, including fear of being infected with SARS-CoV-2, concern when someone has to leave the house, interference of social distancing with daily routine, feeling of sadness or worry, feeling of restlessness, tension or nervousness, physical symptoms without apparent cause, change in sleep pattern, difficulty concentrating or "blanking", and difficulty focusing on activities.

Inclusion criteria were age 18 or over, living in Ceará, and completing the questionnaire. The present study did not need approval by a research ethics committee as described in Resolution 510/2016 of the National Health Council. However, the study procedures were conducted following the ethical principles of Resolution 466/12 of the National Health Council (BRASIL, 2016).

Data were analyzed using SPSS® version 24.0. Absolute and relative frequencies were calculated for all the study variables. The Chi-squared test was used to check for association between the variables with a significance threshold of 5%.

III. RESULTS

A total of 2,983 people living in the state of Ceará completed the online questionnaire. In all, 88.2% (2,630) of them were aged 18-59 years, 74.4% (2,218) were women, 52.6% (1,569) were graduate students, and 52.1% (1,551) were either married or in a common-law marriage. As for employment status, 29.2% (870) were civil servants, 23.6% (704) were self-employed and 26% (776) were employees with a formal contract. With regard to household income, there was a higher rate of people with income ranging 2-5 minimum wages [28.6% (853)] and more than 8 minimum wages [27.5% (819)]. A total of 32.9% (980) of the respondents had lost their jobs or experienced pay cuts during the COVID-19 pandemic and 77.9% (2323) reported 2-4 people living in the same household (Table 1).

Table 2 shows the profile of people who lost their jobs or had their pay cut. Most of them were aged 18-59 years ($p<0.001$), had a graduate degree ($p<0.001$), were self-employed ($p<0.001$) and had an income of 2-5 minimum wages ($p<0.001$).

Psychological symptoms were observed in people who had lost their jobs or had their pay cut during the pandemic. In all, 86.3% (846) of the respondents reported fear of getting COVID-19 ($p=0.008$) and 87.1% (854) showed concern in case someone needed to leave home ($p=0.04$).

Regarding the interference of social isolation with routine, 67.1% (658) of those who had lost their jobs or had their pay cut said their routine changed but they were able to adjust to the new reality ($p<0.001$). In addition, 67.7% (663) showed a feeling of concern in view of the difficulties arising from the pandemic ($p<0.001$), 57.9% (567) felt irritated by the situation they were experiencing ($p<0.001$), 74.2% (727) reported changes in sleep pattern ($p<0.001$) and 71.8% (704) reported feelings of restlessness, tension or nervousness ($p<0.001$).

Furthermore, 50.3% (493) of the respondents reported physical symptoms without any apparent causes, whereas 41.4% (830) did not report such symptoms ($p<0.001$). Additionally, 52.9% (518) reported difficulty concentrating on daily activities or "blanking" while 44% (882) did not report such symptoms ($p<0.001$).

Finally, after summing the negative feelings reported during the pandemic, we found a gradual increase in the percentage of symptoms in people who had lost their jobs or had their pay cut ($p<0.001$) (Table 3).

IV. DISCUSSION

The economic effects felt in the first months of the COVID-19 pandemic signaled that there will be serious consequences for the world health and economy that have not yet exactly been measured. The impact on different sectors of society in the short, medium and long term will depend on the response given to this public health problem by managers and civil society.

In our study, 101 (3.4%) of the respondents confirmed having contracted COVID-19. This rate is higher than the official figure published by the Ceará State Health Department on April 1, 2020. The difficult access to tests, which were initially performed only in private laboratories due to political and economic setbacks to acquire rapid testing kits, associated with milder symptoms of the disease may also have contributed to underreporting during this period.

The epidemiological bulletin published on April 14, 2020 – two days after data collection – showed 1,844,863 cases of COVID-19 and 117,021 COVID-19-related deaths worldwide, with a lethality rate of 6.3%. In Brazil, there were 23,430 cases and 1,328 deaths, with a lethality rate of 5.7%. In the state of Ceará, there were 1,989 cases (0.02% of the state's population) and 111 deaths, with a lethality rate of 5.6% (SES, 2020).

In the present study, most of the respondents who had lost their jobs or had their pay cut were younger people,

women, people with higher levels of education and self-employed people. On the other hand, older adults, people with graduate degrees, those with a formal work contract, public servants, and those who reported earning 5-8 minimum wages did not report major financial consequences, perhaps because they experienced greater job security. This finding is supported by Bezerra et al. (2020) who found that the main impact perceived by those earning 5-8 minimum wages (45.5%) and more than 8 minimum wages (52%) was related to the lack of social interaction compared to family stress resulting from the financial difficulties that arose due to the pandemic. In addition, social distancing contributed significantly to the relationship between perception of the impact on income and family stress, which were also more pronounced among people who earned two minimum wages. The same study revealed that more than 90% of the people with an income of up to two minimum wages experienced a greater loss of financial resources compared to those with higher levels of income.

The population can experience loss of income in several ways. They can be directly affected by a government decree closing their workplace or by an infected co-worker or business losses. Although working from home may be an alternative for some people, for others it may not be possible – especially in the public sector and in industries where jobs are precarious and poorly paid (Mckee, Reeves, Clair, & Stuckler, 2017).

Most of the respondents in our study who had lost their jobs or income during the pandemic reported fear of contracting the disease. In addition to the stress associated with the fear of contracting the disease, other factors have also been found to increase psychological vulnerability, namely financial hardship and risk of unemployment, which are associated with worsening of mental health conditions (Strandh, Winefield, Nilsson, & Hammarstrom, 2014; Benzeval et al., 2014).

Thus, it is important to recognize that the COVID-19 pandemic has exposed and exacerbated the existing inequalities in the labor market. People with precarious jobs can be affected by stress and uncertainty and hence be at risk of mental and physical illnesses (Blustein, 2019). In our study, job loss and pay cut were associated with negative psychological symptoms. The respondents who experienced this situation reported feeling more irritated ($p<0.001$), physical symptoms for no apparent reason ($p<0.001$), changes in sleep pattern ($p<0.001$) and "blanking" ($p<0.001$), probably due to the absence of the occupation that was once usual and has been modified.

These changes represent risk factors for mental disorders and worsen the effects of the COVID-19 pandemic crisis. Thus, the COVID-19 pandemic is undoubtedly causing the most serious economic crisis after the great depression of the 1930s (Chang, Stuckler, Yip, & Gunnell,2020).

Job loss, debt and financial hardship are associated with an increased risk of mental illness (Fitch, Hamilton, Bassett, & Davey, 2011; Haw, Hawton, Gunnell, & Platt,2015). Studies have shown that during periods of economic recession the number of people affected by these problems and the rates of depression rise (Chang et al., 2020; Corcoran, Griffin, Arensman, Fitzgerald, & Perry, 2015). Therefore, interventions to mitigate the effect of job loss on mental health are important for an adequate response to periods of recession. It should be noted, however, that although people may enjoy good wages or job security, the severity of the disease itself can affect psychological aspects in the general population.

In addition to the direct burden of COVID-19, the response by the various sectors of society to the pandemic is already causing negative effects such as those described above. These effects are disproportionately felt by people who already have fewer resources and worse health. Therefore, prolonged social problems or more restrictive measures of social distancing can increase health inequalities in the short and long term (Douglas, Katikireddi, Taulbut, Mckee, & Mccartney,2020). Health inequalities and their effect on people's health are more likely to be worse in low- and middle-income countries without social safety nets compared to wealthier countries (Roy, 2020).

It is true that unemployment has devastating effects on the psychological, economic and social well-being of communities (Blustein, 2019). This period of global unemployment is causally and temporally linked to a considerable loss of lives and to diseases, which are generating an intense level of sadness and trauma for many people. This can be confirmed by the negative feelings reported andthe symptoms related to sadness and anxiety during the pandemic, when there was a gradual increase in the percentage of these symptoms in people who had lost their jobs or had their pay cut ($p<0.001$).

V. TABLES

Table 1. Descriptive analysis of the characteristics of the study population.

Variables	n	%
Age		
18-59 years	2630	88.2
60+ years	353	11.8
Gender		
Men	765	25.6
Women	2218	74.4
Level of education		
Complete or incomplete primary education	46	1.5
Complete or incomplete secondary education	324	10.9
Complete or incomplete undergraduate education	1044	35.0
Complete or incomplete graduate education	1569	52.6
Marital status		
Single	1100	36.9
Married/Common-law marriage	1553	52.1
Divorced	274	9.2
Widowed	56	1.9
Employment status		
Employed with a formal contract	776	26.0
Civil servant	870	29.2
Self-employed	704	23.6
Unemployed	407	13.6
Retired/Pensioner	226	7.6
Current household income		
Less than 1 minimum wage	204	6.8
1-2 minimum wages	594	19.9
2-5 minimum wages	853	28.6
5-8 minimum wages	513	17.2
More than 8 minimum wages	819	27.5
Number of people living in the same household (including the respondent)		
Only the respondent	227	7.6
2-4 people	2323	77.9
5-8 people	433	14.5
Job loss or pay cut due to the COVID-19 pandemic		
Yes	980	32.9
No	2003	67.1

Table 2. Characteristics of the population who experienced financial hardship due to social distancing during the COVID-19 pandemic.

Variables	Total	Job loss or pay cut due to the COVID-19 pandemic				p value
		Yes		No		
		N	%	n	%	
Age						**<0.001**
18-59 years	2630	917	93.6	1713	85.5	
60+ years	353	63	6.4	290	14.5	
Gender						0.258
Men	765	264	26.9	501	25.0	
Women	2218	716	73.1	1502	75.0	
Level of education						**<0.001**
Incomplete or complete primary education	46	18	1.8	28	1.4	
Incomplete or complete secondary education	324	150	15.3	174	8.7	
Incomplete or complete undergraduate education	1044	384	39.2	660	33.0	
Incomplete or complete graduate education	1569	428	43.7	1141	57.0	
Marital status						0.101
Single	1100	376	38.4	724	36.1	
Married/Common-lawmarriage	1553	513	52.3	1040	51.9	
Divorced	274	79	8.1	195	9.7	
Widowed	56	12	1.2	44	2.2	
Employment status						**<0.001**
Employed with a formal contract	776	166	16.9	610	30.5	
Civil servant	870	89	9.1	781	39.0	
Self-employed	704	541	55.2	163	8.1	
Unemployed	407	150	15.3	257	12.8	
Retired/Pensioner	226	34	3.5	192	9.6	
Current household income						**<0.001**
Lessthan 1 minimum wage	204	137	14.0	67	3.3	
1-2 minimum wages	594	241	24.6	353	17.6	
2-5 minimum wages	853	254	25.9	599	29.9	
5-8 minimum wages	513	121	12.3	392	19.6	
More than 8 minimum wages	819	227	23.2	592	29.6	
Number of people living in the same household (including the respondent)						0.325
Only the respondent	227	68	6.9	159	7.9	
2-4 people	2323	779	79.5	1544	77.1	
5-8 people	433	133	13.6	300	15.0	

Table 3. Psychological distress in the respondents who experienced financial hardship due to social distancing during the COVID-19 pandemic.

Variables	Total	Job loss or pay cut due to the COVID-19 pandemic				p value
		Yes		No		
		n	%	n	%	
Fear of contracting COVID-19						**0.008**
Yes	2641	846	86.3	1795	89.6	
No	342	134	13.7	208	10.4	
Concern when someone needs to leave the house						**0.040**
Yes	2650	854	87.1	1796	89.7	
No	333	126	12.9	207	10.3	
Social distancing interfered with routine						**<0.001**
No	91	16	1.6	75	3.7	
Interfered with routine but managed to adjust	2268	658	67.1	1610	80.4	
Interfered with routine but could not adjust	624	306	31.2	318	15.9	
Feelings about the COVID-19 pandemic						**<0.001**
Feeling calm despite understanding the severity of the problem	540	135	13.8	405	20.2	
Concerned about the difficulties arising	2129	663	67.7	1466	73.2	
Sad because of the consequences experienced so far	314	182	18.6	132	6.6	
Feeling irritated						**<0.001**
Yes	1486	567	57.9	919	45.9	
No	1479	410	41.8	1069	53.4	
Changes in sleep pattern after social distancing						**<0.001**
Yes	1944	727	74.2	1217	60.8	
No	1039	253	25.8	786	39.2	
Restlessness, tension, or nervousness after social distancing						**<0.001**
Yes	1875	704	71.8	1171	58.5	
No	1108	276	28.2	832	41.5	
Physical symptoms with no apparent cause after social distancing						**<0.001**
Yes	1323	493	50.3	830	41.4	
No	1660	487	49.7	1173	58.6	
Difficulty concentrating while performing daily activities or "blanking" after social distancing						**<0.001**
Yes	1400	518	52.9	882	44.0	
No	1583	462	47.1	1121	56.0	
Number of negative feelings						**<0.001**
0-1	46	8	0.8	38	1.9	
2-3	303	71	7.2	232	11.6	

VI. CONCLUSION

The findings of the present study show the need for further studies to assess the economic impact of the COVID-19 pandemic on the mental health of the population as health is defined as a state of complete biopsychosocial well-being. Moreover, it is important to highlight that the present study was not intended to carry out a clinical diagnosis of any specific mental disorder, but rather identify symptoms that may be related to some level of psychological distress.

Finally, it should be noted that the cross-sectional design of the study does not allow to establish a temporal

relationship between events and determine, with a degree of certainty, whether the relationship between them is causal or not. Also, the online form used to collect data may have contributed to homogeneity in terms of level of educational and socioeconomic status since studies using this tool may exclude people who do not have access to them or are not literate. However, despite these limitations, the results of this study allow an understanding of the psychosocial impact of financial losses caused by measures taken to tackle the COVID-19 pandemic and can contribute to the development of strategies to minimize such impact. Further longitudinal studies should be conducted to assess the extent of these disorders in the near future.

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Investigation of High-Speed Milling and High Efficiency Milling of Ti6Al4V

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***Keywords*— Spacecraft, High-Speed Milling, High Efficiency Milling, Ti6Al4V, Machining.**

***Abstract*—** *Ti6Al4V a Titanium alloy, is one of the prominent materials used in spacecraft components and it is a difficult to machine material. In this paper and experimental investigation is carried out to compare High Efficiency Milling (HEM) and High-Speed Milling (HSM) of Ti6Al4V. The MRR, surface roughness and tool wear were determined from the investigation. From the work it was found out that the MRR for HEM was less than that of HSM, while surface roughness variation was less and no significant tool wear was observed for HEM strategy.*

I. INTRODUCTION

Titanium alloys constitute one of the most important materials in spacecraft because of its high specific strength and good corrosion resistance. Several spacecraft mechanism components are made of Titanium alloy Ti6Al4V. As machining is the most apt manufacturing strategy in realizing the spacecraft titanium parts, owing to the high dimensional and geometric tolerances called for, it is majorly used for the realization of the parts. Of various machining operations, major bulk of the workpiece material is removed using milling operations.

As Titanium is very difficult to machine material due to its low thermal conductivity and chemical reactivity, only limited cutting tool materials can be used. Also due to the poor machinability, cutting tools experience tool wear leading to reduced tool life. Hence, it calls for exploration of advanced machining technologies like High Speed & High Efficiency Machining etc.

II. HIGH SPEED MACHINING

King, R. I (1985) discussed the history of High Speed Machining initially proposed by Salomon and its relevance to aircraft structures made of Aluminium. Ippolito, R et al. (1988) conducted the High-Speed turning tests for steel with ceramic tool to study the effects of machining parameters on surface finish, tool life, chip formation. 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 high-speed grinding of gears. Dagiloke et al. (1995) developed a software package which allows user to obtain process parameters for changing cutting conditions in both conventional and high-speed regimes. 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 the 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 an increase in machining speed. Urbanski, J. P et al. (2000) conducted an experiment to machine the hardened AISI H13 hot work tool steel in HSM regime, using indexable insert ball nose end mills. Tool life of different tool inserts and factors affecting them were investigated and the effect of different inserts on surface roughness values and cutting forces were also studied. Compressed chilly-air coolant was found to increase the tool life. Lei, S., & Liu, W. (2002) developed a new generation of driven rotary lathe tool for high-speed machining of Ti-6Al-4V and conducted experiments for cylindrical turning. When compared with the stationary tool, results showed an increase in tool life for the 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. The tool wear, size of burr and machined surface quality were studied. Rahman, M et al. (2006) presented an overview of developments in the field of high-speed machining of Titanium alloys, geometric modelling and cutting force models for high-speed machining of Titanium alloys. They have also proposed a hybrid cutting force model, based on FEM simulation and Oxley's machining theory, and this model was found to predict the cutting forces accurately. Su, Y et al. (2006) performed high-speed machining of Titanium alloy Ti-6Al-4V under dry, flood coolant, nitrogen oil mist, Compressed Cold Nitrogen Gas (CCNG) and Compressed Cold Nitrogen Gas and Oil Mist (CCNGOM), using coated cemented carbide tools. Results showed that CCNGOM condition increased tool life. Ekinović, S et al. (2007) performed machining tests on different materials with different hardness, different machinability index and by using different experimental approaches. In combination with new cutting tools, common production machines can be effectively in high-speed machining applications. Their work highlighted the advantages of high-speed turn-milling over conventional machining

Study of tool wear mechanism through diffusion wear during high-speed machining is critical in assessing the tool life. Zhang, S et al. (2009) proposed the diffusion analysis of tool chip interface while high-speed milling of Ti-6Al-4V alloy with straight Tungsten Carbide tools. Diffusion was analyzed using Scanning Electron Microscope and dispersive X-Ray spectroscopy. The study showed that pulling out and removing of WC particles due to Cobalt diffusion dominated the crater wear mechanism. Hashmi, K. H et al. (2016) developed an average surface roughness (Ra) model for milling of Ti-6Al-4V alloy using Carbide inserts tooling. Responsive Surface Methodology (RSM) is used to arrive at a relation between Ra and machining parameters. Their findings showed that the depth of cut is the most influencing parameter on surface roughness in high-speed machining range of Ti-6Al-4V while cutting speed and feed rate does not have a notable effect.

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]-[17]. The HSM calls for totally different tool design concentrating mainly on the insert type tools, wherein only the 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 Efficient Machining (HEM), which calls for different tool design, machine tool architecture and machining strategies. (WitGrzesik, 2017 & HEM Guidebook, 2017)

Tönshoff, H. K et al. (1999) explored this very idea of HEM and its variation from HSM. The work reviewed the previous work and existing practices in the aerospace industry and mentioned the requirements for HEM like high spindle power, machine structures, coolant system, cutting tool requirements, drive controls etc. The work also highlighted the advantages of HEM for aerospace components. Potentials of HEM 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 the first two toolpaths performed a rouging operation and the third one removed the staircase pattern left out by first two tool paths. Zhao, W et al. (2004) presented an efficient approach 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 was 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]-[23] it was observed that, very limited work pertaining to comparative study of High-speed machining versus High Efficient Machining of aerospace components, has been done. Since Ti6Al4V alloy is the most commonly used Titanium alloy in spacecraft components and it is a difficult to machine material, exploration of advanced machining strategies especially milling is required. To the best of the authors knowledge and from the literature survey, no work was done to study the High Speed Milling (HSM) and High Efficiency Milling (HEM) of Ti6Al4V for spacecraft components. Hence it is proposed in this work to carry out the experimental investigation of the same for Ti6Al4V alloy.

IV. METHODOLOGY

a. Work Material

Since Titanium components are difficult to machine and they are found in various spacecraft subassemblies, Ti6Al4V alloy was selected for the experiment as it is the most widely used alloy in spacecraft components. The composition and properties of Ti6Al4V are given in Table 1 & Table 2 and HEM is carried out on Ti6Al4V. The composition and properties of Ti6Al4V are given in Table 1 & Table 2.

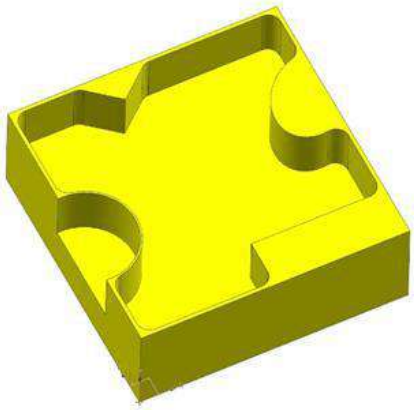

Fig 1. CAD Model of the sample

Table 1. Composition (in %) of Ti6Al4V

Al	5.5-6.5
V	3.5-4.5
Fe	0-0.3
O	0-0.2
Ti	Balance

Table 2. Properties of Ti6Al4V

Density (g/cc)	4.4
Youngs Modulus (GPa)	108
Yield Strength (MPa)	883
Melting Point (^{0}C)	1660
Thermal Conductivity (W/(m-K))	17
Linear Thermal Expansion Coefficient (10^{-6} K^{-1})	9

b. Geometry of test Part

A 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 DMC 650V vertical CNC Milling machine with a maximum spindle speed of 20,000 rpm. A CERATIZIT Indexable cutter with 20mm diameter with TiN-TiB2 (Titanium Nitride - Titanium Boride Coated Inserts) were used for HSM experiment and CERATIZIT TiSiN coated solid carbide end mill cutter with 20mm diameter was specially used for HEM experiment. These tools were used mainly for roughing operations. For finishing operation 3 Flute TiN Coated Carbide End Mill cutter with 10 mm diameter was used. The details of the cutting tool are given in Fig 2.

(a)

(b)

Fig 2. Geometry of Cutting tool
(a) Milling Cutter (b) Carbide insert

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. Sample toolpath for HSM is given in Fig 3.

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=113 m/min

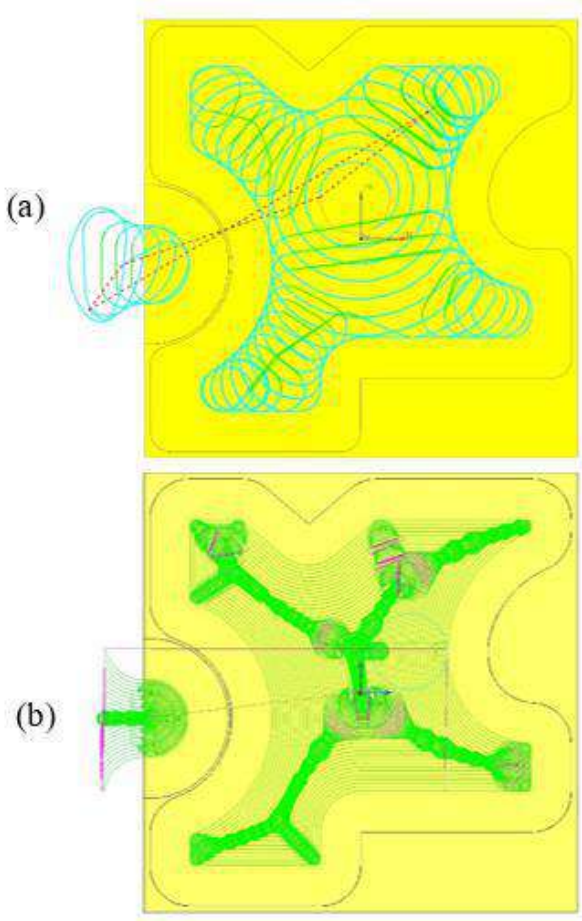

Fig 3. CAM toolpath (a) HSM (b) HEM

(correspondingly, the spindle speed N was 1800 rpm), feed f_z=0.093 mm/tooth (correspondingly, the feed rate for three flute cutter was 502 mm/min), axial depth of cut a_p=0.5mm and radial depth of cut a_e=6mm (30% of 20mm diameter cutter).

The methodology to select the cutting parameters for HEM are elucidated in [23] and same were considered for fixing the HEM cutting parameters. The cutting parameters for HEM were listed as follows: Cutting speed Vc=25.13 m/min (correspondingly, the spindle speed N was 400rpm), feed f_z=0.0625 mm/tooth (correspondingly, the feed rate for two flute cutter was 100 mm/min), axial depth of cut a_p=20 mm and radial depth of cut a_e=1mm (5% of 20mm diameter cutter).

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 up to 20mm depth as per CAD model.

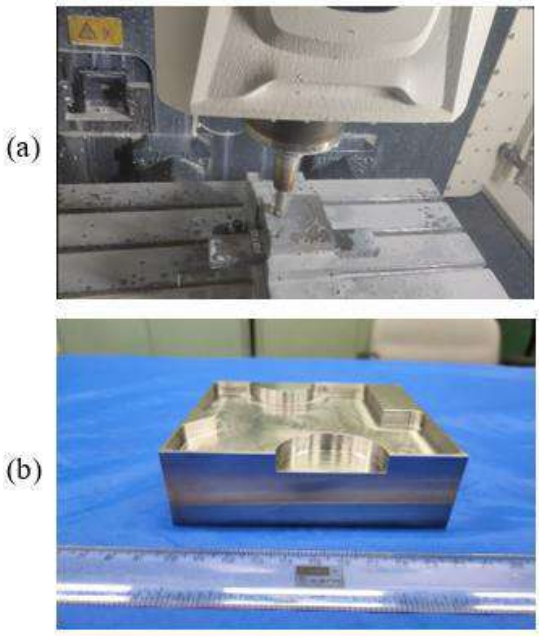

Fig 4. HSM (a) Component under machining (b) Finished Component

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 cleaned 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.

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 HEM is around 7% less than that of HSM. This may be because of the very less radial depth of cut, leading to longer toolpath.

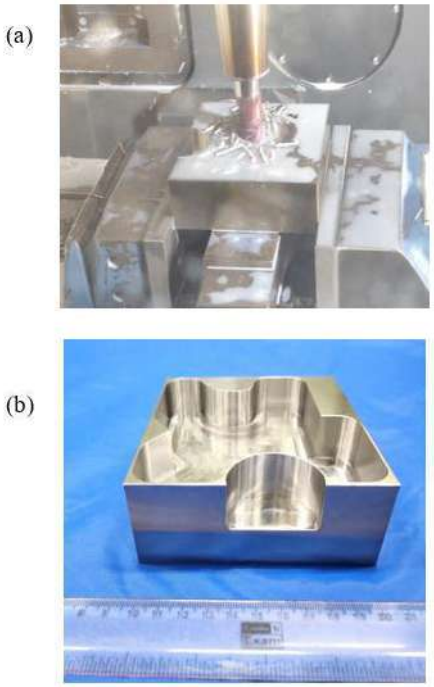

Fig 5. HEM (a) Component under machining (b) Finished Component

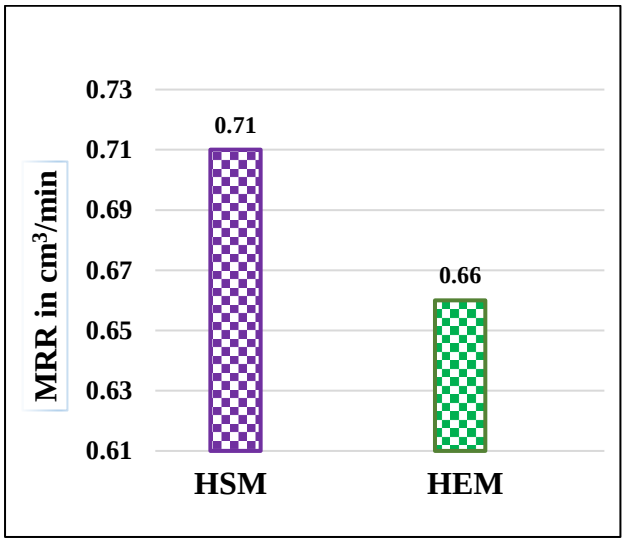

Fig 6. Material Removal Rate (MRR)

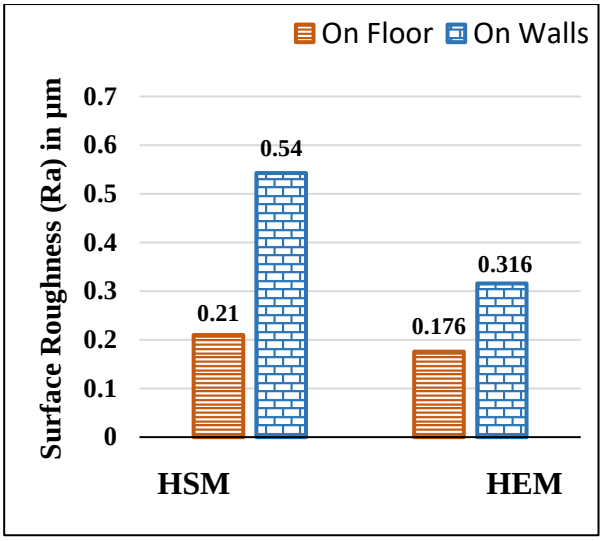

Fig 7. Surface Roughness (Ra)

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 HEM was less than that of HSM while SR values on walls was considerably high for HSM than HEM. This may be due to gradual wear of the tool.

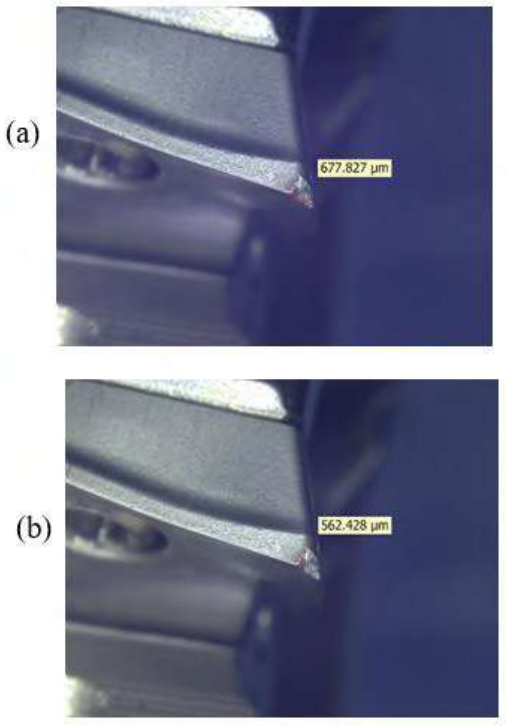

Fig 8. HSM flank tool wear
(a) Lengthwise (b) Widthwise

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 flank wear of 0.677mm on lengthwise and 0.562mm on width of the flank was observed. However, for HEM no flank wear was observed but loss of coating was observed for both length and width of flak wear. The increased axial depth of cut with less speeds and feeds compared to HSM may be the cause of coating loss on tool and absence of tool wear.

c. Chip Morphology

In HSM, the chips are shorter and curly, 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 optimum cutting length, the length of the chips is more, due to more depth of cut.

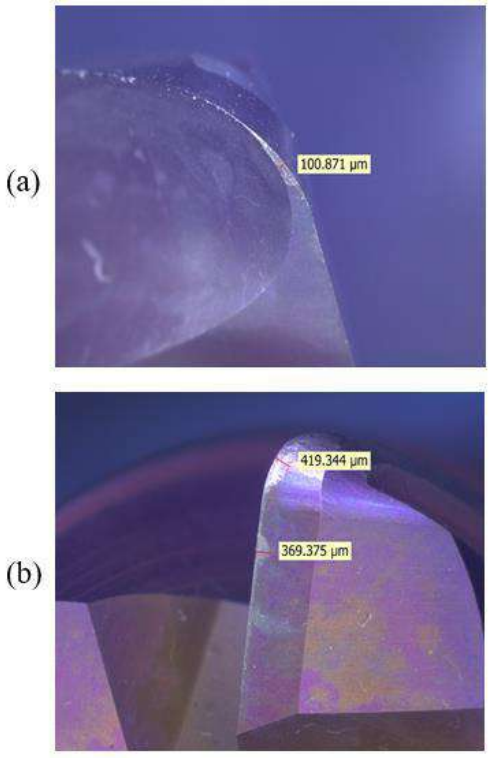

Fig 9. HEM flank tool wear

(a) Widthwise (b) Loss of coating

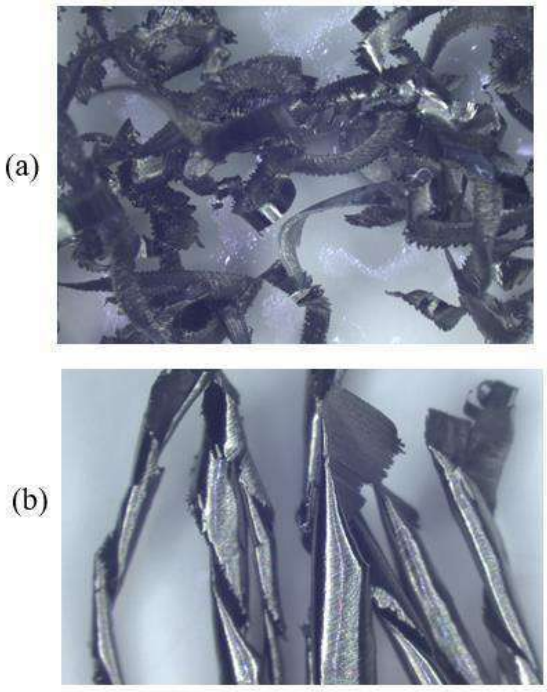

Fig 10. Chips during machining

(a) HSM (b) HEM

VI. CONCLUSION

It can be inferred from the experiment conducted that, there is slight decrease in MRR for HEM than HSM. However, HEM was instrumental in generating better surface finish and lesser tool wear compared to HSM. It can be seen that for Ti6Al4V, HEM seems to be more promising than HSM. However, owing to several factors, the trade-off between HSM and HEM while machining spacecraft components would be a suitable option, depending upon the component than choosing only one method.

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Fish and Fisheries in India is improving due to COVID Time

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***Keywords*— Marine zone, Fresh water zone, Riverine system, 2021.**

***Abstract*—** *Marine zone in India is mostly in Deccan plateau. In West Bengal, Midnapur& 24 Parganas(S) is mainly placed beside coastline. Many tourist's spots and fish landing stations are located in these two districts. Since March 2020 India is facing problems due to lock down phase. Fish and fisheries sector is improving due to non-usage of marine zone and riverine system in West-Bengal. Good production will be in those marine zone as well as in fresh water zone is obvious in next year i.e 2021.*

I. INTRODUCTION

In India major river system contains Ganges, Indus, Yamuna, Bias, Jhelum, Tapi, Narmada, Godavari, Krishna, Cauvery, Brahamaputra, Teesta ,Torsa, Ajoy, Damodar, Hooghly, Kangshabati, Dwarakeswar, Rup Narayan, Jalangi , Churni, Mahanadi, Mayurakshi, Ichhamati, Saptamukhi, Thakuraan, Gosaba, Matla, Vidyadhary, Herobhanga, Bhagirothi are located.

Coastal belt near Bakkhali and Digha is almost 220 km. stretch in West Bengal. Bakkhali is in South 24 parganas, whereas Digha placed in Midnapur(E).

Total area is under Sundarban Biosphere Reserve. 210 islands scattered in three districts. South 24 Parganas, Midnapur(E) and 24 Parhganas (N).

Biggest delta in Asia continent declared as World Heritage Site in the year of 1984. Major portion is shared by Bangladesh (~ 60%) and (~40%) by India.

Fish and Fisheries sector is important as people are dependent on fish as major protein source in their daily intake of food. In every house and people living in coastal belt (Marine zone) are very fond of fish in their diet. (Iyenger, 1988).

In Covid-19 period due to less catch and supply in major Cities like Kolkata, Chennai, Delhi and Mumbai fish can grow in water without hindrance. Over exploitation in marine water is also a cause for fish catch depletion in last 5 years (60%-56%).

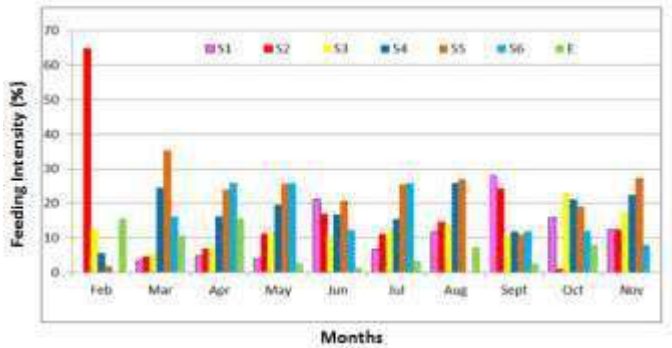

Fig-1 Liza tade catch for 10 months to observe feeding intensity (Source: Google)

II. MATERIALS AND METHOD

Fish variety from different locations in India proves that it is improving during Covid -19 period (i.e from March to till date). Healthy fish are available now in market.

Weight and Length has increased due to non- exploitation in marine as well as in fresh water.

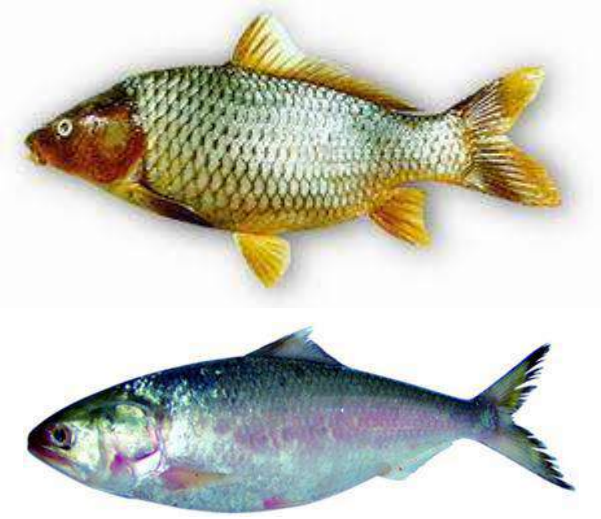

Fig-2 C. Carpio fresh water and H.ilisha marine fish are healthier now.

III. RESULT

People will get more fish variety in market like fresh, estuarine as well as marine variety.

Most of the city dwellers like to buy fish and preserve in their refrigerator. In hotel and restaurant supply required everyday.

Hospitals required fish supply to cure patients rapidly. Collagen fibre in fish muscle tissue helps to improve health. (Dr. Axe)

IV. DISCUSSION

Due to non supply in market during lock down phase 2-3 months fish life become safer in water both in fresh as well as in marine zone. In West Bengal supply starts (perishable items and vegetable with proper precaution) after 3 months. Media persons help to aware people regarding all cases of CIVID-19 positive patients.

Corona virus is spreading worldwide and death toll is increasing. Doctors and Pharmaceutical industries are working hard to solve problem. Research findings help to invent vaccine for the disease. In U.K. Oxford University proves the dosages but it requires application in large scale. Marketing is necessary for implementation for mankind.

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Improvement of LEACH based on K-means and Bat Algorithm

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***Keywords*— Low-energy adaptive clustering hierarchy protocol, Bat algorithm, Energy efficiency.**

***Abstract*—** *A low-energy adaptive clustering hierarchy (LEACH) routing protocol has been proposed specifically for wireless sensor networks (WSNs). However, in LEACH protocol the criteria for clustering and selecting cluster heads (CHs) nodes were not mentioned. In this paper, we propose to improve the LEACH protocol by combining the use of K-means algorithm for clustering and bat algorithm (BA) to select nodes as CHs. The proposed routing algorithm, called BA-LEACH, is superior to other algorithms, namely PSO-LEACH, which using particle swarm optimization (PSO) to improve LEACH. Simulation analysis shows that the BA-LEACH can obviously reduce network energy consumption and optimize the lifetime of WSNs.*

I. INTRODUCTION

The WSNs consist of sensor nodes (SNs) with limited energy, SNs collect environmental parameters and transmits information to the base station (BS). In WSNs, routing protocols aim to optimize the energy use of SNs. Several routing protocols were proposed of which LEACH was the first and most commonly used hierarchical routing protocol (Singh et al., 2017). In the LEACH protocol, SNs are clustered, each cluster randomly selects one SN as CH, and the clusters perform the function of collecting and transmitting data to the BS via CH. By the way, LEACH can extend the life of the network, reducing the energy consumption of each node. However, the LEACH protocol does not consider the current node energy and random selection of CHs can easily lead to uneven energy consumption between network nodes, shortening the network life. Recent LEACH improvement clustering routing protocols for WSNs will be proposed based on CH selection and cluster formation methods., many of which reduce energy consumption in the LEACH protocol; others consider the energy consumption balance (Cui et al., 2019; Singh et al., 2017). Most of the recent improvements are based on CHs selection using nature-inspired algorithms. Typical of which are improving LEACH using PSO (PSO-LEACH) (Edla et al., 2019; Nigam & Dabas, 2018).

The bat algorithm (BA) is a new stochastic optimization technique based on bat behavior. This algorithm has been successfully used to solve various kinds of engineering problems (X. Yang, 2014; X. S. Yang, 2010). BA better than PSO optimization in terms of speed of convergence, robustness, and accuracy (X. S. Yang, 2010).

In this paper, the BA-LEACH routing algorithm based on BA and K-means algorithm is proposed. The rest of this paper is organized as follows: In Section 2, we review the background of the LEACH convention and BA. Section 3 uses BA for CH selection optimization. Section 4, we verify the proposed improvements through simulation

experiments by comparing with LEACH and PSO-LEACH, and at the end of the paper, the conclusions are presented.

II. RELATED WORK

2.1 Low-energy adaptive clustering hierarchy

LEACH protocol was the first hierarchical wireless sensor routing protocol, which was proposed by Wendi B. Heinzelman in 2002 (Heinzelman et al., 2002). Fig.1 shows the architecture of LEACH

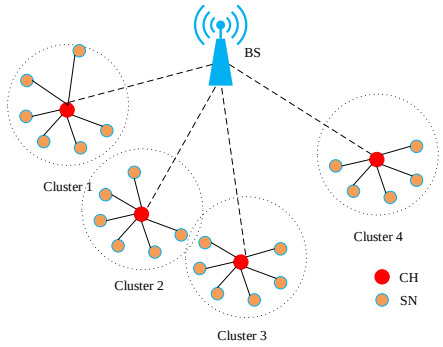

Fig.1: Architecture of LEACH

LEACH operation is divided into several rounds, each consisting of two phases: set-up phase, CHs selection processed and steady-state phase, the CH for each cluster receives and aggregates the data from cluster members and then transmits the aggregated data to the BS. CH selection is performed at the beginning of each round. Each sensor node decides independently of other senor nodes whether it will claim to be a CH or not, by generating a random number between 0 and 1 comparing with a threshold $T(n)$. The node is elected as a CH at current round if the number generated is less than a certain threshold $T(n)$. The threshold value is computed using (1)

$$T(n)=\begin{cases}\dfrac{P}{1-P\left(r \bmod \left(\dfrac{1}{P}\right)\right)}, & n \in G \\ 0, & n \notin G\end{cases} \quad (1)$$

where n is the number of nodes, P is the denoted percentage of the node to be selected as CHs, r is the round for which cluster the head is selected, and G is the set of nodes that have not been accepted as CHs in the last $1/P$ rounds. After choosing the CH node, the entire network is informed by broadcast.

2.2 Bat Algorithm

Bat algorithm proposed by Xin-She Yang in 2010, which utilizes the behavior of nature bats [5]. This algorithm shows its superior capabilities when applied to the problem of global optimization. The BA is summarized as follows:

In BA, the position and velocity of the $t-th$ bat at the iteration $(t+1)$ are given by (2):

$$\begin{aligned} f_i &= f_{\min}+(f_{\max}-f_{\min})\beta, \\ v_i^{t+1} &= v_i^t+(X_i^t-X_{best})f_i, \\ X_i^{t+1} &= X_i^t+v_i^{t+1} \end{aligned} \quad (2)$$

where β is a uniformly distributed random vector in the range $[0,1]$; X_{best} is the best solution after the $t-th$ iteration. To avoid falling into local optimization, a new solution for each bat is created around the most optimal solution chosen by (3)

$$X_{new}=X_{best}+\varepsilon A^t \quad (3)$$

In which $\varepsilon \in [0,1]$ and A^t is the average loudness value of all bats at $t-th$ iteration. During the optimal search process, the loudness and the emitted pulse rate are updated according to equations (4)

$$\begin{aligned} A_i^{t+1} &= \alpha A_i^t, \\ r_i^{t+1} &= r_i^0\left[1-\exp(-\kappa t)\right] \end{aligned} \quad (4)$$

where $0<\alpha<1$ and $0<\kappa<1$ are constants.

III. IMPROVED LEACH APPROACH

3.1 Fitness function

In WSNs using the LEACH protocol, energy consumed when transferring from $i-th$ sensor node (SN_i) to CH node is determined by (2) (Heinzelman et al., 2002)

$$E_{SN_i-CH}(k)=\begin{cases}k\left(E_{Tx}+\varepsilon_{mp}d_{(SN_i,CH)}^4\right) & if \quad d_{(SN_i,CH)}>d_0 \\ k\left(E_{Tx}+\varepsilon_{fs}d_{(SN_i,CH)}^2\right) & if \quad d_{(SN_i,CH)}\le d_0\end{cases} \quad (5)$$

where E_{Tx} is transmitter energy per node, k is number of bit per data packet, θ_{mp} is amplification energy when distance from a sensor node to CH is greater than threshold d_0, θ_{fs} is amplification energy when distance from a SN to CH is less than threshold d_0

$$d_0=\sqrt{\frac{\theta_{fs}}{\theta_{mp}}} \quad (6)$$

$d_{(SN_i,CH)}$ is distance from $i-th$ SN to CH.

The energy consumed when transmitting the signal from $j-th$ cluster head (CH_j) to BS station is calculated by (4)

$$E_{CH_j-BS}(k)=\begin{cases} k(E_{Tx}+E_{DA}+\theta_{mp}d^4_{(CH_j,BS)}) \\ \quad if\ d_{(CH_j,BS)}>d_0 \\ k(E_{Tx}+E_{DA}+\theta_{fs}d^2_{(CH_j,BS)}) \\ \quad if\ d_{(CH_j,BS)}\le d_0 \end{cases} \quad (7)$$

where E_{DA} is data aggregation energy, $d_{(CH_j,BS)}$ is distance from $j-th$ CH to BS.

Our aim is to select the central node so that the total energy consumed during transmission and receiving data in the cluster is minimal. Furthermore, the energy transmitting and receiving data between sensor nodes were highly dependent on the distance between them. Therefore, we proposed the fitness function for selecting CH node as follows:

$$Fitness=\psi\left(E_{CH_j-BS}(k)+\sum_{i=1}^{M}E_{SN_i-CH}(k)\right) + (1-\psi)\left(d_{(CH_j,BS)}+\sum_{i=1}^{M}d_{(CH_j,SN_i)}\right) \quad (8)$$

In (5), $\psi\in(0,1)$ is the weight, set at 0.9 in this experiment based on study (Miao et al., 2016), M is the number of nodes in $j-th$ cluster.

3.2. Improved LEACH based on K-means and Bat algorithm

The BA is applied to determine SN as CH so that energy consumption and the total distance is minimum. In this algorithm, each bat has a position $X(x_d,y_d)$ with a velocity of movement is v_i. The position of each bat is evaluated by the fitness function, and the best position is the one that best matches the requirements of the problem. In the problem of finding the CH node in a cluster of sensor nodes, each network node in a cluster is considered as a bat with hypothetical coordinates in two-dimensional space with corresponding travel velocity v_i. The K-means algorithm is used for clustering, which aims to partition N sensor nodes into K clusters in which each SN belongs to the cluster with the nearest mean (cluster centers or cluster centroid). Combining K- means and BA algorithm to improve LEACH, called BA-LEACH. The pseudo-code of BA-LEACH is described as (2).

IV. SIMULATION RESULTS

Input: Positions, Energy of SNs, position of BS …
Output: CHs position, state of each SN, Energy consumption in each SN.
Set parameters: N (number of SN) $f_{\min}$, r_i, A_i, Max_round (loop number)
While not all node dies
  Compute the number of cluster by (1)
  Clustering nodes according to K-means algorithm
  While (i< Max_round)
  Compute the Fitness(X_i), of each particle using equation (8) find the best position and set it to X_{best}.
  If rand > r_i
  Update the temp position for the corresponding bat use (3)
  Else
  Update the temp position for the corresponding bat use (2)
  Calculate Fitness(X_i)
  If Fitness(X_i) < Fitness(X_{best}), then update X_{best} = X_i.
  i = i+1
  Increase r_i and reduce A_i use (4)
  SN with the X_{best} position is selected as CH
end.

Fig.2: Pseudo-code of BA-LEACH

This section describes the various parameters in scenario simulation and the results of the proposed protocol. A 500 x 500-dimension field is taken for conducting the experiment. All sensor nodes are uniformly

Table 1: The parameters of BA-LEACH

Parameter	Value
Network field	500mx500m
Number of SN	100
Initial energy of Nodes E_0	0.5J
E_{Tx}	50 nJ/ bit
E_{Rx}	50 nJ/ bit
E_{DA}	5 nJ/ bit/
Message Size	4000 bits
θ_{mp}	0.00013pJ/bit
θ_{fs}	10pJ/bit
Maximum No. of Iteration	3000
ψ	0.9
P	0.1

dispersed in the above-mentioned sensor field and it is supposed that the BS is located in the corner of the sensor field. The parameter settings of simulation as described in Table 1.

Fig.3 shows the comparison of live nodes in each round for LEACH, PSO-LEACH, and BA-LEACH algorithms, and Fig.4 shows the average of energy in each

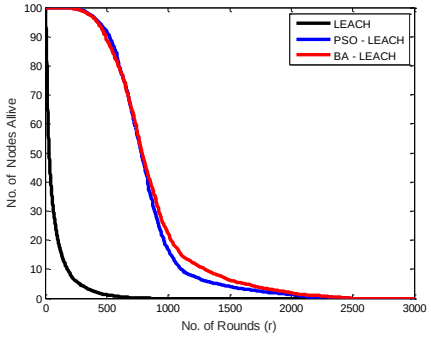

Fig.3: The number of live nodes

round of LEACH, PSO-LEACH with BA-LEACH protocol. In this, the number of live nodes and average energy corresponding rose considerably in BAT-LEACH and PSO-LEACH protocol when compared with LEACH protocol. Furthermore, the number of live nodes in BA-LEACH was higher than that of PSO-LEACH.

Fig.5 shows the time fist node, middle node, and all node dead in LEACH, PSO-LEACH, BA-LEACH protocol. It is clear that in LEACH all node dies after 631

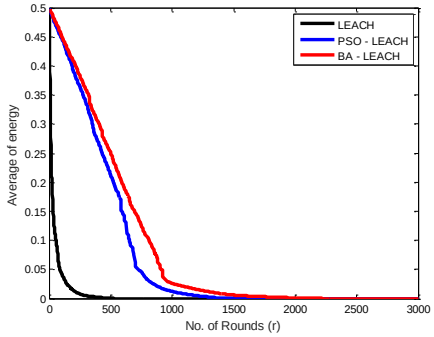

Fig.4 The average residual energy

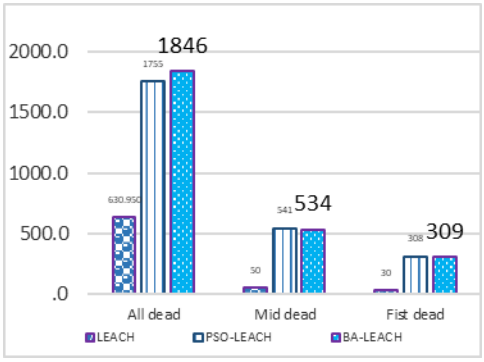

Fig.5 Compare the time when the fist, middle and all nodes dead

rounds, in PSO-LEACH all node dies after 1755 rounds, and that number in BA-LEACH is 1846 rounds. The time life of WSNs using the PSO algorithm increased 64% and using the BA algorithm increased 65.8% compared to LEACH.

The proposed protocol is implemented in MATLAB 2018b environment using window 10 based Lenovo Idea pad laptop with 2.0 GHz, Intel Core i3 processor and 6 GB RAM. Result simulation in Monte Carlo 300 times, the average time using in PSO-LEACH was 0.1269s and 0.0393s in BA-LEACH. So that, our suggestions improved LEACH protocol 65.8% in time life and reduced computation time compared to the PSO-LEACH algorithm 30,9%.

V. CONCLUSIONS

In this paper, an energy-efficient routing algorithm for WSNs has been proposed which considers selective clustering of CH nodes. By using the K-means algorithm for clustering, using BA to select SN as CH node leads to

reduced average WSNs energy consumption, WSNs life is extended compared to LEACH, PSO-LEACH.

ACKNOWLEDGEMENT

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Slavery and slave Trade Activities: The case of Blackbirding in the Pacific Ocean and Interiors from the 19th to the 21st centuries period

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***Keywords*— Poor, conditions. Plantations. Pacific. Oceans, enslavements, Blackbirding, trade, slaves. Brutalize, millions, lost, lives, combating, sea, ills.**

***Abstract*—** *Poor conditions at sugar and other plantations in the Pacific Oceans as study territory or area tells, led to the outbreaks of disease and deaths in massive rate or amount. This was a form of human labour enslavements hence slavery and slave trade in the 19th and 21st centuries. Here, we are interested to find out, to know what Blackbirding is all about and what surrounds the word. From considerable operations, of investigations, documents and internet research, we unveiled all the slaving activities as characteristics of this phenomenon from 1800 to 2019.Furthermore, this paper rotates on the axis of Blackbirding, some samples that deed on tables, statistics and others and the applications of laws that helped change the course of events as this history is concern. Our analytical presentation of materials gotten from documents and investigation sources serve as methods. To add more, we drew our result from the substance that, the trade on slaves hence Blackbirding actually existed in this part of the continent, possible means were used to bundle and erase the action that brutalize humanity and simplify their vitalities. Many millions of people lost their lives and properties. What should be noted is the fact that efforts were made, is currently going on combating these sea water ills.*

I. INTRODUCTION

The Pacific Region Slavery, (Blackbirding) started because or due to the fact that other countries abolished it. Aboriginal people were blackbirded and used in the pearling, sugar cane sheep and cattle industries. They suffered terrible abuse and were denied their small or no wages. slavery is “the condition in which one person is owned as property by another” and the owner has "absolute power” over their "life, liberty, and fortune”. Such people are usually forced into work "in harsh conditions for low pay”. During the period of Blackbirding, Australia’s slaves Blackbirded worked in all essential industries, from the 1840s through to the 1970s: The first slaves to reach Australia from the South Sea were used as shepherds on properties in southern New South Wales, but died like the red Indians but due to cold.When the American Civil War cut off the world's cotton supply, Australian slaves were used to establish cotton plantations in southern Queensland. A strong male Blackbirded would cost the modern equivalent of between $5 and $19, while women, particularly Tahitians, who were regarded as the most attractive, often fetched $32.Between 1842 and 1904 more than 60,000 men and boys from the South Pacific islands, and an unknown number of women and girls that make the economy vibrant, were kidnapped and brought to Australia to work as slaves on the sugar plantations that still dot the country's north-east coast. Between the 1860s and the 1970s, aboriginal people of all ages were taken from their homes and sent to work on cattle and sheep properties or farming all across Australia. Several such schemes were run by colonial and State Governments mostly from Europe, theoretically to protect aboriginal Australians from mistreatment. Mistreatment was abundant and rife. The Government of Queensland

filesproves and shows that, from the early 1900s, for 20 years there were no limits on how many hours aboriginal people worked, how hard was the labour, how bad was the treatment or the provision of food and living quarters. Minimum situation or conditions, introduced in 1919, were greatly and wildly ignored in the absence of any inspections in the Pacific region.In the Pacific, more than 1.000.000 people are thought to have been blackbirded, meaning manipulated, dribble and tricked, coerced or forced into indentured labour or slavery at this time called the blackbirded, a practice that is thought to have ended over a century ago but still mingle in the Pacific region and others. There are calls for a formal system to help the descendants of blackbirded Pacific Islanders find their relatives.[1]Here, the question pose is how was slavery and slave trade activities carried out like the case of Blackbirding in the Pacific Ocean Region and the interior in the nineteenth and twentieth first centuries? To answer this question, it will be interesting to rotates on the following points: Conceptual issues in the Pacific Ocean slavery and slave trade affairs, 'Blackbirding', The Population, Horrific sampling of Blackbirding, Research tables and additional Severe Rift Attacks on Blackbirding Activities (Tables), statistic and Data Collection. Representations in tables. And Protecting the Ability to Trade in the Indian Ocean as preventive Responses to Blackbirding

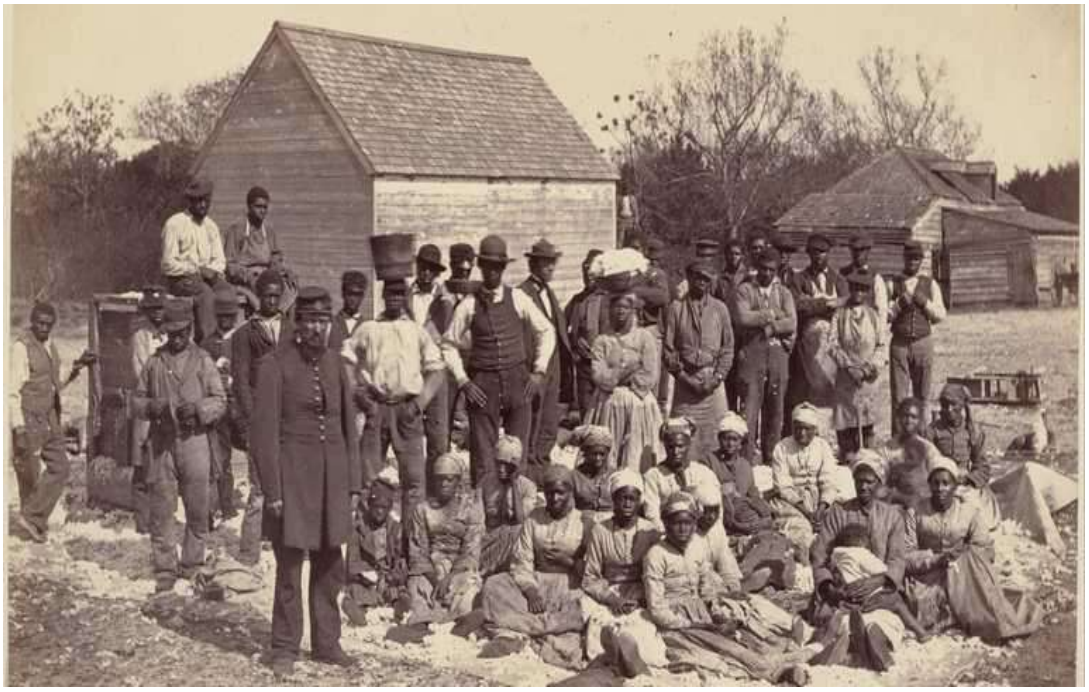
A. Conceptual issues in the Pacific Ocean slavery and slave trade affairs, 'Blackbirding'.

Blackbirding is an etymological oretymology which is a term, may have been formed directly as a contraction of "Blackbird catching" thus "Blackbird." This was a slang word or term used by the local indigenous people referring to the capturing of persons and forced them into slavery passing them into or via slave trade.The first major Blackbirding activity was conducted out of Twofold Bay in New South Wales, found in Australia. In later periods it extended to other areas within and out of the Pacific Ocean. It is well noted that areas like Samoa, Hawaiian islands and the United State of America suffered severely with extreme death rate, followed by Australia, New South Wales, Queensland, Western Australia, Fiji, French Polynesia, Mexico and Guatemalia,New Caledonia, Peru, America and others.[2]

[1]Jens Korff**,***Australia has a history of Aboriginal slavery*. *Last updated: 29 June 2020*. (Pacific Vanuatu). Jacob Miley, *Was John Mackay a black birder?* Dailey Mercury News, 3rd March 2017, (7:00AM).

[2] Etymology is the study of the origin and history of words and their meaning or the origin and history of a particular area.

Picture: Slavesin America, 'The Blackbirded'



Source: Henry P. Moore**,** American Slave of General-thom as f drayton-g

Blackbirders; This involves the owners captains and crew of the ships involved in the acquisition of these labourers as slaves. Theword blackbirders demanded for cheap labour or nothing as reward that principally came from European colonists in NewSouth Wales, Peru, Queensland, Samoa, New Caledonia, Fiji, Tahiti,Hawaii,Mexico, and Guatemalia.[3]Blackbirded; They were the caught or in other words slaves. They were used labouring in sugarcane, cotton and coffeeplantations in this lands, hence they were also exploited in other industries.

Picture: The Blackbirded of South Sea Islanders in a Sugarcane Plantation

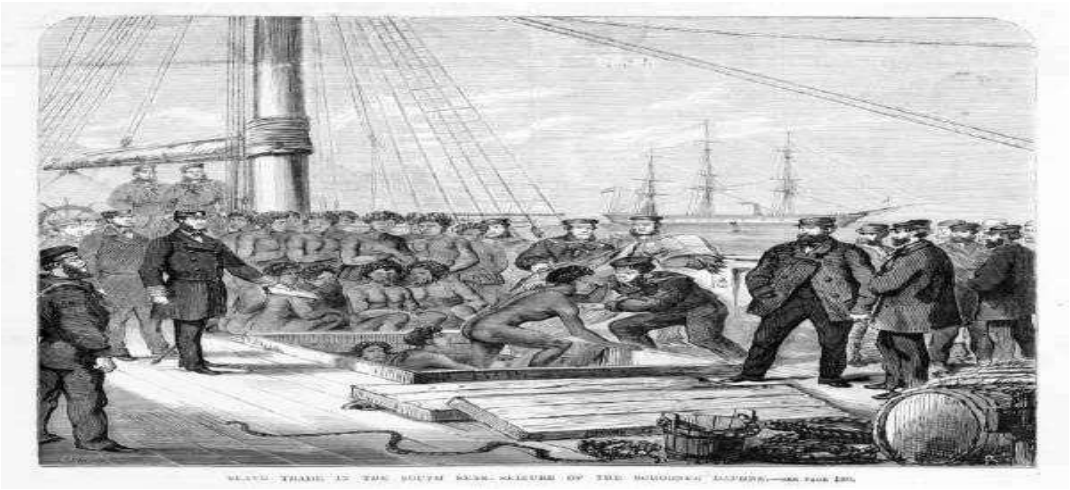
Source: The sugar labour trade:https://dl.nfsa.gov.au/module/364

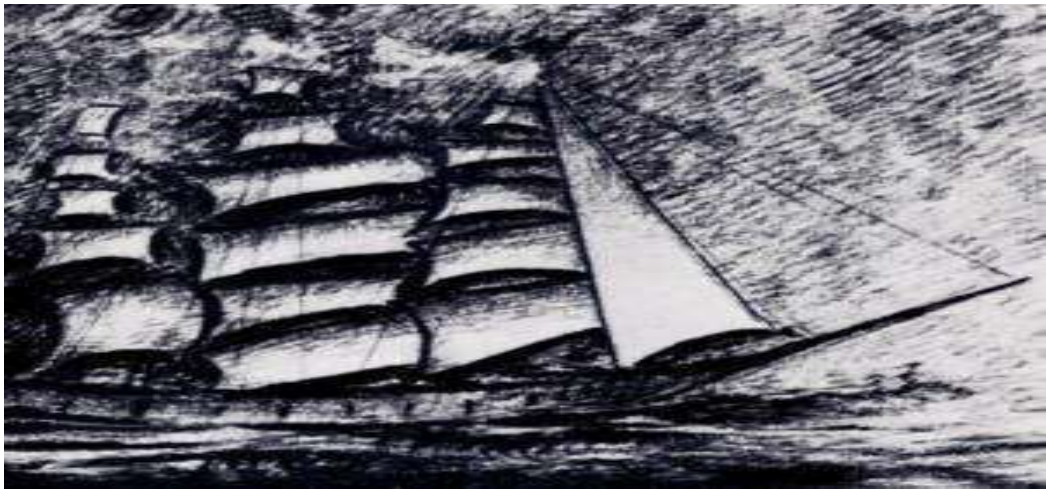
Blackirding ships; These are large sea and Ocean vessels that began operations in these areas and the Pacific Oceans from 1840s which continued into the 1930ˢ.It should be noted that blackbirders from the Americas sought or searchfor

[3] Emma Christopher,Cassandra, Pybus and Marcus Buford Rediker, *Many Middle Passages: Forced Migration and the making of the Modern Wolrd*, University of California, press,pp. 188-190

workers for their plantations and to mine the guano deposits on the Chincha Island, thus the organised blackbirding trade took placein areas like some colonists; Queensland, Fiji and New Caledonia thatused those that has been blackbirded as labourers at various plantations especially or particularly those producing sugar-cane. (**seepictures**).

Pictures: Blackbirding Ships in The Pacific Ocean (Daphne, Virginia)





Source: Authors Research Photos

The word blackbirding could also mean a reserve underground Rail road, but this is not related to account of all aspects of blackbirding in the Pacific Seas and Oceans that link America, South and North Eastern Asia not

leaving out Australia and her close Vicinities. Therefore, Blackbirding can be confined as an involvement of coercionof people through deception and orkidnapping to as unpaid or poorly paid laborers' in countries distant to their native land. The term has been commonly applied to the large scale taking and carrying of people as such indigenous to the numerous islands in the Pacific Ocean during the 19th to the 21st centuries. Those that were blackbirded were people,they were taken from places such as the Solomon Islands, Vanuatu, Niue, Easter Island, Gilbert Islands, Tuvalu and the Islands of the Bismarck Archipelago amongst others.[4]

Reserves underground rail road blackbirding; This as noted took place in the UnitedState of America since before colonial and colonial period from1800 to 2019.The reverse underground rail. Road existed to capture free Africa-Americans and Fugitive slaves and sell them into slavery which was and has been prevalent inthe 19thcentury, during and after when the Trans-Atlantic slave trade was outlawed.[5] This was outlaw same or similar as that of the Pacific Ocean slave trade . In Africa those groups that were implicated in supplying and most slaves, werethe Aro, Oyo and the Hausa which they also experienced internal crisis and struggling and Yoruba city-states ended up engaged inintercedewars for control of the slave trade. This paraded almost inline of prevalent operation in the reverse underground railroad, blackbirding that tantamount to conflict. From Bell Richard CounterfeitKin: Kidnappers of colour, the Reverse Underground Railroad, and the origins of practical Abolition, people of Africa and Mixed ancestry commonly took part in these operations in order to make aliving. Some worked under white employers, playing instrumental roles in deceiving fellow African-Americans and luring them into traps, while others pointed slaves.Owners to the location of their escaped slaves to the got bounty on the slaves head. The kidnappers were recorded to have acted against their family members in addition to others members of the community. Their careersalso tended to be long due to African-Americans particularly children being more inclined to trust them than whitepeople. Successful kidnappings mainly relied on the blackbirders developing a connection to target by using their shared racial and cultural identities.[6] However it was and still prevailed in the 21st century. New York,California, Philadelphia, and others were particularly prominent places for these kidnappers to work, causing fear of being kidnapped by anyone to become prevalent. In case of being kidnapped some lost their lives for enslavement refusal,while those captured, by those who captured become practical blackbirdingas slaves.[7] The British Pacific highlights in the 19th century in particular experience or witness an imperial connections between the French and the British on the perspective of, on Blackbirding for an Anglophone audience as experience and recounted by an author Georges Baudoux's. New Hebridean mining employees went on when Anglophone, Francophone and pacific inhabitants or people interacted, exchanged and moved in and out of each other's lives, perhaps more frequently than today but all entails the pacific history of blackbirding as seen with the slave workers, for example the Queensland kanaka workers. The frequentepisodic actions from Blackbirding gave rise to anti Blackbirders which imagine couldno longerbare the aforementioned activities, freed some passengers in 1869, HMS Rosario, seized the blackbirding schooner Daphne with several slaves onboard. (**see first picture of Daphne above**). Areas such as Australia, America, thePhilippines, Hawaiian, and Tapan including the entire pacific oceanic took part in the slave trade in line with notion of blackbirding which has become a historical jargons or parlance of historical tales presentation.[8]

B-The Population, Horrific sampling of Blackbirding, Research tables and additional Severe Rift Attacks on Blackbirding Activities (Tables), statistic and Data Collection. Representations in tables.

According to census carried out in the 1900s, the Pacfic Region made up of more than 20 countries and above 250 Islands supplied Blackbirded to work in Pacfic Plantations as a replacement of slaves that were liberated after the abolition of the slave trade. Moreso, areas like New Guinea, The Philippines Islands, Singapore, New Zealand, Fanning Island, Solomon Island and the American Islands down to The South Sea Islands and the close interior of the Asian and American continent. Hence all these Islands and countries supply labour via Blackbirding method in the Pacific Ocean. The below table shows exceptionally the population of South Sea Islander where the majority of Blackbirded originated.

[4].Materials from Willoughby , Emma, "Our Federation Journey 1901-2001"// https://web.archive.Org/web /2006062 5205722/http://www.museum.vic.gov.au/Federation/pdfs/ multiv. pdf) May 4, 2020

[5] Bell Richard, Counterfeit, Kin : Kidnappers of color, the Reverse Underground Railroad,and origins of particular Abolition ." in http://web b.a. ebscohot.com.proxy-um.researchport..umd.edu/e host/pdfviewer/pdviewer?vid=28sid=da822a84-6674-44f6-a849-ea21124de0a%40 Sessionmgr4008.EBSCOHOST.

[6] Ibid

[7]Ibid

[8] Shineberg, Dorothy, The people trade: pacific island labourers and New caledonia,1865-1930 (pacific islands monographs series)

II. THE POPULATION

Table: Population of South Sea Islanders

American Samoa	56,700
Cook Islands	15,200
Fiji	888,400
French Polynesia	277,100
Guam	172,400
Kiribati	120,100
Marshall Islands	55,500
Micronesia (Federated States of)	105,300
Nauru	11,000
New Caledonia	285,500
Niue	1,520
Northern Mariana Islands	56,200
Palau	17,900
Papua New Guinea	8,558,800
Pitcairn	49
Samoa	196,700
Solomon Islands	682,500
Tokelau	1,400
Tonga	100,300
Tuvalu	10,200
Vanuatu	304,500
Wallis and Futuna	11,700

Source: Authors Research Table

From the above table showing the population of the South Sea Islanders, Papua New Guinea registered8.558.800 people as the highest population which might have come because of Much slaves entering the Island to work in Plantations and finally when stay above twenty years could obtain citizenship. Also, Tokelau Island register the least population of 1.400 people which might be as a result of over drained of the population due to Blackbirding activities.

III. HORRIFIC SAMPLING OF BLACKBIRDING

The Horrific sampling of blackbirding. (A global view analysis is preferable at this juncture). Thefirst major blackbirding operation in the pacific was conducted out of aBay in South Wales. This was also the first ofits kindwas horrific due to reports of violence, kidnap and murder. InAustralia, New South Wales, about 65 Melanesian labourers loaded in a ship finally stopped at Boyd Town on the 16 ofApril 1847 on board the ship velocity. Under the command of Captain Kirsopp.Another personality of Benjamin Boyd engage with two financed loads of 70 and 57 for Sydney arrival in September 1847 and October 1847 but not long from workplaces as observed, starving and destitute on the streets of Sydney hence the experiment of labour exploitation was discontinued in Australia, Robert Town and Queensland in the early 1860s.[9]

As events continued to unfold another incident took place in 1863 at Robert Town where the American civil war gave rise or raised blackbirding, to help as labourers inplanting about 160 hectares of cotton in Robert Towns. The ships Don Juan brought 73 South Sea Islandersin 1863 at the port of Bribane. In the vessels Uncle Tom and Black Dog 400 Melanesians came to supply labour as slaves ofBlackbirding. In 1866 the Blue Bell brought fromthe southsea labour to the port. The labourer were paidin trinketsnot cashin terms of money at kanaka as such claimed, blackbirded labourers were savages andknown as use of money.

[9] Bennett A « immigration, blackbirding, labour recruiting.2 The Hawaiian experience 1877-1887" Journal of pacific History.11(1):3-27. Doi 10. 1080/0022334 7608572288(https://doi. Org/10.1080% ZF00223347608572288)

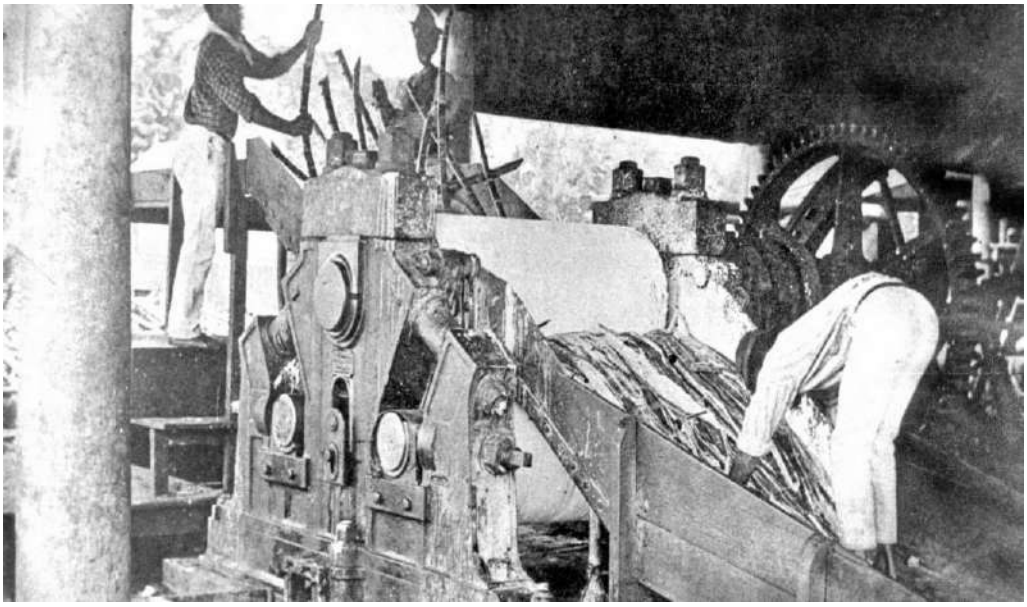
Picture: Blackbirded Working in Newly Planted Sugarcane Field at Queensland.

Source: Authors Research Photo

They were exploited and sold for a minimal sum of £2 each and that kidnapping was at least partially during recruitment, hence raised fears of a burgeoning new slave trade. Blackbirding aspointed ofriot, here, is that some villages were ravaged like Lifou.In 1868 a ship Siren with 24 dead Islander recruits, the remaining 90 onboard were taken by forced and deception, at Brisbane when the ship Siren anchored. The Siren debacle made Queensland Government invested in labour trade, kanakas actively working on their land holdings. Here, the engagement on kidnapping with violence was real. The London Royal Navy with base in Australia station in Sydney gathered momentum and shattered this event.[10]

[10] «Like an African slave ship» was compared to Daphne that was under the command of Captain Daggett and licensed in Queensland to Henry Ross Lewin.This ships activities were like those of the African type like Dradong, Rogulo and others. what should be noted here is the fact that humanitarian action of a senior officer of the Royal Navy, gave find their legitimacy to the blackbirding trade out of Queensland

Picture: Blackbirded working in a Sugarcane mill



Source: Jacob Miley, *Was John Mackay a black birder?* Dailey Mercury News, 3rd March 2017,(7:00AM).

Furthermore, other slave ships such as spunkie,Jason Lyttona carried kanaka boys aged 12and 15 years for the plantations. It was also noted that some and others rape like a pubescent Islanders girl which later the girl was sold for £20 in Brisbane. Most of those under the Blackbirding worked or were used in Canfields,sheep stations, pearl dowers being subjected to violent and neglectful treatment, hence kanakas would fight back and kill their overseas, they were hunted down and shot bythe Nativepolice. It should be noted that there existed some River plantation in the 1870s.Moreso, more samples, sampling the fact that Blackbirding actually existed are ships evidence engage in this business; Woodbine, Christina was owned by James Merrman who held the position of major ofSydney. Isabella, Flora, May Queen, Dancing Wave, Margaret Chessel, Mystery were checked for their attacked and shooting carried out,notleaving out the Royal Navy who delivered severe summary punishment upon killing blackbirding crews as examine. Others instance in the 1870s at this juncture involve HMS Beagle, HMS Wolverine, Sybil went killings of blackbirding crews through indiscriminate bombardment of villages, raids by marines, burning houses, destruction of crops and the hangings of Islanders from the Yardarms.[11]

IV. RESEARCH TABLES AND ADDITIONAL SEVERE RIFT ATTACKS ON BLACKBIRDING ACTIVITIES (TABLES), STATISTICS.

This aspect could be classifyingor drown from several levels within the 1880s;the early conflicts in 1880s the conflicts involving the Age of the slave trade 1800 to 1882 and the later years. The Blackbirding spin-up till witness Greatviolent act at Queensland with it intensification in 1880s. Vessels that were involved, that runs through the beginning and the end could or were as follows including their owners. It should be noted that their fire arm shave increases and robust or vigorous.

[11] The above mention ships were under the auspices of the following personalities; Captain de Houghton, Commodore John Crawford Wilson, Captain Satim and Davidson (plantation owners)

Table: Blackbirding Vessels and Owners or security and companies in the Pacific Ocean

Ships or Vessels involve	**The Owners or Concern (Areas or Country)**
Esperanza	Sambo(Area)
Pearl	Rendova Island
May Queen	Ambae Island
Stormbird	Tanna
Janet Stewart	Malaita
Isabella	Espiritu Santo
Officers of Royal Navy Warship attempting punitive action	
HMS Sandfly	Lieutenant Bower (five others)
HMS Cormorant	Luckcraft
HMS Emerald	Captain W.H. Maxwell
HMS Miranda	Captain Dawson
HMS Diamond	
HMS Dart	Commander Moore
Ship Borogh Belle	Captain Belbin (killed)
HMS Undine	Patrolled Blackbirding ship
Vessels Ceara	Labour recruits (matiries)
Slaves ship Lavinia (Blackbirding operation 1882)	George E.Morrison(crew, physician)
Alfred Vittery	Blackbirding crew (Griffith)
Stanley	Captain Joseph Davies
Jessie Kelly	Captain Millman
Ethel	Captain Loutit
Forest King	(owners)
Hopeful	Crew
Young Dick	The crew members
Eliza Mary	Crew
Helena	Captain A.R Reynolds
Para, Lochiel, Nautilus Rio loge, Roderick Dhu, William Manson,	/, /, / , /, Robert Cran (Sugar Magnel) Vos and Crew.
Sea witch etc.	William Hilton Hovell etc.

Source: Authors Diverse Research Materials Collection

Statistically, the Transportation of Slaves in the Western Pacific: Towns of Islands and Labourers-slaves transported, British Queensland 62.500, Fiji 27.000, French New Caledonia 15.000, Tahiti 2.500, German Samoa 12.500, Hawaii 2.500, Peru 3.600, Guetamala 1.100. Making a total of 126.700 slaves.At Somoa, much engagement was centered at selling and exacerbating factional conflict. In 172 agricultural plantations,

expansion was done on over 100.000 acres due to blackbirding operations works in the farm plantation. Men, women and children of alleges were taken, separated and sent to work in harsh conditions with many succumbing to illness and poor diet. Here, the known German company "Deutsche Handels und plantagen Gesellschaft (DHPG) expanded Samoan plantations. Later all German asset after the First World War went to New Zealand. It should be noted that large British and American plantations which owned blackbirding vessels and exploiting blackbirder labour exist much and widely in the colonial Samoa.[12]

In the Haawailia Islands about 50% male able-birded indigenous Hawaiians were used as workers on the plantations. Approximately, about 200 people came from Tahiti, Caroline Islands and line islands were recruited, to work in Hawaiian plantations owned by Europeans colonists. Ships or blackdirding vessels like Stormbird recruited 85 people from Rotuma, Norounti, Mariana and Tabiteuea. The death rate was 20% and the mortality related at over 10% for each year were protection was less and the death rate was much higher when compared to the United States of America.

In the United States, since the colonial era, underground railroad blackbirding was reversed and the African-Americans worked under white employers, playing instrumental roles in deceiving fellow African-Americans. Successive kidnapping mainly relied on the blackbirding blackbirders, hence coursing fear of being kidnapped by anyone to become prevalent, thus ships were several and in varied sizes for slaves transportation involving their captains, who also participated in capturing the slaves, or blackbirders.[13]

V. DATA COLLECTION REPRESENTATIONS IN TABLES.

This study has got clear evidences from statistics as has been mention above and as well as, here we find some datas in a table form how the existed some forces againstslavery or Blackbirding and against Blackbirding ships.

[12] Statistic on Blackbirding in the pacific ocean https://books.google.cm/bookspid>kdzbAAAAQBA/8PG=PA458*/pq= statisticston

[13].What is blackbirding https://www.abc.net.au/news/2017-09-17/blackbirding-australias-history- of -kidnapping-p

Table: Blackbirdingships and their Vessels Captains in the Pacific Region

Blackbirding ships	Vessels or ships captains
Lavinla	Blackbirding operation (Queensland)
Lizzie (burns Philip company)	William T. Wawn
Hopeful Ereuo Cessel (burns Philip)	Captain Lewis Shaw
Sea witch	William Hilton hovel
Loung Australian	Commander hovel
Bring Carl	Dr. James Patrick Murray being ship recruiter and Joseph Armstrong and mate Charles Powden.
Peri (low in supplies and was blown Westwand)	Seen or spotted near to Hinchinbrook Island Queensland Coast by captain John Moresby
HMS Basilisk	Spotted the Ship Peri.
Donald Maclean	Captain Mcleod
Flirt	Captain McKenzie
Wild Duck	Captain Martin (stole people from espiritu Santo)
Lapwing, Kate. Grat Harriet Arnytage, Frolic, Atlantic	Kidnapper Blackbirders ships e.g. Bully Hayes
Margavet Chessel, MariaDouglass and Marion Renny	The crew (not named)
Nukalau	Captain Finlay Mclever
Stanley(chartered by colonial Government)	Captain Lynch
Heather Belle	Captain John Daly
Leonidas	
Lord of Isles	CSR Sugar mill at Nausori
Winifred, meg Merrilies, dauntless and the Ovalau	Fijian registered ships.
Moavoa vessel (French Potnesia)	Captain Blackelt
Rona	
Lucene	Government ships
Helen W. Almy	Captain Luttrell
Tahili (bargue) always anchored al Drakes bay north of san Francisco	
Montserrat	Contract more Gilbert Islanders as slavery
Aoba Annelte, Venus, Aursralica, Vuka, Idaho, (new Caledonia) Ambround and the Effie Meikle	Captains and recruiters on the bladelonding for the New Caledonia market included James Toutant proctor “black tow” Jean-louis Villedieu, Martial Briault, Charles Peterson Stuart, Walter Champion, Gabriel Madezo and Captain H. Mckenzie. The company Joubert and Carter run by Didier Numa Joubert and Douglas Carter owned many of the blackcbirding vessels in the early years of trade, new calederia well into the 20th century. Atlower rate and most violent manure but ended in 1980s towards world war II.
Adelante (Peru)	Peruvian and Chilean ship

Rosa y Carmen	Captain Marutani
Tasmanian Whaler Greacian new slave trade profitable than Whaling	Captain Thomas James Mc Grath.
Tumbes (Peruvian) ship	Warship
Upolu	The German blackbirding vessel
Ubea, Florida and Maria	W&A Mc Arthur company of the Anglo-Australia recruiting vessel
Mary Anderson, Aele	Crew of the British blackbirding ship in charge of recruiting starving Gilbert Islanders.
Stormbird Vessel (Hawaiian Islands)	Captain H.W Mirt of the royal Navy was employed to arrange a large recruitment of Islanders to be recruited for Hawaii- mist bought the vessel stormbird at Sydney and appointed another ex-navy officer in captain George Jackson to conduct the expedition.
Sea Waif	The government agent aboard the vessel, Henry Freeman, bought a boatload of Gilbert Islanders form another blackbirding vessel
Pomare	Captain Cadigan
Hazard	Captain Tierney (labour supplying company Haiwai)
Kaluna, Elsinore, Hawaii, Nickolaus, Mana and Allieroue	Other ships involved (recruiting voyage to the Pacific Islands for the Hawaii and plantation 1887 under commended captain Philips

Source: Authors Diverse Research Materials Collection.

Data collection indicates that, from the above table that clearly shows the blackbirding, blackbirders, and blackbirded, we could deduce the following historical analyses, it reveals and gave an insight to most aspects of the blackbirding activities in Australia and the Pacific Ocean. They, the South Sea Island were starving and became destitute on the streets of Sydney. About 55.000 to 62.500 in 45 years arrived Australia while 15.000 Kanakas died while working in Queensland and at gunpoint was acceptable for negotiation hence mortality rate was 30% which in the transatlantic slave trade indicated similar or close statistical percentage view.[14] In 1863 as time went on some recruiters amounting to 73 South Sea Islanders which about 24 died out of 90 on board the ship Siren. Recruitment was engaged in kidnapping with violence. It actually overrode the obvious humanitarian actions. Some captains like, Captain Coach, John Coach of the Jason and spunkier ship lost a total amount of 45 kanakas due to incurred bearings. Missionaries were also attacked killing an Anglican missionary Jogn Coleridge Patterson in 1871. Some ships were attacked causing the dead of about 47 kanakas, thus another large or huge mortality rate in 1892 and 1893 made up 50% of all deaths hence 20% of the total population in Bundaberg. From 1908, the Pacific Island Labourers Act led to the compulsion repatriation of around 4.000 to 75.000blackbirded or slaves. While statistics shows that about 1600 remained in Australia because of the fact that in 20 years. blackbirded, some were already married, own lands and have stay for 20 years and above. Around 350 of South Sea Islanders were banished from Queensland, were transferred to plantations in Fiji and on their journey at least statistics shows or proved that 27 of them died while being transported. The 1992 census in Australia indicated that around 10.000 descendants are in Queensland, and in 2016 census or count, 630 people declared in Queensland that, they were South Sea Islander labourers while in 2012 before this a seasonal workers ship was introduced that brought in 416 and 403 visas for Pacific Islander labour workers in the agricultural industry on fruits picking. By 2018 around 17.320 Islanders, mostly from variety Fijiand Tonga to work in farm in Queensland. It was marked with widespread exploitation, Intimidation and underpayment of workers with at least 55%of employers being non-complaints in regard to payments and conditions.[15]Blackbirding by Blackbirders, Blackbirded until it reached a climate of them opening a city called sailors city Queensland. They were the rich merchants who constructed houses from their rich or supernormal profits. (see picture below)

[14] The trade over the Atlantic water mass gave an estimation of about 33% slaves who died in the first three years of being imported to America.

[15] Poor access to clean water, adequate food and medical assistance has resulted in several deaths.

Picture: Sailors City Queenslands

Source: Authors Research photo

From the above picture we find out that the sailors go a roving the streets especially in the evening and night after their return on shore or land. Some walk struggling to organized methods to gain more slaves ready for their next take-off to the Islands for their plantation. Furthermore, Melanesia people were killed and buried and the early 21th century recruitment of labour under the unconnected 457 visa scheme blackbirder's treated no mourning and were buried in their farm, some were thrown in the seas after dead for the fishes to feed on them, while other were buried in the farm.to make the farm soil rich. History proved this harsh treatment above human reasoning for it is very difficult or hard to explain the treatment given to the stolen people or inhabitants of the Pacific Islands. At the time, this city was actually in the hands of sailors bringing the Blackbirded or taking them away to work in other Islands and close interiors in the Pacific. At Fiji, before annexation that took place from 1865 to 1874 slaves vessel or blackbirding ships, 03 Islanders were shot dead aboard the vessel slaves and the rest sold in Levuka for £3 to £6 per head for males and £10 to £20 for females and at the end the survivors were recommended by the government to go back.Here it should also be noted that some two Islanders crew were shot. What should not be forgotten was the fact that young girls were openly bartered for and sold into sexual slavery. A worker who returns or survived were able to return to their home Islands regarded as lucky,[16]still at Fiji every 1000 Islanders had at least about 20% death labourers. The mortality rate for blackbirder labour group at or was around 80%.[17]

At Mexico and Guatemala, New Caledonia, Peru Easter Island, Ata, Tuvalu, Samoa, Hawaiian Islands, United states of America and more others experience or witnessed and register some statisticson activities in figures of Blackbirding. As far as statistics in event surfaced and was retained, out to the Pacific, where captain Lautrec recruited 300 Blackbirded,At Gilbert Islanders they were offloaded in Mexico and sent to work at a coffee plantation close to Tapachula owned by an American named John Magee. On three years' contract established, in 1894 none of the recruited return home but it was found that only 58 were still alive. Other ships or vessels carried 370 Islanders involving 100 childrens. On reaching San Francisco at Drakes, but this slavery or blackbirding witnessed a change of captain yet the vessel capsized as discovered in 1892 which a few that has managed to survive drowned to death. At Guatemala 470 Islanders were brought with each worth £100 which they work in the plantation in an area of 70 miles which about 200 of them were infected and killed by disease.[18]

[16] « South sea Islands » in http:/nla.gov.au/nla.news-article60849109.empire5027.newsouthwales, Australia, december31,1867 p.8.

[17] ibid

[18] Approximately 1200 Gilbert Islanders were recruited in three shipboards for the Mexican and Guatemalia coffee plantation, survivors 250 only, with a mortality rate of 80% in two voyages in 196 to 1908

Table: Blackbirding with very low wages in shillings and pence

Origin of labour	Wages per month (shillings)	Bonus per month (shillings)	Overtime per hour (pence)
China	34 to 50	4	5
Caroline Islands	30	4	3
New Guinea	5[a]	5	1.5

Source : " Extract from letter to Chief Representative, Melbourne, 16 January 1922 ", CO 225/188.

a. In addition, recruits from New Guinea received clothing and tobacco to the value of about five shillings a month.

Territory	" All-in " cost of native labour per day (in pence)	Daily task of cutting out copra (in lbs)
Fanning Island	36.0	300
Solomon Islands	20.5	450
Papua	12.8	450
New Guinea	9.2	520

Source : Encl. in A. K. Mackintosh to Secretary of State, 7 August 1936, CO 225/301/86276.

Source: Authors Research Tables

The above tables show that, China, Caroline Island and New Guinea took active part and participated in the Blackbirding activities system in the Pacific Region. Wages ranges from 5 to 50 shillings, while Bonus from 4 to 5 and Overtime worked ranges to 1.5 to 5pence and varies in the different countries. The second table explains incidence operational in Fanning Island, Solomon Islands, Papua and New Guinea which labour cost per day 36.5, 20.5, 12.8 to 9.2 respectively while daily task ranges on payment from 300, 450, 450 to 550 respectively. Furthermore, recruits from the New Guinea received some goods such as clothing and tobacco monthly in value of 5shillings as noted in an extract and Encl. of 16 January 1922 and 7 August 1936 respectively in the tables above.In New Caledonia, about 15,000 people were transported between 1865 to 1930s as some came initially in 1870, about 720 Islanders went to Caledonia to work in mines. Blackbirding wantonly increased which 06 years old were legally noted, were recruited, which the majority were children. Approximately 33% of the workers died while working in plantations, mining, pastoral, domestic servant and sailing, pearling and mailing industries(**see picture above on Cane mailing**). They were all in horrible conditions; subjected to inadequate food, poor shelter and harsh punishments while in New Caledonia, they were impressed if not work as blackbirding or slaves and sold to the colonial government to further exploit them as unpaid labourers. They were sold on, and again to other colonists; if their original employer was bankrupt or death. This blackbirding altitude or manifestation only come to an end in the 1930s with the approach of world war II in 1939.[19]

In Peru, some racial backing, import blackbirded due to labour shortages, in which about 253 recruits of which more than half were women and children. Some of them worked as plantation labourers while others as domestic servants. Some other set out to make money on Polynesian labour. Easter Island, mass kidnapping was realized. About 1407 people were taken for the Peruvian labour trade which made-up third of the Island population, several vessels were involve in recruiting for Peru, kidnapped or deceptively obtained people throughout Polynesian. At Ata, mass-kidnapping was witnessed which about 350 people were living on Ata and about 144 people never return out of those who went or left for the plantation. By October 1863 the imprisoned Ata people

[19].Statistic on Blackbirding in the pacific ocean https://books.google.cm/bookspid>kdzbAAAAQBA/8PG=PA458*/pq= statisticston

died from neglect and disease while about 38 survivors were taken hence, where they might have died since nothing is known more about them. At Tuvalu about 180 went to Funafuti, while 200 were taken to Nukulaclae that some fewer left in number 100, of the 300 recorded in 1863 about 3,634 Polynesians were recruited and over 2.000 died from disease starvation or reflect either aboard the blackbirding ships. Due to outbreak of disease in Peru further death rate was registered to about 1.030 Polynesian labourers. To their home land epidemics and additional mortality was registered.[20]

C-Protecting the Ability to Trade in the Indian Ocean as preventive Responses to Blackbirding

The notion here lay firm to the issue that, whether it be for this or for major international responses to natural disasters as this we saw in the Philippines and the Island in the past years. At the core of these types of international responses are relationships, relationships at the political level and for us relationships between our military forces. Events such as that of blackbirthing are crucial for the development of these relationships. From Some hopes we can further develop relationships between navies and each other over the next few days, so we can continue the important work we do. At the heart of the important work we do at sea is to protect our collective ability to.Everyone has heard shocking stories before sometimes and presently about the transatlantic slave trade, but this was hardly the only type of slavery in which Europeans weredirectly engaged. The Pacific slave trade involved the forceful enslavement of Pacific Islanders from the mid-19thcentury to the 21thcentury. This particular type of slavery is often referred to as "blackbirding". The primary focus of "blackbirding" was to supply cheap labour to sugar-cane plantations on Pacific plantations, particularly in Queensland, Fiji, New Caledonia, and the Samoan Islands. This was mainly achieved through methods such as trickery and kidnapping. They were frequently deceived about the length of time for which they were "contracted" and the nature of their "contract." If all this failed, the Islanders were simply loaded onto slave ships at gunpoint.The captured Islanders were collectively known as Kanakas, which means Person or Man in Hawaiian. These workers were essentially treated as slaves, using the word Blackbirding, but officially they were referred to as "indentured labourers". There have been debates as to whether "blackbirding" was considered slavery, as the "labourers" were paid. Yet, it is worth noting that their wages were well below the wages of European workers just to shy abit away from the original slavery and slave trade situations.[21]

According to various studies, they work more than the normal rated time or period as first-year workers received a standard pay rate of six pounds per year. The pay rate was also fixed for 40 years without taking inflation into account. As slavery had already been outlawed by the British Empire, the minimal pay was used to justify the practice. "Blackbirding" can be seen as a euphemism, because the captured workers still worked in slave-like conditions. A person recounting their grandfather's story explains how, he was told that once they were here, they were unable to speak their mother language, they were punished in terms of corporal punishment. They were also segregated from wider society just like African American slaves were in the US. In 1872 the British Parliament introduced the Pacific Islanders' Protection Act which outlawed "blackbirding". Yet, the practice still continued until the early 20thcentury. The Act did provide for agents on British recruiting vessels, leading to stricter licensing procedure, and patrol of British-controlled Islands. The Pacific Islands were not the only area where "blackbirding" took place. The practice was also common in the United States after slavery was banned. Many US citizens used the Reverse Underground Railroads to capture free African-Americans and fugitive slaves and tricked or sold them into slavery. This practice in the United States was also known as "blackbirding" and relied on the same type of coercion and trickery. People of India and Africa or mixed ancestry frequently took part in these actions. While some worked for white employers, others helped slave owners with finding escaped slaves. For many tricking their fellow African-Americans was not a choice, but a necessity to survive. For their help they would receive a bounty. Their actions also resulted in more successful kidnappings, as "blackbirding" largely relied on developing a connection between the hunter and their target and for ex-slaves it was easier to trust a fellow African-American person.[22]

In 1807 Britain passed the Abolition of the Slave Trade Act and in 1862 Lincoln signed the Emancipation Proclamation, but this was hardly the end of slavery.

[20].Statistic on Blackbirding in the pacific ocean https://books.google.cm/bookspid>kdzbAAAAQBA/8PG=PA458*/pq= statisticston. By 1866, only around 250 of those recruited had survived with about 100 of these remaining in Peru. The death rate was therefore 93%. Maude, H E, slavers in paradise in https://openresearch-repository.anu.edu.au/handle/1885/114682.ANUpresu.

[21]What is "blackbirding"? Posted by: Elles Hon: January 21, 2019 In: Breaking News, Australia

[22]Differential mortality of Asians and Pacific Island in Pacific labour Trade https://link.springer.com/article/10.1007/Bf 030 29360Protecting the ability to trade in the Indian ocean, Figure 1: Indo-Pacific strategic overview

"Blackbirding" was simply one of the many ways in which people circumvented official laws to continue profiting from slavery.[23]

VI. CONCLUSION

To conclude, the Population, Horrific sampling of Blackbirding, Research tables and additional Severe Rift Attacks on Blackbirding Activities (Tables), statistic and Data Collection. Representations in tables. And Protecting the Ability to Trade in the Indian Ocean as preventive Responses to Blackbirding has been the pivot of this studies. When the British assaulted slavery and slave trade, the scene was then transformed to another level where the traders,(blackbirders) deem it necessary to start using an advance method to give little compensation to the blackbirded as a means to avoid check on them. It is worth noticing that the little that was given was collected in the form of labour because the slaves or blackbirders still have no right of opinion to bargain on their salaries. They were taken out of their regions forcefully without their will or decision. Many of them toil in the plantations that was in Islands thus all was in vain. Some hard working Blackbirded were sold to other plantation merchants if the existed no job or transfer of ownership or business failures in the pacific to some plantations merchants. Some blackbirded end up dying not knowing where they originated due to the fact that they were, and are offspring of those who went to various direction during the capture of their parents. But it was only when Modern Slavery Act., criminal justice at the expense of victim protection, reversing the low risk and high pay out dynamic, the imposing of balancing the immigration policy and anti-slavery, victims identification and support to gain status and implication for promoters victims, increase protection for vulnerable groups, transparency in supply chains and bring out the hidden victims of modern, of the modern slavery Act hence looking forward in the application of more law canons in Human Right procedures. The debate here is for us to know; What are the internally and International implications of blackbirding and what methods and application worldwide can be use to put a total end to this calamities?

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Analysis of Parachloroaniline Formation through Protocols of Associations between Irrigating Solutions During Chemical-Mechanical Preparation

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***Keywords*— Endodontic Treatment, Irrigating Solutions, Parachloroaniline.**

***Abstract*—** *The success of endodontic therapy depends on the biomechanical preparation and hermetic filling of root canals, but does not generate sufficient microbial reduction in most cases. Chlorhexidine has been used in endodontics due to the wide spectrum of action. However, associated with other irrigation solutions can form Parachloroaniline (PCA), a possible carcinogen for humans, according to the IARC (International Agency for Research on Cancer). The aim of this study is to analyze the formation of PCA through protocols that associate irrigation solutions in chemical-mechanical preparation. Fifty lower premolars teeth extracted from humans were selected, then separated into 5 groups (n=10) for 5 different irrigation protocols and at the end were microscopically analyzed. According to the results obtained only the irrigation protocol of group 5 had the formation of PCA in the three thirds of the root.*

I. INTRODUCTION

Success in endodontic treatment depends on a sequence of operative acts that should promote correct cleaning of the canals, eliminating all debris and microorganisms present there. According to Leonardo and Leonardo (2017), dental roots have areas of difficult access, allowing more resistant pathogens to be confined and survive during the instrumentation of the channels.

Authors such as Cohen and Hargreaves (2011), state that chemical preparation, characterized by the use of irrigation solutions, complements the mechanical preparation stage of root canals. These solutions are used to increase the effectiveness of instrumentation, remove the smear layer and eliminate microorganisms, preventing them from proliferating and consequently reinfecting the pulp and root canals.

Sodium Hypochlorite (NaOCl) is the most widely used irrigating solution by dentists due to its efficacy as an antibacterial agent and its ability to dissolve necrotic, vital tissues and organic components, making it the first choice in endodontics. Pretel et. al. (2011) report that NaOCl has been used as endodontic irrigator for more than 4 decades, however, even though it is an excellent tissue solvent, when applied at high concentrations, it is toxic and harmful to tissues.

To Camara et. al. (2015), although NaOCl is the closest irrigator to the ideal, it cannot dissolve the inorganic dentin particles and prevent the formation of the smear layer during instrumentation. For this reason, EDTA becomes an auxiliary solution, because it can highlight the bacterial biofilm adhered to the walls of the canals. This association is considered the most effective according to some authors.

Pretel et. al. (2011) states that in addition to Sodium Hypochlorite, Chlorhexidine has become a viable irrigator for use during canal instrumentation and as intracanal medication, due to its specific characteristics of substantiality and its high antibacterial effect.

Some authors, in order to make the most of the chemical properties of irrigating solutions have proposed protocols of their associations, potentiating the desired final effect, that is, the effective chemical decontamination of root canals. According to Zehnder (2006), with this

association the Sodium Hypochlorite would act in the dissolution of organic components, EDTA as an auxiliary solution would dissolve a smear layer and the Chlorhexidine would perform antimicrobial action.

Cohen and Hargreaves (2011), however, report that studies have shown that this combination can cause a chemical interaction between irrigators, causing a change of color and the formation of a precipitate, neutral and insoluble substance called PCA (Parachloroaniline).

Considering the risks exposed to the use of irrigating solutions, it is of paramount importance that the dentist professional is aware of the use of these solutions and the protocols of association of the same, in order to select the most indicated and use it in the best possible way, thus avoiding that the risks or harmful effects of the therapy chosen to perform the treatment are greater than the harms of the disease.

In view of the above, the present work aims to analyze the formation of Parachloroaniline through protocols of association of irrigator solutions in chemical-mechanical preparation.

II. METHODOLOGY

This study was approved by the research ethics committee of the Lutheran University Center of the Palmas-Tocantins, Brazil. Thus, the analyses were developed in the dentistry laboratories of this university.

Lower 50 premolar teeth with complete rhizogenesis, single channel, rectum, without calcification, with similar sizes and diameters in the cervical, middle and apical thirds were included.

Dental elements were given through a free and Informed Consent Form - left in dental clinics and dental schools in the state of Tocantins.

Cleaning step of specimens:

Root scraping with periodontal curettes (Duflex - SS White, Rio de Janeiro - RJ/Brazil) and prophylaxis with pumice (SS White, Rio de Janeiro- RJ/Brazil) and water were performed using Robson's brush (KG Sorensen, Rio de Janeiro - RJ/Brazil) coupled to a counter-angle with micromotor (Kavo, Joinville - SC/Brazil). The specimens were stored in Timol 0.1% (Formula and Action Pharmacy, São Paulo - SP/Brazil) for a maximum period of three months.

Preparation step of specimens:

The crowns were sectioned at the amelocementary junction with the aid of a carborundum disc (Fava, São Paulo - SP/Brazil) coupled to the straight and micromotor part (Kavo, Joinville - SC/Brazil), standardizing the length of the roots by 15 mm using calibrating endodontic ruler (Dentsply/Maillefer, Ballaigues/Switzerland). As roots were identified with Romans numerals through a marker for projector.

Group distribution step:

After root preparation, these were randomly distributed into five groups with ten specimens each (n=10).

Instrumentation step of the groups:

The odontometry was made visually through a flexofile 10 file (Dentsply Maillefer, Ballaigues/Switzerland) inserted into the channel until it is visualized in the apical foramen, and the obtained value should be 15 mm, and the working length 1mm before the apical foramen (14mm).

With the Prodesign S engine and rotational system (Easy, Belo Horizonte/Brazil) the root flue was instrumented, being used the rotational files 30/10 and 25/08 crown direction - apex at 5mm below the actual length of the tooth (10mm) for the preparation of the cervical third, and the file 25/01 in 1mm beyond the actual length of the tooth (16mm) for the realization of the foraminal patency, and with a file 25/06 was performed the apical stop 1mm before the actual length of the tooth (14mm).

Irrigation step of the groups:

• Group 1

Throughout the instrumentation, experimental unit was irrigated with sodium hypochlorite of 2.5% (Formula and Action Pharmacy, São Paulo - SP/Brazil), 10 ml per experimental unit, using the plastic syringe 10 ml (Advantive Nanchang, Shanghai/China) and disposable needle 25 x 0.55 (BD, Curitiba - PR/Brazil), introduced until reaching 2mm below the working length (12mm).

The channels, at the end of the preparation, were dried with tip Capillarytips (Ultradent Products, Jordan/USA) coupled to endodontic sucker and with absorbent paper cone (Tanari, Manacapuru - AM/Brazil).

At the end of the instrumentation, irrigation was carried out with 3 ml of EDTA 17% (Formula and Action Pharmacy, São Paulo - SP/Brazil), being 1 ml of EDTA 17% every 1 minute, then the irrigation was performed with 5 ml of sodium hypochlorite 2.5% (Formula and Action Pharmacy, São Paulo - SP/Brazil) and the drying of the channels with tip Capillarytips (Ultradent Products, Jordan/USA) coupled to endodontic sucker and with absorbent paper cone (Tanari, Manacapuru - AM/Brazil).

• Group 2

Throughout the instrumentation, experimental unit was irrigated with chlorhexidine 2% (Formula and Action Pharmacy, São Paulo - SP/Brazil), 10 ml per experimental unit, using the plastic syringe 10 ml (Advantive Nanchang, Shanghai/China) and disposable needle 25 x 0.55 (BD, Curitiba - PR/Brazil), inserted until it reaches 2mm before working length (12mm).

The channels, at the end of the preparation, were dried with tip Capillarytips (Ultradent Products, Jordan/ USA) coupled to endodontic sucker and with absorbent paper cone (Tanari, Manacapuru - AM/Brazil).

At the end of the instrumentation, irrigation was carried out with 3 ml of EDTA 17%(Formula and Action Pharmacy, São Paulo - SP/Brazil), being 1 ml of EDTA 17% every 1 minute, then irrigation was performed with 5 ml of sodium hypochlorite 2.5% (Formula and Action Pharmacy, São Paulo - SP/Brazil) and drying of channels with tip Capillarytips (Ultradent Products, Jordan/ USA) coupled to endodontic sucker and with absorbent paper cone (Tanari, Manacapuru - AM/Brazil).

• Group 3

Throughout the instrumentation, experimental unit was irrigated with sodium hypochlorite of 2.5%(Formula and Action Pharmacy, São Paulo - SP/Brazil), 10 ml per experimental unit, using the plastic syringe 10 ml (Advantive Nanchang, Shanghai/China) and disposable needle 25 x 0.55 (BD, Curitiba - PR/Brazil), inserted until it reaches 2mm before working length (12mm).

The channels, at the end of the preparation, were dried with tip Capillarytips (Ultradent Products, Jordan/ USA) coupled to endodontic sucker and with absorbent paper cone (Tanari, Manacapuru - AM/Brazil).

At the end of the instrumentation, irrigation was carried out with 3 ml of EDTA 17% (Formula and Action Pharmacy, São Paulo - SP/Brazil), with 1 ml of EDTA being 17% every 1 minute. The channels were dried with tip Capillarytips (Ultradent Products, Jordan/ USA) coupled to endodontic sucker and with absorbent paper cone (Tanari, Manacapuru - AM/Brazil), then the irrigation was carried out with 5 ml of chlorhexidine 2% (Formula and Action Pharmacy, São Paulo - SP/Brazil) and again the drying of the channels with tip Capillarytips (Ultradent Products, Jordan/ USA) coupled to endodontic sucker and with absorbent paper cone (Tanari, Manacapuru - AM/Brazil).

• Group 4

Throughout the instrumentation, experimental unit was irrigated with 2.5% sodium hypochlorite (Formula and Action Pharmacy, São Paulo - SP/Brazil), 10 ml per experimental unit, using the plastic syringe Luer Slip 10 ml (Advantive Nanchang, Shanghai/China) and disposable needle 25 x 0.55 (BD, Curitiba - PR/Brazil), inserted until it reaches 2mm before working length (12mm). Subsequently, irrigation was performed with 5ml of saline solution (Formula and Action Pharmacy, São Paulo/Brazil) using the plastic syringe Luer Slip 10 ml (Advantive Nanchang, Shanghai/China) and disposable needle 25 x 0.55 (BD, Curitiba - PR/Brazil), inserted until it reaches 2mm before working length (12mm).

The channels, at the end of the preparation, were dried with tip Capillarytips (Ultradent Products, Jordan/ USA) coupled to endodontic sucker and with absorbent paper cone (Tanari, Manacapuru - AM/Brazil).

At the end of the instrumentation, irrigation was carried out with 3 ml of EDTA 17% (Formula and Action Pharmacy, São Paulo - SP/Brazil), with 1 ml of EDTA being 17% every 1 minute. Then, it was irrigated with 5ml of saline solution (Formula and Action Pharmacy, São Paulo - SP/Brazil) using the plastic syringe Luer Slip 10 ml (Advantive Nanchang, Shanghai/China) and disposable needle 25 x 0.55 (BD, Curitiba - PR/ Brazil), inserted until it reaches 2mm before working length (12mm). The channels were dried with tip Capillarytips (Ultradent Products, Jordan/ USA) coupled to endodontic sucker and with absorbent paper cone (Tanari, Manacapuru - AM/Brazil). Subsequently, irrigation was performed with 5 ml of chlorhexidine 2% (Formula and Action Pharmacy, São Paulo - SP/Brazil) followed by irrigation with 5ml of saline solution (Formula and Action Pharmacy, São Paulo - SP/Brazil) using the plastic syringe Luer Slip 10 ml (Advantive Nanchang, Shanghai/China) and disposable needle 25 x 0.55 (BD, Curitiba - PR/Brazil), inserted until it reaches 2mm before working length (12mm) and again drying the channels with tip Capillarytips (Ultradent Products, Jordan/ USA) coupled to endodontic sucker and with absorbent paper cone (Tanari, Manacapuru - AM/Brazil).

• Group 5

Throughout the instrumentation was irrigated with sodium hypochlorite 2.5% associated with chlorhexidine 2% (Formula and Action Pharmacy, São Paulo - SP/Brazil), 10 ml per experimental unit, using the plastic syringe Luer Slip 10 ml (Advantive Nanchang, Shanghai/China) and disposable needle 25 x 0.55 (BD, Curitiba - PR/Brazil), inserted until it reaches 2mm before working length (12mm).

The channels, at the end of the preparation, were dried with tip Capillarytips (Ultradent Products, Jordan/ USA) coupled to endodontic sucker and with absorbent paper cone (Tanari, Manacapuru - AM/Brazil).

At the end of the instrumentation, irrigation was carried out with 3 ml of EDTA 17% (Formula and Action Pharmacy, São Paulo - SP/Brazil), being 1 ml of EDTA 17% every 1 minute. Then, it was erected with 5ml of saline using the plastic syringe Luer Slip 10 ml (Advantive Nanchang, Shanghai/China) and disposable needle 25 x 0.55 (BD, Curitiba - PR/Brazil), inserted until it reaches 2mm before working length (12mm). After this process, irrigation was performed with 5 ml of sodium hypochlorite 2.5% (Formula and Action Pharmacy, São Paulo - SP/Brazil) and again the drying of channels with tip

Capillarytips (Ultradent Products, Jordan/ USA) coupled to endodontic sucker and with absorbent paper cone (Tanari, Manacapuru - AM/Brazil).

Specimen Analysis:

The specimens were sectioned longitudinally with the aid of a Carborundum disc and analyzed under the operative microscope (M 9000 DF Vanconcelos S. A., São Paulo - SP/Brazil) in 12.5x increase, to check if there has been the formation of Parachloroaniline.

III. RESULTS

Based on the methodology used, of the 50 lower premolar dental elements instrumented, irrigated and analyzed in the cervical, middle and apical thirds using the operative microscope, it was possible to observe a change in color in the three thirds, in all 10 dental elements of group 5 (Fig. 2), where was performed the root canals irrigation with sodium hypochlorite 2.5 directly associated with chlorhexidine 2.

The staining formed almost immediately, when sodium hypochlorite came into contact with chlorhexidine, thus verifying the formation of Parachloroaniline.

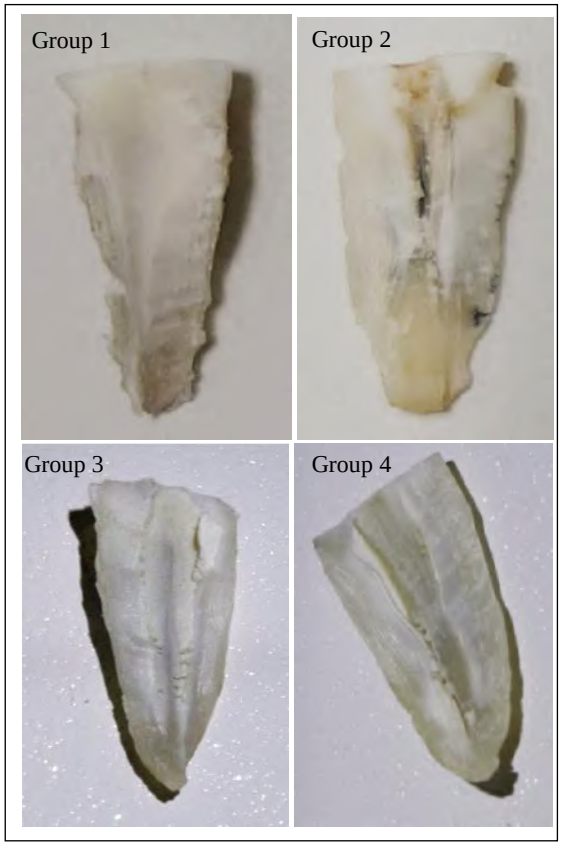

Fig. 1: No formation of Parachloroaniline in the three thirds (Groups 1, 2, 3, and 4).

Group 5

Fig. 2: Formation of Parachloroaniline in the three thirds (Group 5).

IV. DISCUSSION

In order to study whether different protocols of association of irrigator solutions could form Parachloroaniline, the lower 50 premolars were separated into 5 groups with 10 specimens each. Only group 5 where sodium hypochlorite had direct contact with chlorhexidine presented a different coloration in the three thirds after chemical-mechanical preparation. This precipitate can arise in several colors and its formation is explained by the acid-base reaction that occurs when there is interaction between the irrigators.

It was observed that in the other experimental groups, the results were negative for Parachloroaniline, because even using protocols of association of sodium hypochlorite with chlorhexidine, both were applied separately and after the root canal was completely dried with endodontic sucker and cones of absorbent papers.

One of the justifications for the formation of Parachloroaniline in group 5 is that sodium hypochlorite when it comes into contact with chlorhexidine causes hydrolysis, transforming it into smaller fragments and forming by-products, including the Parachloroaniline, a solid substance that is separated from the liquid part.

Many authors have been studying the consequences of the formation of Parachloroaniline, which can deposit in the dentinal tubules and obstruct the canals, impair sealing during filling, stain and darken the dental structure, affect the aesthetics of the tooth, besides being toxic to humans and present carcinogenic action.

With the results obtained in several studies, and the divergences found in some results presented, it is still

necessary to conduct more research involving irrigating solutions and pca formation, as well as their possible effects on dental structures. With further studies it will be possible to increase the search for reliable scientific references and more safety during the irrigation of root canals using both solutions.

V. CONCLUSION

With the present study, it was possible to observe that irrigation protocols associating the use of sodium hypochlorite 2.5% and chlorhexidine 2% in the same root canal during chemical-mechanical preparation causes the formation of Parachloroaniline, as occurred in the experimental group 5. However, it was visualized in the other groups that this association can be safe, since in the irrigation protocol the solutions are used separately and with the dry channel, avoiding direct contact between the two irrigators. This care absentees or minimizes systemic and/or local risks during or after the therapeutic application of the protocol, thus allowing a successful endodontic treatment and especially without causing harm to the patient.

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Extracurricular Activity and Vocational Technical training: Meetings and meanings in Integrated Technical Teaching

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***Keywords*— Curriculum, integrated ethical training, extracurricular activities.**

***Abstract*—** *Basic education is going through a transformation moment, in some states in Brazil schools are already implementing a new curriculum. Discussions of the new National Common Curricular Base are part of the teaching routine and in the case of federal institutes, the reformulations of pedagogical course projects are taking place on the various campuses. However, regardless of the result of the work of the commissions, the institutional pillars will be observed: the integration of teaching, research and extension. And it is in this scenario that we sought to analyze the teaching and student perceptions regarding the contributions of extracurricular activities in the integral formation and the protagonism of the IFRO Campus Porto Velho Calama student. Methodologically, a qualitative research was developed, based on a bibliographic study and field research using a semi-structured interview with 26 professors and 118 students. The results incited multiple perspectives regarding this relationship between extracurricular activities and income.*

I. INTRODUCTION

With the advent of the National Common Curricular Base (NCCB), the curriculum for Basic Education is going through a moment of restructuring, readjustment and flexibility with respect to essential learning and integral training of the student. According to Brazil [1], the NCCB as a normative document defines an organic and progressive set of learning that is considered essential that assures the student's learning rights throughout all stages and modalities of Basic Education. In this sense, as pedagogical foundations, the NCCB proposes to focus on the development of skills with the commitment of promoting Integral Education to the student.

As initial assumptions, they constitute factors that culminate in the emergence of the transformation of teaching in Basic Education, especially in High School, the global changes in the lifestyle, in the way of living, knowing, being, thinking, acting and learning of the student, and consequently, in the act of educating and training this new generation [2]. In light of that, it should be noted that, from the potentiation of essential learning, pedagogical practice goes through a period of metamorphosis [3]. As main changes, the student's centrality in the educational process stands out; the construction of knowledge considering the needs and reality of this student; and youth protagonism in activities

from social practices that contemplate the contexts and scenarios in which the young student is inserted.

In this sense, the moment experienced in high school with the implementation of NCCB in many states in Brazil, is to rethink and re (create) educational practices based on active and collaborative learning [4;5];innovate learning spaces and strategies in the classroom [6]. It is time to re (invent) and re (signify) the continuing education of the reflective teacher [7] considering Education by skills [8], the perspective of Integral Education, the student's Life Project, the centrality the young student in the educational process; the youth vision and youth culture of each locality; In short, there is an emergence through the innovation of the educational scenario in order to contemplate the central issues of the educational process that run through the pillars of education "learning to learn"; "Learn to know"; "Learn to live together"; "Learn to do" and "learn to be".

In this context, "learning needs to be meaningful, challenging, problematizing and thought-provoking, to the point of mobilizing the student and the group to seek possible solutions to be discussed and implemented in the light of practical theoretical references" [9]. The central concern in the school context is the preparation of the autonomous and critical student to self-manage and self-govern their training process from an integral perspective with a view to developing personal, cognitive, social, citizen and professional dimensions. Therefore, according to Freire [4], the teacher must perceive the student as a socio-historical and cultural subject of the act of knowing and expand his educational possibilities while respecting the coherence between know-how and knowing how to be.

As elements that support the debate around this metamorphosis that involves the curriculum of High School, it is pertinent to emphasize that they constitute triggers for this new educational scenario, the lack of interest of the student in the offered education; their distance from the classroom and the strong presence of traditional teaching methods. Linked to this, the advent of the information, knowledge and learning society points to the urgency that the school as a space for social transformation accompanies social, political, financial and technological changes [3] and develop cognitive skills, communicative and socio-emotional essentials for the integral formation of the 21st century student [8].

The contemporary youth does not have the same profile and cultural behavior as previous generations. The student is no longer the receptacle to be filled with content, the teacher is not the only transmitter of knowledge and the school does not have a monopoly on knowledge. In this context, the need for young people to learn to manage and relate information to transform their knowledge and their knowledge is revealed as emerging [10]. Therefore, in the context of educational activities it is essential to provide students with learning situations that challenge them to solve a complex problem, mobilize multiple knowledge, make complex decisions about doing and promote collaborative learning networks.

Regarding the focus on the development of competences, the clear indication of what students should "know" and "know how to do" requires much more than the accumulation of information, the new scenario of education in Brazil and in the world, requires productive and responsible subjects; individuals who recognize themselves in their historical and cultural context; who know how to communicate, be creative, critical analytic, participative, open to the new and resilient. In view of this, the Curriculum for Secondary Education in accordance with the NCCB, when consolidating the rights of learning and development based on ten general competences, ends up requiring that the pedagogical work in this teaching stage involves the mobilization of knowledge (concepts and procedures), skills (cognitive and socioemotional practices), attitudes and values to solve complex demands of everyday life, the world of work and for the full exercise of citizenship [11; 1].

In view of the above, in the field of Technical Education Integrated to High School, many actions, efforts and challenges are envisaged that are daily put to institutions that need to articulate and seek strategies for the development of curricular and extracurricular activities that develop competences and skills Comprehensive student education is necessary, especially with regard to exploring youth protagonism and inserting the youth as the central subject of their learning.

In the state of Rondônia, professional education integrated with teaching has been developed by the Federal Institute of Education, Science and Technology of Rondônia (IFRO), which in the curricular structure of technical courses integrated with high school seeks to educate for knowledge, know how to do, know be and know how to live together. For this reason, the training itineraries involve disciplines organized in three groups. a) Core of the Common National Base (Languages, Codes and their Technologies; Human Sciences and their Technologies; and Natural Sciences, Mathematics and their Technologies); b) Professional Group (specific subjects of the course curriculum) and the Complementary Group (Professional Practice and Complementary Activities the desired training) [12].

For this, all courses offered have a pedagogical course design prepared by a committee and approved by the

Superior Council. This project is the pedagogical instrument that guides teaching and learning, and aiming at the quality and improvement of knowledge and skills already foresees an interrelation between teaching, research and extension and it is in this integration that the relevance of extracurricular activities in integral training is located of the student.

In association with the new curricular architecture of NCCB, it draws attention that includes Basic General Training by area of knowledge and training itineraries. The basic general training includes the curriculum components within the areas of knowledge, which are: the area of languages and their technologies; area of applied human and social sciences; mathematics and its technologies. In relation to the training itineraries, it corresponds to the flexible part of the curriculum that includes the Life Project, the electives and the curricular units for further study by area of knowledge, as well as the Technical and Professional Training itinerary.

The High School curricula are composed of Basic General Training, linked to the training itineraries as an inseparable whole, under the terms of the National High School Curriculum Guidelines (NHSCG). Since the training itineraries are characterized by a set of curricular units offered by schools and education networks that enable students to deepen their knowledge and prepare themselves for further studies or for the world of work. Another relevant factor in the curricular structure is that the recent changes in the LDB, due to Law nº 13.415 / 2017, replace the single model of the curriculum for high school with a diversified and flexible model [1].

Give the above, considering the new curricular architecture proposed at NCCB and the paths taken by Integrated Technical Education for Secondary Education, the following question was raised: “How can the planning and development of extracurricular activities interfere and / or contribute to the full training and the role of the student from the Technical High School Integrated to the High School of the Federal Institute of Rondônia?”. Given of the problem, the present research sought to analyze with the student and the faculty how the planning and development of extracurricular activities can interfere and / or contribute to the integral formation and protagonism of the student of the Federal Institute of Education, Science and Technology Rondônia (IFRO) Campus Porto Velho Calama.

II. METHODOLOGY

Methodologically, it is a qualitative research, carried out from a bibliographic study about professional education integrated to high school and field research with data collection using individual interview technique. These two research techniques resulted in reflections on the curriculum from the new NCCB and the importance of extracurricular activities for the school performance of students at the Federal Institute of Education, Science and Technology of Rondônia (IFRO), Campus Porto Velho Calama.

The research was approved by the Ethics Committee in Research with Human Beings, of the Federal Institute of Education, Science and Technology of Rondônia (IFRO), through the substantiated opinion number 1,906,927, issued on February 3, 2017. The population of this The study was formed by professors and students from IFRO, Campus Porto Velho Calama, with a sample of 26 professors and 118 students. In order to maintain anonymity, teachers were numbered from D 01 to D 26 and students E 01 to E 118.

The interviews were conducted at the Campus Porto Velho Calama, in the morning and afternoon, based on an interview script. This data collection technique was chosen because the interview is a “technique in which the researcher presents himself / herself to the investigated person and asks him / her questions, in order to obtain the data that are of interest to the investigation” [13]. Thus, it is a tool for social interaction that makes it possible to “obtain information about what people know, believe, expect, feel or desire, intend to do, do or have done, as well as about their explanations or reasons about things precedents”, in this case, the relationship between extracurricular activities and school performance.

After the interviews, these were transcribed and the data analyzed and reported verbatim from six categories: 1: Student's perception of the interference of extracurricular activities on school performance; 2: Perception of the student on the contributions of extracurricular activities to “knowing” and “knowing how to do”; 3: Extra-class activity and the development of cognitive, communicative and socioemotional skills; 4: Teacher's perception of the interference of extracurricular activities on school performance; 5: Planning and development of extracurricular activities; 6: Teacher's perception of the contributions of extracurricular activities.

Seeking to provide a graphical representation of the perception of students and teachers regarding extracurricular activities, the NVivo 10 Software was also used to create some illustrations that facilitate the visualization of the research results (word clouds).

III. RESULTS AND DISCUSSION

The presentation of the results is organized according to the two types of participants, so that first the students 'opinions are presented and then the teachers' views regarding the researched theme. For this, it started with the words that were most repeated in the participants' speech, from the word cloud of each segment: students and teachers.

Category 1: Student's perception of the interference of extracurricular activities on school performance.

The Figure shows the words that appeared in the interviews with students, when asked how extracurricular activities interfere with school performance. It is observed that the terms time, a lot and interferes were quite frequent. Thus, some statements illustrating the context in which these terms appear are presented, as well as denoting the relationship that students establish between extracurricular activities and school performance.

Fig. 1: Student perceptions of the relationship between extracurricular activities and school performance[1]

In the perception of student 04, extracurricular activities do not interfere in school performance due to the organization of time: "Well, practically nothing, because I can always organize my time" (E 04). In this same sense, student 43 states that there is no interference: "For me none. Because I manage to organize my time well and put each one in its space. I don't run over anything and I can quite differentiate which one is more important than another"(E 43).

For student 54, the relationship between extracurricular activities and school performance "It depends on extracurricular activity, because there is activity that is related to what you are studying, so it interferes on the positive side and there are others that have nothing to do" (E 54). For others, this relationship will depend on each student: "I think that sometimes they are harmful and sometimes not, because when you do these activities, you end up taking a lot of your time and you end up having to dedicate yourself more, if you are a hardworking and centralized person, you can do it and it ends up being good" (E 05) "Well, it depends on the person, there are people who are doing sports, some extracurricular. She stops studying to do this other thing, there are people who can't do both at the same time"(E 12). "They can get in the way a little, if the person is unable to organize their time" (E 71). "I think that it doesn't interfere with anything, that goes to the person whether he wants to study or not. A person who practices sports does not mean that he will not study. It belongs to each person"(E 79). "It depends on how much the student would be dedicated to that, you know? Sometimes there are people who do not know how to discern their time, they do not know how to organize and sometimes they give more credibility to one thing or another, and forget that the main thing is studying, they know it is high school that they are doing"(E 117).

Student 22 states that this relationship will depend on the degree of student involvement:

> So in my opinion, if a student gets too involved with curricular activities he will do poorly in performance because. Because it is a matter of capacity and organization, the more items you have for extracurricular activities. But it has to be your dedication to organization time and also in practice to exercise the activity, consequently if you have more activities your school performance decreases, so it is this relationship in my opinion (E 22).

For student 26, the tiredness caused by extracurricular activities hinders school performance: "Because it takes a little longer, it is a time when we get tired because of these activities, the fatigue is also great from time to time" (E 26). "Well, I end up getting very tired after practical and physical activity, usually I don't have the strength to study because of physical or emotional pain" (E 55).

The pleasure of extracurricular activities can divert the dedication to school activities and compromise school performance.

> A lot because sometimes you need to dedicate your time to important things at school, but at the same time you also have something important in your extracurricular activities that you decided to do, you chose to do because it is something you like and sometimes you dedicate yourself more to something you like than something you have a responsibility for. So sometimes it interferes a lot (E 62).

[1]When translated from Portuguese into English, the software used omitted connective terms from the source language, prioritizing substantive terms.

For some students, some extracurricular activities hinder and others help to improve school performance: “Some activities hinder and some help in the sense of consuming you a lot of time” (E 72).

The excess of activities or some proposals with short term for execution compromise the dedication to the curricular contents:

> So, sometimes when we need to do some participation like last week that had the education week for life, as it was very late, then we had to dedicate all our time, so we were practically a week without do nothing, just chasing things without being able to study, right? Just running after the things we would need for the fair, so sometimes they put a lot on top, like one thing after another and we accumulate things to do and we are unable to dedicate ourselves fully to all matters, we have to choose a subject to dedicate (E 91).

Extracurricular activities interfere negatively when they involve travel is the view of some students: “Well, for some athletes, for example, they lose a lot. It's a test week and you lose a lot of tests with these trips, then you end up coming back and have a lot of accumulated evidence, then you end up not studying and doing poorly, but I never had this problem”(E 03). “Well, it interferes for me, but when I travel, because I miss a lot of content at school and then I have to go after it. So, I'm like crazy after chasing my stitches and that's it”(E 15). “[...] Because when it is necessary for the student to travel, he misses many classes, understand? And when he comes back he doesn't have much to do ... So, he gets a little undergraded, let's say, but also if he is an applied student he can regulate, so he doesn’t interfere” (E 33).

There is also the perception that extracurricular activities take a lot of time from students, because in addition to meetings with teachers (classes, training, rehearsals), students need to dedicate themselves at other times to improve their skills:

> I would say that they interfere with the general timing issue. Music, for example, does not wait! they interfere more in time because generally the time that I am dedicating to extracurricular activities I could be dedicating to other activities such as, for example, studying more for school subjects. And also dedication because we know that activities in sports, music and any other activities they require dedication in order to achieve a goal within them, so it is not just the time of classes that is occupied (E 96).

The discernment that extracurricular activities do not interfere with school performance, but rather the state of competition was evident in the student's approach 37:

> I think it is not even the activities, I think it is because of the pressure that we have to be good here that interferes, you know, because in general we always go to a competition, because here we prepare for the job market. So, it is conference, travel, this is only given to the best students. So, we are always in competition even if it is not said, I think this is worse than the activities (E 37).

Category 2: Student's perception of the contributions of extracurricular activities to “knowing” and “knowing how to do”.

Extracurricular activities add knowledge and enrich the curriculum: “Well, a lot of people think it should interfere, you know, because it's something else, but I think it just fills my time for my knowledge more” (E 80). “Yes, they help a lot in the matter of technical matters, especially robotics, which helps me a lot in the electrical part” (E 56).

Likewise, students say:

> Well, they take up time that they could be studying, right? So, I have to organize my time better, but they are much better in relation to my curriculum, because I will have more experience and I will have other things to add, to say that I have more experience, not only with what I learn at school, right? So, I think that in relation to school performance as a whole they are very good. But, in relation to studies only here, they do not get in the way, they take up a little time, then it gets tighter (E 41).
>
> On the good side, the Chemistry Project, the two Chemistry projects, in this case, help me to clarify some contents that sometimes become more difficult to understand in the room, because here we have practical experience. That's it in the Chemistry content, since the contents of the projects with the teacher “X”, help me in the part, mainly in the writing part, mainly scientific writing because... And also for is ... Knowing how the scientific methodology for referentials. I think this is good mainly because we students at the Federal Institute need to have a good basis on how to work with scientific methodology, since we are focused on this side of research, innovation, extension, so, employment, generates articles, booklets that need to be published. Well, (laughs) every activity besides spending time generates stress, so, some days I may feel a little harmed by having a heavy work routine, but nothing that interferes a lot. I think what most interferes is because I spend four hours in the morning in the laboratory, but as I said, when I have a little time left to study (E 85).
>
> Well, they interfere in a positive way, because they cause me to awaken my knowledge. After entering the research area, I really started to dedicate myself even more to the study. Not only in the area of Physical Education, and in chemistry, but in general, because I started looking for research in all other areas (E 101).

On the other hand, it is necessary for the student to police himself in order not to get involved in many extracurricular activities and find himself in the condition

of having to choose which is more important, urgent, and priority, as reported by student 97, who described,

> Look, there we have two points. Point one: the activities help a lot, for example, for those who do research it is very good even more that you have to write an article, when we have to make a report, because it helps, for example, Portuguese language discipline and when we conduct a research that is to assimilate the technical disciplines, for example, it also adds knowledge, so it is important for that, because of the autonomy because when we do a research project in which we are the researchers, we have ... that, for example, in my Project I am a researcher and I have supervisors, but I am the one who develops, so it is the question of you have to develop because if you don't do it, nobody will do it. So this question of autonomy and responsibility helps a lot when you participate in these extracurricular activities, also because of time management, but it hurts in the sense of just overloading because, for example, I develop a lot of activities and I get very overloaded with them, so, for example, I said that I study at night and at the weekend, I often have to give up parts of the night, parts of my final week to dedicate the research, to finish something I'm doing, to read the research group's book, so there are these things and then these extracurricular parts are often left out, sometimes I have to choose whether I'm going to study for my exam or whether I'm going to read the book that the research group asked for read to us, right? If I find and discuss it, then, I have to decide what to choose when you do many things, many extracurricular activities have some that will be a priority and others that will not be, so on this side it is a little harmful and then it depends on the student knowing how to manage what he will choose and what he will not (E 97).

Still in this light of the positive points, student 19 stated that "Interfering, does not interfere. It even helps sometimes, it helps to de-stress and it also helps you lose. No, being very stressed" (E 19). And student 112 pointed out that "Extracurricular activities take a long time, make it very difficult, but it's worth it. It makes me more dedicated and more focused" (E 112). Student 28's speech is added when he says "I think it doesn't interfere, because in basketball you train your reasoning a lot. So, I think that sometimes it ends up helping"(E 28). "I think they don't interfere, it helps the person who tries to try hard to want something" (E 47).

Category 3: Extra-class activity and the development of cognitive, communicative and socioemotional skills.

Student 116 corroborates this analysis by stating,

> Do they interfere positively in school performance, because always when I was in sports I was very hyperactive, did I have motor coordination? I didn't have it, my grades were very bad, I stayed in many subjects, after I started athletics it improved a lot, my grades started to rise a lot (E 01).
> I think they never interfered, in fact they always helped, because the sport helped me to have dedication and focus, and the research activities helped me to have organization, especially with my time, and date of delivery of the works, to organize myself better for knowing how long I will need to take to do a certain job and how long I have to deliver it (E 116).

It was also evident to look at extracurricular activities as an occupation of free time: "Extracurricular activities for me is a hobby, not least because I believe that if I hadn't had fun with that, I wouldn't go out, I wouldn't feel so comfortable with participate, so I really enjoy doing it as a hobby, something that amuses me, entertains me (E 81).

> They interfere, as I said mainly in training because most of the time as a player it is because we usually have a contract, so this contract, we have a boss. So, like, if he asks us to train at that time, it has to be that time, we can't postpone it, we can't postpone training, especially the game, so most of the time there is an activity to deliver another day, but there is training, so training takes that part because he gives the money, he does these things, right? So, it is practically, because it is because he is, like it or not, our boss, even though he is a great friend, being a great person, but in relation to this he has been caught (E 86).
> When you instead of studying more, you are training more and it ends up interfering, but they also interfere in health since to study you need to be healthy, you need to have performance and energy, because you cannot study without energy (E 65).

Category 4: Teacher's perception of the interference of extracurricular activities in school performance.

Regarding the opinion of teachers regarding the interference of extracurricular activities in school performance, the word cloud (Figure 3) is highlighted, with emphasis on the words activities, student, people. The citations presented (after figure 3) allow us to know the context in which these terms appear.

Fig. 2: Teachers' perceptions of the relationship between extracurricular activities and school performance[2]

The presentation of teaching citations begins with the perception of positive and negative aspects in extracurricular activities. However, teacher 02 showed only the aspects perceived as negative:

> Look, it has the positive side and the negative side. Because like this, I often see that activities are not scheduled "within the school year, and they are not talked about" between departments, between teachers. So many times, I feel hurt when I have to release students, or when they leave to travel, to play and I have no knowledge. But I see this as a lack of organization in the institution, right? And that sometimes ends up harming the student, why? Because the Institution's lack of communication means that he sometimes has to run after evidence that he lost. Because nothing is foreseen in the calendar, understand? So this complicates a lot (D 02).

The interference of extracurricular activities will be negative for school performance if students who do not engage in curriculum studies in the same way that they engage in research and extension activities.

> If they do not know how to divide the activities. There are students who only want to know about playing ball, only about being in the laboratory, only about doing other activities and this can end up getting in the way. So, there is a lot of the student himself, or the one who is advising to take and explain "look, there is time to study, there is time to practice sports, there is time for research, there is time for study". So, a lot of that goes on there. And so, I believe it can hinder performance on this issue, but if you are a student who is dedicated, if that student is dedicated to research, dedicated to sport, he can also be dedicated to his study. That, positively. If you think about the negative side, you can take into account what I said earlier (D 14).

There is a perception that students with low school performance should be prevented from participating in extracurricular activities:

> When it is a research activity, it improves performance, because as the student has to study well to be able to develop his research. He begins to take this practice to other disciplines. So, for me, this is positive, right?, also music, for example, sport, or at least it should be. I see that, unfortunately, in some cases, we see people who excel, both in music and in sports, but who are not dedicated to the classroom, right? If we had, as a criterion, for their participation, sports and music, the good performance in the classroom, we would have an incredible improvement in the subjects, as in research, for example, we have a teacher, arrived recently at our course, his name is X, and students, in order to continue researching with him, have to take an average, in all subjects, eight or above eight. If you get any average below eight, leave the survey (D 03).

The perception that extracurricular activities have a more negative influence on school performance was presented by the teacher 5:

> Unfortunately, it has mostly interfered in a negative way, since students are often very dedicated to extracurricular activities, be it artistic; cultural or sports and ends up leaving the academic part on top of the plan. Many students, for some reason, prefer to go to a rehearsal, to go to training than to do a job or attend classes in the regular period (D 05).

Teacher 06 tries to find a middle ground, indicating that the influence of extracurricular activities will depend on the students' involvement, on the commitment to the study. On the other hand, teacher 16 points out that if students participate in these activities in search of a point in a given subject, they will not be involved enough to learn.

> Now positively, now negatively. I have students involved in sports, for example, sports that are offered here at the Institution, which are students of excellent performance. However, I have students, I have a student who he is, being involved in activities, in the fourth quarter, for example, he didn't come to any of my classes. So it is relative, it would have to be a question better evaluated, better monitored because I have these two extremes: students who are involved in sports or music, with activities that are offered here that are excellent committed students, who participate hard in what is proposed in the discipline and such, I have another compensation, another one that they have been since the beginning of the year, from the third quarter to now, he practically

[2]When translated from Portuguese into English, the software used omitted connective terms from the source language, prioritizing substantive terms.

> doesn't have any classes and is, he went to the games and everything, but in class he doesn't come (D 06).
> Well, I see that they usually promote personal development, right?, of the student. A growth of the student, either because he participates in an event by the Institution outside the Institution or even within the Institution, but he has to get involved with that, he has to research. So, that is, he will, in a way, get involved. He will learn to format a job to be able to deliver his report. He will learn how to do his research, he will learn to ask for help when he has difficulty. So, it is a very interesting element, but only if the student really gets involved with it, if he is just doing it because he wants points on something there is no involvement and it will not bring him a great benefit (D 19).

Teacher 08 realizes the need to guide students in order to prevent them from participating in many activities and being able to select those that are more related to each one, so that they do not commit to many teachers and then delay school activities due to extracurriculars:

> Yeah, I even talked to the students that, one of the things I find interesting at the Institute, is that unlike other conventional educational institutions, we offer a range of activities for all tastes. The problem we have is that sometimes students are so amazed by this list of activities, that they start to prefer extracurricular activities due to the study, and then, something that I always call attention to, even in the first days of school , 'the Institution has many activities, before you arrive and enroll in all of them, check which ones have more to do with, which have, with which you identify more, and select, because you have here, you are attending high school and vocational education, so it is a load of work, very intense activities, so if you take more than one activity, if you are not an organized person, you will not be able to cope, right? You will not be able to perform, develop with excellence nor your main activities, which are your studies, which is your technical course, nor the extension activities. So, we always draw attention. It is good, it is excellent, because that is, they are enriching activities, but what I see is that sometimes I have a student here who is sometimes in four projects, research, extension, sports, everything, then you say, 'oh, why didn't you deliver your work on the date', 'oh because I was in an activity', 'oh because I had to do a report', 'because I had to do this', 'I had to do that'. So, I see that they often lose focus, because they don't have the maturity to choose, they subscribe to everything, then they stay with that one, with that moral weight of 'oh, I gave my word that I was going to do the project with the teacher, the teacher ', and then they can't get out of activities and can't handle their studies. So this is something that I have been following a lot since I arrived at the Institution (D 08).

Category 5: Planning and development of extracurricular activities.

The need to manage time to dedicate to curricular activities was highlighted in the speech of the teacher11:

> Extracurricular activities. They interfere, level if she ... has two points, right? It can interfere positively, it is mainly with activities that are directly related to some activities of that specific discipline, right? But most of the time it interferes positively. As long as the student, he can balance his time, right? Yeah, like, he can't just dedicate himself to extracurricular or extracurricular activities because she is more attractive, she is more interesting to him and to leave others and not give due attention to others, he ends up hurting himself, right? I think that's it. It can already influence negatively when the student is dedicated to only one thing. He doesn't know how to separate things. Manage time actually, right? (D 11).

While teacher 12, see the need for planning so that extracurricular activities do not compromise curriculum activities,

> Yes, when they are done without planning, without a visualization at the end of the project, that end, right?. When it's out of hours, when it disrupts regular education, when the student says "teacher I have to go there because I have to do a project with such a teacher". There, it disrupts the student's performance, when activities are poorly planned, in fact (D 12).

Teacher 13 proposes to take advantage of extracurricular activities to replace some school subjects in order to avoid overloading the student. Professor 21, on the other hand, states that it is necessary that the construction of knowledge also occurs in these activities and in a consistent manner:

> A big problem, in my view, at the Federal Institute is that people need to mature the idea, I even talked to you there on the integration day you had, that the institutional curriculum must understand that these activities should not be extracurricular, they should replace curriculum activities whenever possible, because if not, you create an overload of work for the right student? If the student is doing a research activity, which involves one of the subjects he is studying, we should have some mechanism to take advantage of this research activity to eliminate part of the study. The same thing is cultural practice, it is always possible to take advantage of something to avoid work overload (D 13).
> Then, I think it is extremely important that they have contact with these others, with these other activities it is, I believe that the school still needs to improve in this sense, to understand that education is also the construction of knowledge, it is also done through these activities, no only in class in the classroom. Yes, many positive experiences that I have in my life both in high school, technical education is, extracurricular activities are extension projects, sports activities. So, much of what constitutes me today I have

> through these activities, so, as it served me, I think it can serve my students. I really believe that this involvement with other activities can contribute in a very, very consistent way (D 21).

There is a need to keep the student focused on extracurricular activities and to set limits, defining how far they want to go, the development they want to achieve for the Institution and for the student:

> Yeah ... It depends a lot on ... how they get involved in it, right? It is important that they are focused, right? In extracurricular activities more than know the limit. So, a big question, when it comes to high school students, is that normally, we as teachers, we tend to push hard, right? From the students and demand this, the maximum of them, and those that correspond to us will be pulling more and more, right? This ... sometimes it ends up being our fault, because we forget to look at other issues, right? So, yeah ... I think they have to be done with caution. So, we have to establish how far he can go, but we also have to establish a limit: to know how to reconcile, to make him reconcile these things, right? It is important, therefore, that when representing the Institution in these activities, research, extension, right? students are aware of their duty to the Institution. So, they need ... to know the impact that this has on their lives and for the Institution as well (D 17).

Category 6: Teacher's perception of the contributions of extracurricular activities.

Extracurricular activities are motivating and this contributes to increase school performance, in addition to reducing stress contributing to the exam period:

> Look, the activities are, extracurricular, it will contribute a lot, because it gives the student the opportunity to break the ice, break the ice that I say like this, get out of that day-to-day routine, and then he sees another initiative, another purpose and it motivates him to continue doing that motivating activity. Then, the person who is directly connected to a classroom, suddenly he goes there and does a sports activity, he will considerably increase his income. I believe that and research shows (D 15).
>
> Well, as I only saw one student, so I find it difficult to answer this question, but I think that for people who participate in something like me as a child, this helped because it kind of balances the mental part and the body knows, so it doesn't generate as much stress, I think it relieves when you are in the test period, so, maybe for these people the same thing happens (D 24).

Extracurricular activities contribute to physical, mental, emotional, intellectual well-being and interaction and stimulate students in their studies, with the need for teachers to monitor these activities to prevent them from interfering in curricular matters and preventing students from dispersing and damaging their school performance.

> Well, extracurricular activities are interesting as they do not interfere with other subjects, right? In matters of both the basic and technical core. Yes, but they cannot fail to be executed, to be done, since it is, it is part of the health issue, right? Physical, mental and emotional well-being of the student. And sports practice, it stimulates both the point of view of the human body and the intellect. So it is important, extracurricular activities (D 18).
>
> So, some extracurricular activities, they meet what they are studying, right? And for also participating in extracurricular activities in which they form teams, right? They and the students start to have a greater interaction between them and this also encourages them to study more. There are already other cases where they are dispersed by these extracurricular activities and end up leaving aside their academic curriculum, right? And we always try to keep checking if this is happening so that we don't harm the student who is part of the research project, for example, right? Because he is there to learn more, within the research, and not to forget what he had to do (D 16).

Extracurricular activities, such as sports, should have a place in the school institution, either for the direct benefits or for the indirect benefits. Exceptions cannot be used as rules to speak negatively about sports in the school environment:

> Look, when I am practicing some activity, even if it is just a walk, my brain works better, so I believe that school activity, it is extremely important for students because those who are good will become better, right? And those who have a certain difficulty, I think they will be able to overcome barriers more easily. Of course we have some students who are also not a rule, but it is an exception that has a series of difficulties, but who love the sport that are there or often, are here can be at the Institute just for the activity, just for the sport, that it is not good, but this is also not a rule, this is an exception and people can work the latter differently, right? And demonstrating the importance of all other areas and making sure that he can produce the minimum necessary so that he can have a job placement and make his commitment and performance in physical activities really, if he is a talent, that he can continue in this career because then a student who loves or loves Physical Education can do a higher level in this area, right? And being an excellent tutor, an excellent personal trainer or an excellent future teacher, why not? I think sports are fundamental, right? To think that sport as I have heard it from some colleagues, right? Sport, it doesn't help or it doesn't add value, I think this is a huge mistake, right? Because like this, I speak from my own experience when I'm practicing any physical activity, my brain works better and we know that this is science, this is not, let's say, not blah, blah, blah, right? So, I think people need to work in this direction, of course there are some exceptions from students who just want the sport

> and sometimes forget to study, but then I think it's a matter of sitting down to channel this student, it's a matter of orientation, but the sport, it does help, there has to be a space, we have to work for it to happen (D 23).
>
> Look, in the students' performance, it tends to, in my view, tends to improve, right? Because it keeps students here inside the institution, right? This is outside the class period. This is important for students, because they end up staying here, and having more interest to learn the classes, and they have an activity that involves, it does not involve itself, the content itself, that they see in the class, but they can see this, for example, in a research project, they can see how the theory will be worked in the classes they are understanding, that's all (D 07).
>
> I think she can interfere in a positive way, but with care. Yes, I say in the following sense, a question of responsibility, mainly of group work, I think it is very developed with the issue of sports activity, and extracurricular activities, research and everything. But people have to be very careful, because sometimes they are used by students, not as crutches, but as justifications for not doing some activities related to the classroom and everything. So I think the student has to be aware that from the moment he assumes his responsibilities for research, sport, extension, in short, he has to assume that responsibility and continue to bear the responsibility of a high school student and everything, because he will have to find a way to reconcile it (D 09).
>
> I believe that extracurricular activity, if it is well directed, it enriches the student's performance. Because, many times when you leave the school curriculum, but not running away from education, it helps. Nothing will: make quality decrease if you know how to work this extra-curricular curriculum (D 10).
>
> I consider that positively, it is seen that all extracurricular activities are marked out for the contact of a student teacher, right? And in this way, whether for sport, research or music, there is always a relationship between teacher and student and the request, right? It is the monitoring of the teacher so that these students are carrying out their activities is in the classroom (D 22).
>
> Positively, extracurricular activities end up, so to speak, a complement to conventional education (D 25).
>
> I think it is good, if the student if the student has a good development in sport, it means that he is an interested person, that is, this should reflect on school life, I believe that this would be so (D 26).

Considering these perceptions is indispensable, taking into account that the integrated technical training also requires more dialogue between teachers and between the contents, favoring the quality of learning in the formative itinerary of this student who knows, knows how to do, knows how to do and knows how to live together, in consonance with the CNCB and the pedagogical project of the course, which are assumed to be in accordance with the human training needs that Brazilian society, especially that Rondônia craves.

IV. CONCLUSION

Among the students there are several perceptions, evidenced in the research, mainly three: the view that extracurricular activities do not interfere in school performance, the opinion that they interfere negatively and the discernment of positive interference.

Extracurricular activities negatively affect school performance if the student does not organize his time, if he overly involves these activities, because these activities cause tiredness, when there is an accumulation of activities, because these activities require a lot of time, when they involve travel.

The perception that extracurricular activities interfere positively was associated with enriching the curriculum; help in organizing time; Skills development; increased focus, dedication and effort; student entertainment (hobby); stress reduction; improved reasoning.

Regarding the teaching perspective, positive and negative points were also evidenced. The negative aspects stand out: students are more involved with extracurricular activities to the detriment of the curriculum, which is why students with low performance should be prevented from participating in research and extension activities, students are dispersed by activities. However, there was a teacher who considered that interference will depend on the student's dedication to extracurricular activities and the organization of time for studying the curriculum.

As for the positive factors, observations were made that the extracurricular activities are enriching, favor teamwork, responsibility, encourage students to study more, increase interaction, contribute to physical, mental, emotional and intellectual well-being; in learning work formatting, forms of research, knowing how to ask for help in difficulties

The views of students and teachers are in need of organization / time planning, so that students can effectively develop teaching, research and extension activities without overlapping one another, without compromising school performance in this integral formative itinerary the future working man, who is also a sociocultural being able to reflect and recreate the reality of the community.

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Impact of Coronavirus Disease (COVID-19) towards Economy and Vaccine Industry

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***Keywords*— COVID-19, Economy, Vaccine, Supply-demand curve, Market equilibrium.**

***Abstract*—** *As 20 January 2021, there have been 94,963,847 confirmed cases of COVID-19, including 2,050,857 deaths, reported to World Health Organization (WHO). The outbreak of coronavirus disease (COVID-19) creates significant impact to economy activities in worldwide. Most economic sectors including tourism industry facing with difficulties during the outbreak of COVID-19. The COVID-19 outbreak creates negative effect and slow down all economic activities in worldwide. This disease spread easily that transmitted through droplets generated when an infected person coughs, sneezes, or exhales. Therefore, in surviving for global economy, a few pharmaceutical companies developing vaccine to cure the disease. Vaccines function by training and preparing the immune system of human body, to recognize and fight off the target viruses and bacteria. If the body is exposed to those disease-causing germs later, the body is immediately ready to destroy them, preventing illness. This paper analyzed the demand-supply of COVID-19 vaccine towards price and quantity. Result shows the increments in demand for vaccine, creates increments in price of vaccine. The finding of this study is important for policy maker to develop proper strategy in monitoring vaccine implementation including the price behavior.*

I. INTRODUCTION

The increasing number of COVID-19 cases give a big impact on the industry sectors worldwide. As reported by World Health Organization (WHO), on 20 January 2021, the total confirmed cases of COVID-19 are 94,963,847 cases with the deaths cases is 2,050,857 cases. Thus, this number indicates the crucial level of economic and social impact toward COVID-19 pandemic. Therefore, a new strategic are needed in order to overcome the problem happened such as unemployment rate, bankruptcy and social impact. Many efforts have been done to reduce the spread of COVID-19 such as Movement Control Order (MCO) (Abu Bakar and Rosbi, 2020a), moratorium schemes, tax incentives and others. However, the number of COVID-19 cases is still increased. Therefore, several research teams were developed a vaccine that can protect human from COVID-19 virus. The main function of vaccine is to prevent diseases that can be dangerous, or even deadly. Vaccination is important to stop the COVID-19 pandemic with help reduce spread of COVID-19 in communities.

The spread of COVID-19 worldwide give impact on the demand for COVID-19 vaccines. The high demand for COVID-19 vaccines give opportunities to vaccines' industry to develop a good quality of vaccines as soon as possible for protect human from suffer with COVID-19 virus. Thus, pharmaceutical companies involved in the vaccine enterprise play critical and often unrecognized roles in the global health management arena (Gordon and Robertson, 2017).

II. LITERATURE REVIEW

COVID-19 give impact into all industry worldwide (Abu Bakar and Rosbi, 2020; Abu Bakar and Rosbi, 2020).

Therefore, a new vaccine needs to introduced in order to reduce the high number of COVID-19 cases. According to WHO, researchers are trying to develop a vaccine of COVID-19 and WHO is supporting their efforts. This vaccination is highly recommended to protect human from COVID-19 virus. As suggested by Abu Bakar and Rosbi (2020) government need to improve their policy in order to be more effective and appropriate towards combating the spreading of COVID-19.

Pharmaceutical companies that are permissible to develop COVID-19 vaccine are Novavax, AstraZeneca, Johnson & Johnson, Sanofi & GlaxoSmithKline, Moderna and Pfizer & BioNTech. These pharmaceutical companies need to supply COVID-19 vaccine globally. Therefore, the demand for COVID-19 vaccines is high due to demand from worldwide country.

III. IMPACT OF COVID-19 TOWARDS ECONOMY

The outbreak of COVID-19 gives significant negative impact towards economy activities in global level. The COVID-19 intensely damaging effects on both the country macroeconomy as well as on the economic welfare of the citizen. The sources of economic damage are two factors namely the first is the knock-on effect from the impacts of the coronavirus abroad, the second is generated domestically due to the newly-imposed movement control measures (Chudik, et al., 2020).

This pandemic COVID-19 devastating effects on the economy from both external factors (namely global supply and demand shocks) and domestic factors (considered for movement control order). Therefore, this factors disproportionately impact smaller businesses and vulnerable groups such as lower-income individuals and workers. Due to this scenario, many countries facing with high unemployment rate that reaching at alarming level.

The infection of COVID-19 not only considered become a public health crisis but also affected the global economy in critical level. Significant economic impact has already occurred across the globe due to reduced productivity, loss of life, business closures, trade disruption, and decimation of the tourism industry. The crisis highlights the need for urgent action to cushion the pandemic's health and economic consequences, protect vulnerable populations. The economic crisis ensuing from COVID-19 involves practically all the countries of the world and recovery is expected to take a long time.

The COVID-19 pandemic considered as a global shock that involving simultaneous disruptions to both supply and demand in an interconnected of globally for world economy activities. The negative impacts towards economy such as low demand for economic products. On the supply side, infections reduce labor supply and productivity, while lockdowns, business closures, and social distancing also cause supply disruptions. On the demand side, layoffs and the loss of income (that generated from morbidity, quarantines, and unemployment) and worsened economic prospects reduce household consumption and firms' investment.

The effect of COVID-19 towards economy was illustrated using the movement of price index in S&P 500. Figure 1 shows the dynamic behavior of market price during outbreak of COVID-19. The S&P500 is a stock market index that measures the stock performance of 500 large companies listed on stock exchanges in the United States. The S&P500 is one of the most commonly followed equity indices in global level. The observation periods were selected in February and March 2020.The initial value of observation is 3248.92 on 3rd February 2020. The last observation shows the value of 2584.59 on 31st March 2020. The maximum value of market price index on 19th February 2020 (12th observation period). The minimum value of market price index is 2237.40 on 23rd March 2020. The percentage of change for market price index is -33.93 %. Therefore, the significant drop of index value indicates the outbreak of COVID-19 shows negative impact for economy activities at global level.

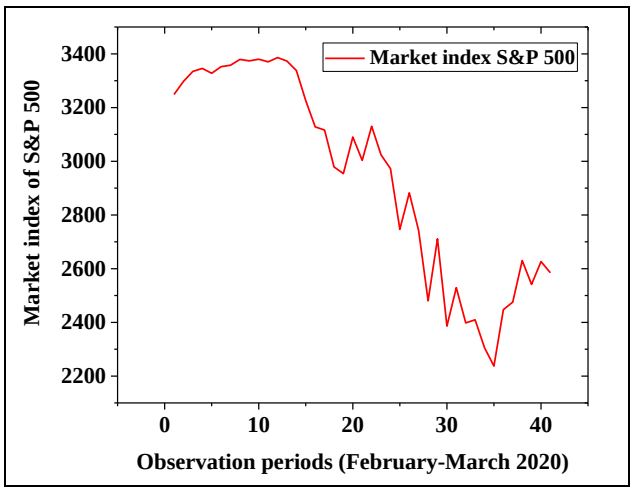

Fig. 1: Dynamic behavior of S&P500 during COVID-19.

In solving these issues, the government in global level started to provided economic stimulus packages in combating the economic issues. In the same time, government in countries provided more option to their citizen to participate in new job opportunities as digital commerce and electronic marketing segment to re-vitalize the economic situation. The financial sectors also offer lower interest rate to increase the economic activities.

IV. DEVELOPMENT OF COVID-19 VACCINE

The COVID-19 can be infected by breathing in the virus if humans are within close proximity of someone who has COVID-19, or by touching a contaminated surface and then their eyes, nose or mouth. Most common symptoms for human that affected by COVID-19 are fever, dry cough and tiredness. COVID-19 is caused by infection with a new coronavirus (called SARS-CoV-2) and flu is caused by infection with influenza viruses.

Vaccines work by mimicking the infectious bacteria or viruses that cause disease. Vaccination stimulates the body's immune system to build up defenses against the infectious bacteria or virus (organism) without causing the disease. The parts of the infectious organism that the immune system recognizes are foreign to the body and are called antigens. Vaccination exposes the body to these antigens (Vaccine Development – 101 (2021).

Some vaccines contain weakened versions of a bacteria or virus, other vaccines contain only part of the bacteria or virus. Some vaccines contain only the genetic material for a specific protein and direct the body to produce a small amount of that protein. The body's immune system reacts defensively once it detects this protein.

After vaccination, the immune system is prepared to respond quickly and forcefully when the body encounters the real disease-causing organism.

The fundamental scientific advances that make vaccine development possible arise from basic research. The full implications and ultimate applications of discoveries made in the basic research laboratory may be unanticipated, even by the investigators involved. Basic research relevant to vaccine development includes such things as the identification and isolation of the protective antigens of a specific pathogen, methods for DNA cloning, the creation of new vector systems, and the development and immunologic evaluation of new adjuvant systems (6 Stages of Vaccine Development (2021).

The health committee believes that priority setting and characterization of desired vaccine products is a critical stage of vaccine development, particularly for vaccines of low commercial interest but acute public health need. In this regard, the committee urges all groups involved in vaccine R&D for international public health applications to focus on a common and complementary set of vaccine priorities (World Health Organization, 2021)

Good vaccines must meet basic criteria of safety, purity, potency, and efficacy. When a product has completed preclinical studies (usually involving animal models) and the sponsor is considering clinical trials in humans, an Investigational New Drug (IND) application is submitted to the U.S. Food and Drug Administration (FDA). The IND application contains information on the vaccine's safety, purity, potency, and efficacy.

The development stage for each COVID-19 vaccine under development must first undergo screenings and evaluations to determine which antigen should be used to invoke an immune response. This preclinical phase is done without testing on humans. An experimental vaccine is first tested in animals to evaluate its safety and potential to prevent disease. If the vaccine triggers an immune response, it is then tested in human clinical trials in four phases as shown in Figure 2.

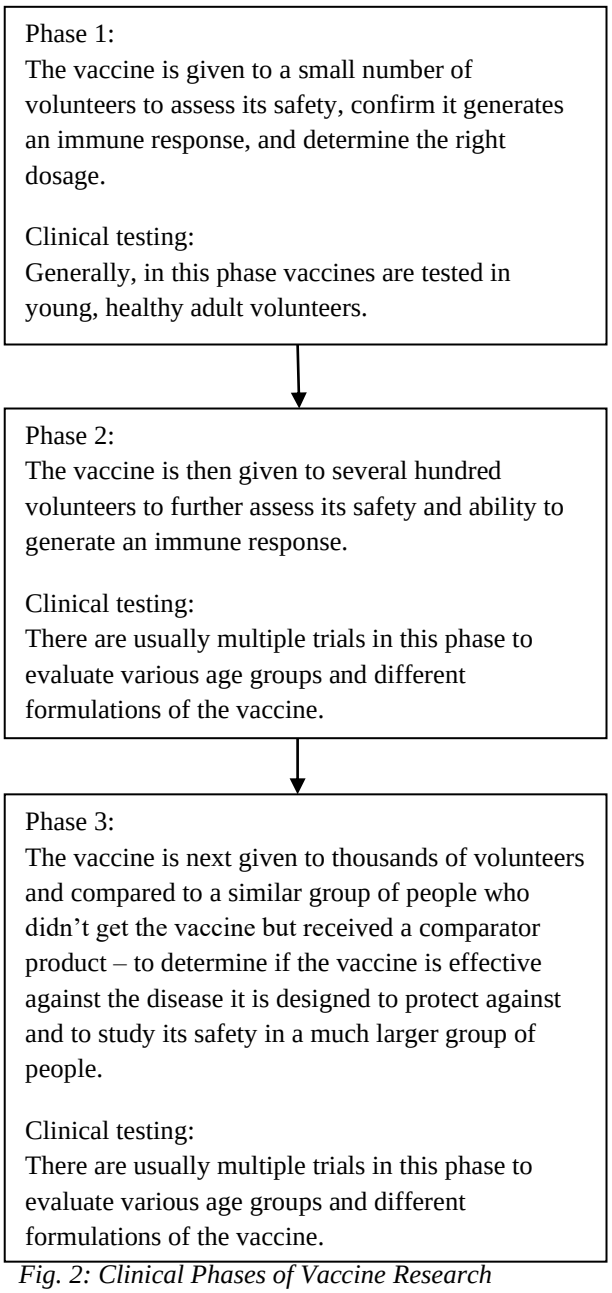

Fig. 2: Clinical Phases of Vaccine Research

V. ANALYSIS OF SUPPLY AND DEMAND CURVE

Outbreak of Coronavirus disease (COVID-19) affected all economic activities in worldwide. Therefore, a solution need to develop for combating this disease. A few companies develop vaccine in trying to solve this problem. The entity that involved in developing the vaccine is pharmaceuticals companies, government and medical and health organization. As market-authorized COVID-19 vaccines become available, specific recommendations for the use of these vaccines will need to be issued. The vaccine cooperation framework is important to offer guidance for considering data emerging from clinical trials in support of issuing vaccine-specific evidence-based recommendations. This information is valuable to countries and regions developing COVID-19 vaccination recommendations.

This study evaluated the economic impact of coronavirus disease(COVID-19) using demand and supply curve. The supply function is the ability and willingness of the firms to sell a specific quantity of a good or service at a given price in a given time period. Meanwhile, the demand function shows the relation between the quantity demanded of a commodity by the consumers and the price of the product (Cheng, 2020).

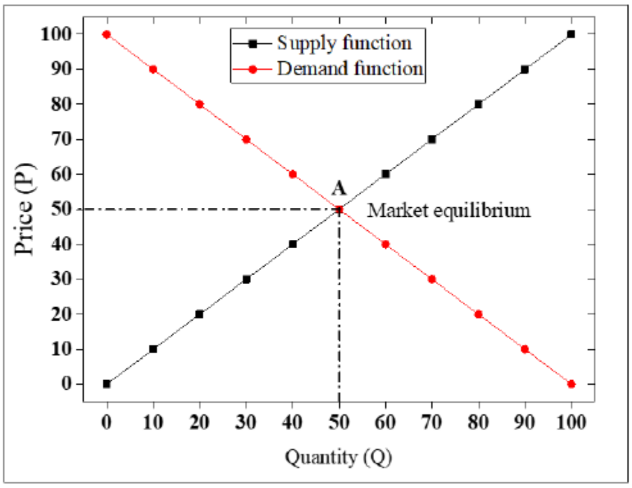

Fig. 3: Demand -Supply Curve for Vaccine

The price of a product is determined by the interaction of supply and demand in a market. The resulting price is referred to as the equilibrium price and represents an agreement between producers and consumers of the good. In equilibrium the quantity of a good supplied by producers equals the quantity demanded by consumers.

Figure 3 shows the market equilibrium for vaccine industry. In normal situation, the equilibrium is a state in which market supply and demand balance each other, and as a result, prices become stable. In this study, the price of vaccine is set at 50, and in the same time the value of quantity is considered as 50. This value developed for understanding the mechanism of COVID-19 impacts towards vaccine industry.

However, the occurrence of coronavirus disease (COVID-19) changed the landscape of economic for vaccine industry. The COVID-19 give negative impact to all of sector of industries in worldwide. Therefore, an urgent solution need to be developed in combating this issue. Therefore, a few pharmaceutical companies increased facilities and capital to develop COVID-19 vaccine. The development of this vaccine is to re-align the economic activity to be same as before the pandemic outbreak (Principle of Economics, 2021).

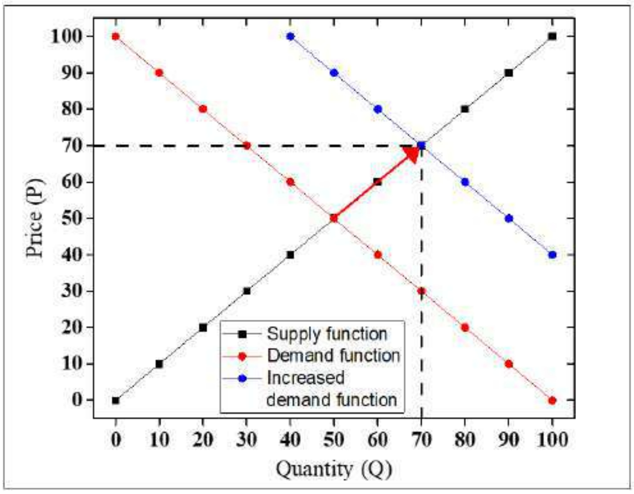

Fig.4: Demand -Supply Curve for Vaccine during COVID-19 outbreak

Figure 4 shows the demand and supply curve that after the COVID-19 outbreak towards vaccine industry. Figure 4 illustrates the price elasticity of demand for dynamic behavior of economic condition towards vaccine products.

The price elasticity calculation is represented using Equation (1). Price elasticity of demand is an economic measure of the change in the quantity demanded or purchased of a product in relation to its price change. In other word, price elasticity of demand is a measure of how sensitive the quantity demanded of it is to its price.

Price elasticity of demand (PED) illustrated using two main variables namely quantity of product, Q and price of that product, P, as shown in Equation (1).

$$PED=\frac{\frac{dQ}{Q}}{\frac{dP}{P}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (1)$$

Equation (1) indicates the price elasticity of demand is the change in demand for a commodity due to a given change in the price of that commodity.

Based on Figure 4, the calculation of price elasticity of demand is shown in below calculation procedure.

$$\text{PED}=\frac{\frac{70-50}{50}}{\frac{70-50}{50}}=\frac{\frac{20}{50}}{\frac{20}{50}}=\frac{0.4}{0.4}=1 \quad \ldots\ldots\ldots\ldots\ldots (2)$$

Equation (2) shows the value of price elasticity for vaccine product is 1. Revenue is highest at the quantity where the elasticity equals 1. The price elasticity for vaccine is considered as unitary elasticity means that a given percentage change in price leads to an equal percentage change in quantity demanded or supplied. In other word, the change in the ratio of the price of the vaccine is equal to the change in demand of the vaccine.

The demand for COVID-19 vaccine keep increasing because the total affected patients with this disease keep increasing sharply. Therefore, a mechanism need to accelerate the development and manufacture of COVID-19 vaccines, and to guarantee fair and equitable access for every country in the world.

VI. CONCLUSION

Main objective of this research is to evaluate the impact of COVID-19 towards economic and vaccine industry. The findings of this research are:

1. As 20 January 2021, there have been 94,963,847 confirmed cases of COVID-19, including 2,050,857 deaths, reported to World Health Organization (WHO). The outbreak of coronavirus disease (COVID-19) create significant impact to economy activities in worldwide.
2. The effect of COVID-19 towards economy was illustrated using the movement of price index in S&P 500. The observation periods were selected in February and March 2020.The initial value of observation is 3248.92 on 3rd February 2020. The last observation shows the value of 2584.59 on 31st March 2020. The maximum value of market price index on 19th February 2020. The minimum value of market price index is 2237.40 on 23rd March 2020. The percentage value of change for market price index is -33.93 %. Therefore, the significant drop of index value indicates the outbreak of COVID-19 contributes negative impact to the economy activities at global level.
3. The value of price elasticity for vaccine product is 1. Revenue is highest at the quantity where the elasticity equals 1. The price elasticity for vaccine is considered as unitary elasticity means that a given percentage change in price leads to an equal percentage change in quantity demanded or supplied.

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Lightning Protection of Rooftop Photovoltaic Systems: A Scientific Approach

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***Abstract*—** *The increasing of photovoltaic microsystems in Brazil follows global trend for low-cost panels and efficient cells. Although the solar modules are located on roofs and lightning strikes can damage all components of PV System (PVS). The Lightning Protection Systems (LPS) associated with Surge Protection Device (SPD) are the effective protection against electromagnetic effects. This study estimated the values of overvoltage and overcurrent induced by lightning in 2.65 kW PVS under different configurations, with or without LPS, by Faraday's Law of Induction. The estimation of the difference of potential on soil is according to the Law of Ohm and Maxwell equation. Thus, the purpose of this publication is to support the LPS design and SPD specification for PVS. The simulation considered the DC wiring design, distances from LPS and tilt angle of solar modules. The results pointed out that impulse rate of 200 kA/μs induces peaks up to 201,6 kV and 28,3 kA in DC circuits by lightning strikes and up to 82 kV in AC terminals of DC/AC converter transferred from soil by grounding systems. In conclusion, the main protection system against lightning damages is LPS associated with SPD that can protection against abnormal values of induced voltage and current. In addition, equipotentialization is necessary to complement the effective protection using a unique grounding system in accordance with the guidelines of the international standards IEC and ABNT.*

I. INTRODUCTION

The photovoltaic systems generally installed on the top of houses and buildings make them susceptible to lightning strikes and their electromagnetic direct and indirect effects. In addition, abnormal electrical current or atmospheric discharges can damage all solar modules and electronic devices during the course to the grounding system. Thus, installations, equipment and even electric vehicles connected to charging stations, may suffer severe damage during the occurrence of this natural phenomenon. In addition, the evaluation of economic losses have to compute the costs to repair the equipment and installations, as well as the energy not generated during the repairing period of the system and its restarting operation.

Therefore, lightning is a worldwide problem. For example, Brazil has experienced an average of 78 million lightning strikes per year [1]. Statistical surveys researched pointed out that at least 30% of the damage in photovoltaic systems of Germany is by lightning [2] and almost 70% in systems of Malaysia [3]. Therefore, electrical and

electronic systems and equipment in both residential and industrial sectors require appropriate protective procedures to reduce or to eliminate the effects of transients in electrical circuits by overcurrent and overvoltage [4].

According to Law of Magnetic Induction (Faraday), the electrical discharges produced by electromagnetic surges can induce currents and voltages in electrical systems, and, in its turn, the lightning protection methods aim to neutralize or reduce the damage to an acceptable level. The risk is directly proportional to the characteristics of the discharge, such as the peak value or the intensity of the electric current, duration, impulse rate (di/dt) and thermal energy or integral of Joule [5,6]. Thus, the performance of a lightning protection system may consider the efficiency formed by the set lightning mesh (electrode), surge protection device (SPD), grounding and equipotentialization system [7].

In addition, a mathematical model of PV system can simulate the effects of lightning strikes using PSCAD/EMTDC Computer Tool. The goal of such research was to estimate transients as induced currents and voltages in electrical circuit of the PV system. The results show that a transient of current will appear at the nearest point to the lightning strike and in same value of lightning current and the transient of voltage will appear at any point in AC side, which can damage the AC/DC converter. In addition, the paper intended to subsidize the performance of project to lightning protection system (LPS) in PV system [8].

A deeper research has investigated and solved complaints about damaged in PV systems of customers due to lightning strikes on power distribution network (electrical utilities) in Malaysia. The study investigated permanent and momentary interruptions in distribution network as consequence of atmospheric disturbance. It used a rooftop system (3.91 kWp) modelled by PSCAD/EMTDC Tool for computational simulations in the Centre for Electromagnetic and Lightning Protection Research (CELP) of the Universiti Putra Malaysia for providing facilities and scientific assistance in experiments. The simulation included several configurations of the PV systems simulating with or without application of lightning protection system (LPS) and surge protection device (SPD) [3].

Over the last years, the need to understand the electromagnet effects in electronics devices and electrical circuits of photovoltaic systems demanded multidisciplinary efforts aiming to produce valuable data for manufacturers and suppliers of PVS projects [9]. Among these investigations, one proposed an extensive review about fault characteristics of DC micro grids (DCMGs) and the protection challenges with a proposition for innovative protection techniques to solve these issues and enhancement of the protection of DCMGs [10]. For example, the analysis of reductions in backflow lightning overvoltage in PVS power plant at Ta'if city (KSA) has used high-frequency models for computational simulation to design a modified grounding system to decrease the lightning overvoltage effects in similar PVS [11].

On the other hand, partial element equivalent circuit (PEEC) method with vector fitting technique has analyzed lightning transients in PV systems, taking into account the frequency-dependent effects and ferromagnetic properties steel-structures [12]. Another paper has developed a new model of system for fault protection in AC micro grids having multiple grounding system, with communication-supported digital relays in different protection modules [13]. Other study has proposed a single-phase three-wire grid-connected power converter (STGPC) with energy storage for positive grounding photovoltaic generation system (PGPGS) where no transformer was required even for PGPGS with low-voltage battery set [14]. Thus, many studies have simulated impulsive voltages (1.2/50 μs) on polycrystalline silicon modules with reduced models with the peak voltages of 15 V, 30 V and 90 V, considering lightning strikes with positive polarity [15].

In general, results proved the occurrence of degradation in photovoltaic modules, DC to AC power converters and other electronic equipment of the photovoltaic systems due to electromagnetic effects. The efficiency degradation of polycrystalline silicon photovoltaic module (6 V - 1.5 W) by induced voltage from lightning was verified by simulation of 3,000 pulses with 1,000 V, 1.2/50 μs waveform and positive polarity, and the outputs proved strong degradation of the electrical characteristics (energy) of the photovoltaic module by impulse voltage (test) during the simulation with the discharges [16]. A second research of such authors detected the exponential decrease of the maximum power point (MPPT) during tests on the same modules exposed to electromagnetic fields simulating effects of lightning [17].

The method of finite-difference in time-domain can simulate the performance of grounding system of SFV under direct lightning strike [18]. The method of the finite elements in the modeling 2D applying to arrangement dipole-dipole can design a system model for estimation of resistivity of geologic layers with minimum errors [19]. A grounding system designed for the safety and dispersion of lightning current in the soil depends on the type of soil and arrangement of modules [20].

The grounding system of electrical installations of photovoltaic plants must consider the electromagnetic

compatibility of electronic equipment (DC/AC converters), including the rated overvoltage or threshold [21]. Insulated power cables for high voltage proposed as down conductor for lightning arresters in LPS as preventive method against structural damage [22]. The finite-element method can analyze the electrical potential and risks related to touch and step voltages during lightning strikes in buildings with rooftop PVS [23].

The theory of Electric Field Deflection (EFD) can subsidize the position of lightning rods (captors) for best protection performance of photovoltaic systems [24]. The capacitance feature (electric field) can provide non-touch or remote measure of voltage without direct contact with an energized conductor [25]. Moreover, the equipotentialization can eliminates or minimizes the ground potential difference to protect people from electrical shock and prevent damage in power system and equipment [26].

In turn, also the international standards directives determine the calculation of the intensity of the magnetic field inside buildings creating internal lightning protection zones (LPZ) as rated safety zones or levels of protection for risk assessment of electronic systems against the effects from lightning electromagnetic impulses (LEMP). However, to external installations located on the roof of buildings, on the contrary, the standard recognizes the greater susceptibility to the direct effects of atmospheric discharge and its non-attenuated magnetic fields where there is greater possibility of damage to PV systems [27,28].

This paper shows a complementary methodology using fundamental laws of electromagnetism and Ohm's theory to subsidize the checking of risk management determined by international standards IEC-62305/2020 and NBR-5419/2015 related to protect photovoltaic systems against lightning damages. Thus, the method proposed has estimated the induced voltages and currents by lightning strikes in PV systems installed in buildings, with or without lightning protection system [29]. In addition, to complete the analysis the methodology has quantified the grounding effects by estimating the values of overvoltage in equipment and building facilities caused by grounding systems. The results has analyzed the performance of grounding grids and equipotentialization projects [26].

II. MATHEMATICAL MODELING

As shown in Fig. 1, the photovoltaic system with surge protection device (SPD) represents two scenarios for case studies, the case one S1 consider flashes striking the (LPS) and the second case S2 the discharge strikes on modules of the photovoltaic system. In both cases, the atmospheric discharge makes the direct current (DC) and unshielded electrical conductors experience the effects of electromagnetic induction, generating overvoltage and overcurrent in the electrical circuit that connects the photovoltaic modules to the energy converter DC/AC. The method of calculation also consider the estimation of the values of induced voltage and current in common and differential mode [29]. In fact, we can obtain several results by changing some parameters into a range of values in the math equations, looking for the simulation on real requirements of the system.

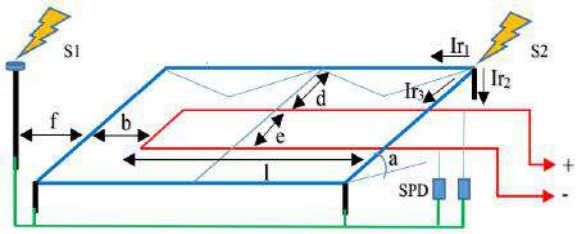

Fig. 1: Lightning strikes LPS (S1) or solar module (S2)

The second part of the study includes the application of the first and second Law of Ohm for soil modeling estimating the grounding resistance value and electrical potentials starting from grounding mesh generated by lightning flashes [26]. The magnetic induction calculation considered the fundamental Maxwell Equation of Electromagnetics [30].

a. Induction model for flashes on LPS

The S1 scenario has considered the strike of the discharge on the lightning rod causing the induction of electrical voltages UIP in non-shielded electrical circuits and structures of the photovoltaic system, estimated by math equations (1) and (2) [29].

$$U_{IP} = K_C . L_M . \frac{di}{dt} \qquad (1)$$

Where K_C is the current division coefficient between the descending conductors in the LPS (K_C = 1 for one downward conductor, 0.5 for two and 0.44 for 3 or more). The di/dt is the rate of change of the current (200, 150 and 100 kA/μs depending on the Level of Protection against lightning - LP). Moreover, L_M is the mutual inductance between the downward cable of LPS and the loop of the electrical circuit calculated according to expression (2):

$$L_M = 0.2 . m . sin(a) . ln\left(\frac{f + b + l}{f + b}\right) \qquad (2)$$

Whereas *m* is the width of loop (*m* = *e*, for differential mode or *m* = *e* + *d*, for common mode), *f* is the minor distance between LPS and structure of array modules, *l* is the total length of the system and *a* is the tilt angle of the solar modules.

b. Induction model for flashes on solar array

The S2 scenario has considered the direct strike of lightning in the modules of photovoltaic system, causing induction of voltage U_{IP} and electrical current I_{SC} in non-shielded electrical circuits and structures of the photovoltaic system, applying equations (1), (3), (4) and (5) [29]:

$$L_M = 0.2 \, . \, l \, . \, ln\left(\frac{d + e + r}{d + r}\right) \qquad (3)$$

Where r is the radius of circumference equivalent to the total area of the PV system (metallic structure for support).

The induced short-circuit current I_{SC} is estimated by equations (3) to (5), whereas L_S is the self-inductance and consider in equation (4) the current of lightning I must be divided by 3, considering the three possible flow paths of the current to earth by [29]:

$$I_{SC} = K_C \, . \, I \, . \, \left(\frac{L_M}{L_S}\right) \qquad (4)$$

Where I is the peak of lightning current (200, 150 or 100 kA, according to Level of Protection against lightning - LP) and L_S is the self-inductance as in (5):

$$L_S = 0.8.\sqrt{l^2 + e^2} - 0.8.(l + e) + 0.4.l.ln\left(\frac{2.e/r}{1 + \sqrt{1 + \left(e/l\right)^2}}\right) + 0.4.e.ln\left(\frac{2.l/r}{1 + \sqrt{1 + \left(l/e\right)^2}}\right).10^{-6} \qquad (5)$$

The math expressions (1) to (5) can support the methodology of risk assessment determined by international standards and can improve the performance of the project of lightning protection systems related in IEC-62305/2020 and NBR-5419/2015 standards.

c. Model for ground potential difference

The theory of electromagnetism for ground mathematical model considers the injection of electric current in earth will generate electrical potentials that can be represented by the equation of Laplace (6), considering a conservative field [30]:

$$\Delta V = \frac{\partial^2 V}{\partial x^2} + \frac{\partial^2 V}{\partial y^2} + \frac{\partial^2 V}{\partial z^2} \qquad (6)$$

Considering the interaction vector of electric potential in the three-dimensional axes of ground, the equation of Laplace (6) results in the expression (7):

$$\Delta V = 0 \qquad (7)$$

Where V is the value of electrical potential of a point referenced to the infinity and in constant resistivity soil. Moreover, Δ is the Laplace-Beltrami operator or second order differential operator.

When flash strikes over lightning protection system (LPS) and the overcurrent get down to the ground, there will be an omnidirectional spread of electrical charges in all radial directions, starting from the grounding mesh and causing potential differences in the surface of the soil. The Fig. 2 demonstrates the voltage drop U_{AB} from a ground rod in format of decreasing exponential curve, corresponding the electrical resistance R_{AB} of the volume of soil and considering the potential 0.0 V at a point in infinity.

The model in study, Fig. 2, has considered the spreading of all electrical charges of the flash current only in the first earth layer whose depth is equivalent to the length l of the ground stick and in a ground with constant value of electrical resistivity ρ.

The dispersion of lightning current happens perpendicularly to the area of the cylindrical surfaces of the soil. In last, the first one Ohm's Law (U_{AB}=R_{AB}.I_R) was applied to calculate the voltage drop or potential difference between two points of the ground.

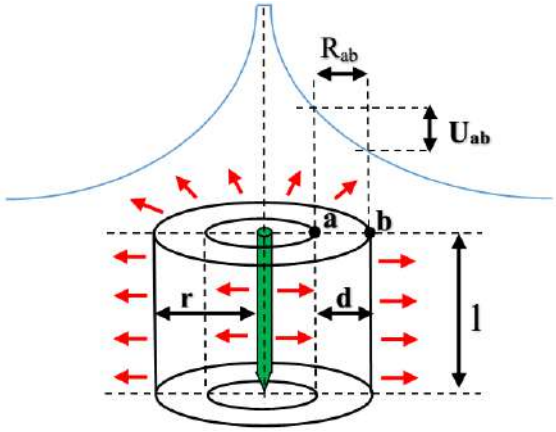

Fig. 2: Ground potential difference for single bar

In addition, for the estimation of the electrical resistance R_{AB} equivalent to the volume of ground formed between two consecutive and concentric cylinders, it applies the second Ohm's Law as expression (8) [26]:

$$R = \frac{\rho . d}{2 . \pi . r . l} \qquad (8)$$

Where ρ is the electrical resistivity of ground, d is the distance between two consecutive cylindrical surfaces S_A and S_B, r is the radial distance from ground bar to the surface of external cylinder, and l is the thickness of the ground layer that is the same length of the rod.

III. RESULTS AND DISCUSSION

The scenario for simulation consists of a 2.65 kWp PV System composed with 10 solar modules of 1.65 x 0.99 m, each, as shown in Fig. 1 and considering the installation on the top of a building whose lightning protection system (LPS) has only one down conductor (K_C= 1).

a. Inductions by flashes on LPS

The values in Tab. 1 to 4 are the results using equations (1) and (2), corresponding to the S_1scenario in Fig. 1 where the lightning strikes over the LPS. The results represent the values of induced voltages in DC wiring of PVS without electromagnetic shielding, with insulation-thickness of 1.50 mm and *l* cable length is 10.0 m. The calculations also considered the differential U_{IP-D} and common U_{IP-C} modes, and the simulation of several scenarios ranging parameters in equations (1) and (2):

• Distance of down conductor (LPS) to PVS structure.

• Rate of current impulse (200 and 100 kA/μs).

• The tilt angle *a* for solar modules inclination.

• Design C_1: The + and – electrical wires routed together and along the edge of the solar modules.

• Design C_2: The + and – wires is tracked together and in middle of modules.

• Design C_3: The + and – cables put separated and put in opposite edges of the modules.

The results were calculated per unit of length and the induced voltages varies in direct proportion with variation of the tilt angle *a*, and the rate of current impulse (kA/μs). Respectively, according to the tilt angle limits of the modules, range 0° to 90°, the values of inductions varies from zero volts to maximum value given by a sinusoidal equation (1). Also, the inducted values were inversely proportional with variation of distance f. However, the induced voltages varied in a greater rate by variation of *a* angle than the reduction in distance *f*. Therefore, variations of 100% in distance and angle has changed about - 21% and + 99% in the induced voltages, respectively. In addition, designs C_1, C_2 and C_3 has demonstrated the best and worst ways to install DC cables that are modes C_1 and C_3, respectively. At last, the increasing in length *l* of DC cables implies direct increase in inductions values. Thus, the results of Tables 1 to 4 can be useful to improve the performance of LPS and SPD before installing a solar PV system.

Table 1 – Induced Voltages for f = 2.00 m and a = 13°

Level of Protection			200 kA/μs		100 kA/μs	
Design of Circuit	e (mm)	d (mm)	DC	Uip-d (kV/m)	Uip-c (kV/m)	Uip-d (kV/m)	Uip-c (kV/m)
C1	3	1.5		0.0024	0.0036	0.0012	0.0018
C2	3	825		0.0024	0.6670	0.0012	0.3335
C3	1,650	1.5		1.1413	1.1423	0.5707	0.5712

Table 2 – Induced Voltages for f = 1.00 m and a = 13°

Level of Protection			200 kA/μs		100 kA/μs	
Design of Circuit	e (mm)	d (mm)	DC	Uip-d (kV/m)	Uip-c (kV/m)	Uip-d (kV/m)	Uip-c (kV/m)
C1	3	1.5		0.0032	0.0049	0.0016	0.0024
C2	3	825		0.0032	0.8925	0.0016	0.4462
C3	1,650	1.5		1.5271	1.5285	0.7635	0.7642

Table 3 – Induced Voltages for f = 2.00 m and a = 6.50°

Level of Protection			200 kA/μs		100 kA/μs	
Design of Circuit	e (mm)	d (mm)	DC	Uip-d (kV/m)	Uip-c (kV/m)	Uip-d (kV/m)	Uip-c (kV/m)
C1	3	1.5		0.0012	0.0018	0.0006	0.0009
C2	3	825		0.0012	0.3356	0.0006	0.1678
C3	1,650	1.5		0.5743	0.5749	0.2872	0.2874

Table 4 – Induced Voltages for f = 1.00 m and a = 6.50°

Level of Protection			200 kA/µs		100 kA/µs	
Design of DC Circuit	e (mm)	d (mm)	Uip-d (kV/m)	Uip-c	Uip-d (kV/m)	Uip-c
C1	3	1.5	0.0016	0.0024	0.0008	0.0012
C2	3	825	0.0016	0.4491	0.0008	0.2246
C3	1,650	1.5	0.7685	0.7692	0.3842	0.3846

b. Inductions by flash in solar array

As shown in Fig. 1, the Tab. 5 presents the results of equations (1), (3), (4) and (5) considering the S_2 scenario of PV system with direct and full lightning strike on the structure of solar array. The results represent the values of induced voltages and currents in DC wiring of PVS without electromagnetic shielding, insulation-thickness of 1.50 mm and length *l* is 10.00 m. The magnitude of U_{IP} voltage is in common mode and I_{IP} current in 10/350 µs impulse rate. The simulations did not include variations in tilt angle of the solar modules and the *f* distance from LPS to PV system, as it did not influence the results of the induction estimations. The overvoltage estimated per unit length and the simulation has considered some designs varying the following parameters:

- The peak of current impulse (200 and 100 kA/µs).
- Designs C_1 to C_3, already described before.

The inductions varied in direct and proportional way according to the variation of impulse rate (kA/µs). Furthermore, the analysis of the three designs pointed out the best and worst situation for installing DC cables are in C_2 and C_3 modes, respectively. The increase in the length l of the DC cables implies in direct and proportional increase to induced voltages and currents in wiring. Thus, the results of Tab. 5 can be the basis for choosing the class of the surge protection device (SPD) for PV systems. The information of this paper can be useful to improve the performance of the lightning protection system before installing a solar PV system.

Table 5 – Induced Voltages and Currents (flashes on array)

Level of Protection			200 kA/µs		100 kA/µs	
Design of DC Circuit	e (mm)	d (mm)	Uip (kV/m)	Isc (kA)	Uip (kV/m)	Isc (kA)
C1	3	1.5	0.026	0.006	0.013	0.003
C2	3	825	0.019	0.005	0.009	0.002
C3	1,650	1.5	09.31	28.31	04.65	14.15

c. Potential difference in ground

The data listed in Tab. 6 to 8 are the results of simulations using the Law of Ohm ($U_{AB}=R_{AB}.I_R$) and equation (8) about electrical resistivity. The calculations have estimated the electrical resistances of the soil in shape of cylindrical layers as shown in Fig. 2. Thus, the values of voltage drop was willing in sequential steps of 1.00 m and starting from the vertical single bar in soil (grounding grid). In addition, the simulation used some different designs by varying the I_R current in the rod, the ρ electrical resistivity of the soil and *l* length of the ground rod. The graphic in Fig. 3 represents the curve of the electrical voltage drop on the ground according to the parameters of first columns of Tab. 6, to I_R = 10 kA, ρ = 50 Ω.m and *l* = 2.40 m.

Table 6 – Ground Potential Difference for a single bar

Ir (kA)	**10**	**30**	**10**	**30**	**10**	**30**
ρ (Ω.m)	**50**	**50**	**100**	**100**	**100**	**100**
l (m)	**2.40**	**2.40**	**2.40**	**2.40**	**3.00**	**3.00**
Steps (m)			**ΔV (kV)**			
0.0 – 1.0	33.16	99.47	66.31	198.94	53.05	159.15
1.0 – 2.0	11.05	33.16	22.10	66.31	17.68	53.05
2.0 – 3.0	6.63	19.89	13.26	39.79	10.61	31.83
3.0 – 4.0	4.74	14.21	9.47	28.42	7.58	22.74
4.0 – 5.0	3.68	11.05	7.37	22.10	5.89	17.68
5.0 – 6.0	3.01	9.04	6.03	18.09	4.82	14.47
6.0 – 7.0	2.55	7.65	5.10	15.30	4.08	12.24
7.0 – 8.0	2.21	6.63	4.42	13.26	3.54	10.61
8.0 – 9.0	1.95	5.85	3.90	11.70	3.12	9.36
9.0 – 10.0	1.75	5.24	3.49	10.47	2.79	8.38
10.0 – 10.0	1.58	4.74	3.16	9.47	2.53	7.58
11.0 – 12.0	1.44	4.32	2.88	8.65	2.31	6.92
12.0 – 13.0	1.33	3.98	2.65	7.96	2.12	6.37
13.0 – 14.0	1.23	3.68	2.46	7.37	1.96	5.89
14.0 – 15.0	1.14	3.43	2.29	6.86	1.83	5.49
15.0 – 16.0	1.07	3.21	2.14	6.42	1.71	5.13
16.0 – 17.0	1.00	3.01	2.01	6.03	1.61	4.82
17.0 – 18.0	0.95	2.84	1.89	5.68	1.52	4.55
18.0 – 19.0	0.90	2.69	1.79	5.38	1.43	4.30
19.0 – 20.0	0.85	2.55	1.70	5.10	1.36	4.08

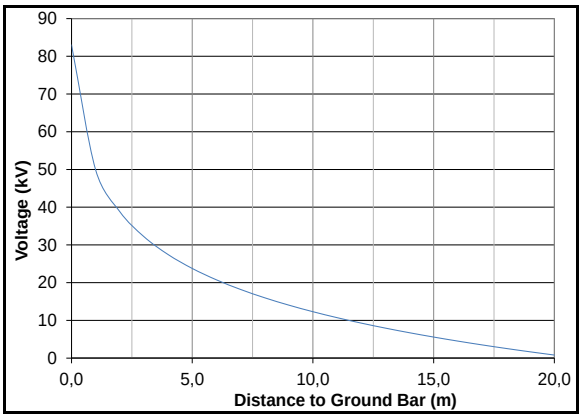

Fig. 3: Voltage drop on ground (Ir = 10 kA, ρ = 50 Ω.m and l = 2.40 m).

The difference between any two consecutive points in soil (steps) in Tab. 6 indicates the voltage drop or potential difference between couple of ground points. The distance refers to the radial lengths starting from earth rod. The voltage drop values listed in Tab. 1 to 6 are the results of the suggested methodology [26] up to a distance of 20.00 m from a ground rod. However, considering the methodology for distance up to 1,000 m using same parameters (IR, ρ and l), proving the same values for the first 20.00 m as computed in Tab. 6. In addition, confirming the values of voltage drop or pitch voltage varied in direct proportional to the variation of lightning current on the ground bar I_R and the ρ electrical resistivity of the soil and inversely proportional to the variation of the *I* length of the bar.

d. Potential difference – Case study 1

The diagram in Fig. 4 represents the configuration of the grounding systems single bars) of a building with lightning protection systems (LPS) and a safety distance s from a rooftop PVS array. The H_1 ground bar represents the grounding of the LPS at 0.0 m milestone, H_2 is the

ground rod to DC/AC converter and photovoltaic array spaced in 10.0 m from H_1. The H_3 bar is grounding system for neutral wire in electrical main board at a distance of 20.0 m from H_1.

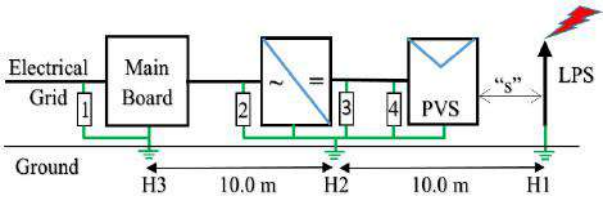

Fig. 4: Diagram for PV system with LPS.

The design of Fig. 4 consists of LPS with isolated grounding or non-equipotentialization among the all three grounding systems (H_1 to H_3). In case of lightning strikes in the LPS, it will rise the potential in H_1 and cause different potentials in others ground electrodes by voltage drop, according to Tab. 7. The results applied the data from the first column of Tab. 6, considering the spacing of 10.00 m. The analysis of overvoltage has considered the values of potential differences between the three grounding bars with LPS stuck:

- H_1–H_2 = 70.70 kV (LPS to DC/AC converter)
- H_2 – H_3 = 11.50 kV (DC/AC converter to board)
- H_1–H_3 = 82.20 kV (LPS to DC/AC converter)

The potential difference between the three independent grounding systems is due to the lack of equipotentialization. There is no interconnection between H1, H2 and H3 isolated grounding bars to the same reference of grounding system, as recommended in the TN-S ground diagram for electrical system by standards [31,32].

Table 7 – Ground Potential Difference for PVS with LPS

Ir (kA)	**10**	**30**	**10**	**30**	**10**	**30**
ρ (Ω.m)	**50**	**50**	**100**	**100**	**100**	**100**
l (m)	**2.40**	**2.40**	**2.40**	**2.40**	**3.00**	**3.00**
Steps (m)			**ΔV (kV)**			
00.0 – 10.0	70.70	212.2	141.5	424.4	113.2	339.5
10.0 – 20.0	11.50	34.50	22.90	68.90	18.30	53.10
00.0 – 20.0	82.20	246.7	164.4	493.3	131.5	394.6

The scheme as in Fig. 5 proposed the safety operation of a photovoltaic system in TN-S grounding system with equipotentialization. Otherwise, the interconnection of the ground rods will not guarantee the equipotentialization of the differences of potential. In case, it will only allow the circulation of abnormal current induced in soil during the occurrence of atmospheric discharges.

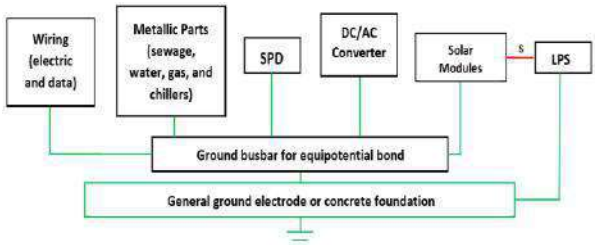

Fig. 5: TN-S grounding and equipotential diagram.

Moreover, if the distance from the solar modules to lightning protection system, as in Fig. 5, is less than the s safety distance (sparking) specified by standard's directives, it will be also necessary to provide equipotentialization of structure of solar array and the LPS [33].

e. Potential difference – Case study 2

The diagram as in Fig. 6 represents the configuration of a building without lightning protection system with only two isolated grounding grids and without equipotentialization. The H_2 rod is for the grounding of the DC/AC converter and H_3 rod for grounding of neutral wire from the power system of electricity utility in the main board of the building. The distance between the two ground bars (H_2 to H_3) is 10.0 m. In case of direct lightning strike over array structure of the photovoltaic system, there will be generated a potential difference between the two grounding electrodes.

The values presented in Tab. 8 came from the data listed in the first column of Tab. 6, considering the step of 10.00 m. The analysis of the estimations identified the following potential differences between the two grounding bars (with no LPS):

- H_2 – H_3 = 70.70 kV (DC/AC converter to board)

Thus, the conclusion about the case studies 1 and 2 is that the potential difference composed by H_2 and H_3 grounding systems has increased from 11.50 to 70.70 kV considering the building and PV system with or without

LPS, respectively. In conclusion, the worst situation for DC/AC converter is case 2 or without LPS.

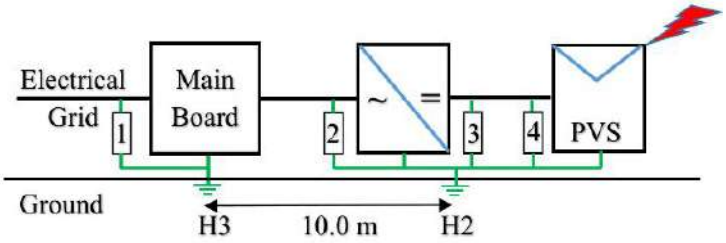

Fig. 6: Diagram for PV system without LPS

Table 8 – Ground Potential Difference for PVS without LPS

Ir (kA)	**10**	**30**	**10**	**30**	**10**	**30**
ρ (Ω.m)	**50**	**50**	**100**	**100**	**100**	**100**
l (m)	**2.40**	**2.40**	**2.40**	**2.40**	**3.00**	**3.00**
Steps (m)			**ΔV (kV)**			
00.0 – 10.0	70.70	212.2	141.5	424.4	113.2	339.5

In both situations, case 1 (11.50 kV) and case 2 (70.70 kV), the grounding systems submits the connections (T-N) of DC/AC inverter to overvoltage transferred by the two H_2 and H_3 grounding systems, as shown in Fig. 7. It is due to the lack of equipotentialization that can breakdown the converter. Thus, H_2 and H_3 ground rods will submit the SPD_2 to overvoltage as shown in Fig. 4 and 6 during lightning strikes. In both cases, the electrical transient will flow through the neutral conductor in an unconventional direction, causing an inverted polarity over SPD_2. The four impedances connected in series and composed by the neutral wire, SPD_2, H_2 and H_3 ground bars, will divide the intensity of induced overvoltage. In addition, all SPD of the conductor's phases of the AC installation will face the same type of electrical disturbance (electromagnetic impulse). Thus, the methods developed in this paper can be useful to support the analysis of risk management to decide a suitable LPS and SPD before installing a solar PV system.

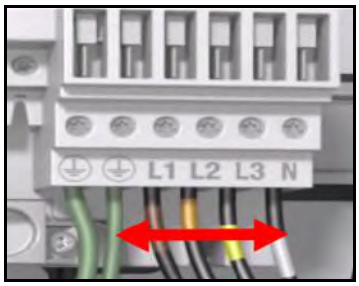

Fig. 7: Potential difference in T N terminals

IV. CONCLUSIONS

This study estimated the effects of lightning strikes on photovoltaic systems. It verified the fundamentals of electromagnetism and Ohm's laws can be an effective support as scientific tool for standards directives to the management of risks and assessment of the effects caused by lightning strikes in photovoltaic microgeneration systems. It researched to proper mathematical models for estimation of induced voltage and current in electrical circuits by lightning struck in PV systems, with and without LPS. The first model applied to simulate inductions in DC circuits of PV systems with LPS, and the second model without LPS. It was verified less induction of voltages and currents in electrical circuits and devices of PV systems operating in structures with LPS than without LPS.

For the simulation, it was considered a PV system of a 2.65 kWp PV System composed by 10 solar modules of 1.65 x 0.99 m, each, as shown in Fig. 1 and considering the lightning protection system with only one down conductor to ground grid. The estimations pointed out peaks up to 201,6 kV and 28,3 kA (200 kA/μs impulse rate) inducted in DC circuits by lightning strikes, according to type of wiring as leapfrog or daisy chain, distances from LPS and tilt angle. The estimated values of inductions can support the definition of the surge protection device or SPD class for protection of the photovoltaic system, giving reasons to application of a robust class of SPD in buildings without LPS.

The results presented in Tab. 1 to Tab. 5 was compared to similar works (peers) treating the effect of lightning on a

solar photovoltaic system and lightning performance analysis of a rooftop grid-connected solar photovoltaic without external lightning protection system.

The lightning strike or discharge of atmospheric electricity originates potential differences on the ground, causing voltage drops influenced by the current intensity, soil resistivity and grounding system configuration. These are the main cause of induction voltages and abnormal currents in several building installations and PV components (inverters, solar panels, etc.). The results pointed out that up to 70.7 kV overvoltage in the AC terminals of inverter due to design of the grounding systems and caused by lightning. Therefore, the results of the present work listed in Tab. 6 to Tab. 8 are a new type of proposition for evaluating the induced voltages by grounding systems in devices of PV power systems. Therefore, the equipotentialization method completes the protection against the electromagnetic effects of lightning on the ground.

Thus, the methods researched in this paper are propositions for assessment of performance, design improving of LPS projects and verifications of SPD specifications. In addition, as scientific support to the directives of standards for protection of PV system.

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Evaluation and selection of scenario-based digital Transformation Projects

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***Abstract*—** *The advent of digital transformation, also known as Industry 4.0, has brought considerable challenges to organizations from various industries. The effects of its relevance and intensity can be observed in the relations between organizations, between individuals and the first and governments with these two entities. By encompassing the intense use of information and communication technologies (ICTs), it raises the need for careful evaluation and selection of projects aimed at digitally transforming, business processes, business models and customer experience to interact with the first two. In this sense, portfolio management which includes the evaluation and selection of projects, has numerous methods of analysis ranging from financial tools to strategic approaches. Therefore, selection of the method directly influences the quality of the decision made, as well as obtaining the optimal portfolio of projects. This study is dedicated to exploring the use of scenarios to support the analysis and selection of digital transformation projects. This research is qualitative, exploratory, descriptive in nature and is structured through ground theory method (GTM) applied in 7 (seven) Brazilian telecommunications operators. The main contribution of this study is the proposition of a framework that integrates prospective scenarios of evaluation and selection of projects in organizations in a structured manner helping them to conduct their digital transformation, through the creation of digital capabilities.*

I. INTRODUCTION

The digital transformation as envisioned by Andal-Ancion, Cartwritgh and Yip (2003) positions itself, as a phenomenon that alters the current technological paradigm (Dosi, 1983) and finally, the technological trajectory (Nelson & Winter, 1977) of how business will be done from now on. In a similar proposition, one of the visions of digital transformation appears from the German perspective and is called Industry 4.0 or fourth industrial revolution. This vision addresses innovations with a strong technological base that affect relations between people and organizations and served as a starting point to improve the competitiveness of German industry since 2011 (Hermann, Pentek & Otto, 2016; Schwab, 2016). In that sense, correct evaluation and selection of innovation projects connected to digital transformation, which occur in portfolio management (Cooper, Edgett & Kleinschmidt, 1999, 2001) shall include not only concepts with a strong technological base such as: big data, cloud computing , mobility, internet of things, artificial and cognitive

intelligence, distributed ledgers technologies (blockchain), consumerization and startups, as well as utilization of decision tools based on scenarios that assures a path to be followed as well as the intermediate scenarios to be reached by organizations (Wack, 1985; Porter, 1986; Schoemaker, 1995; Chermack, Lynham and Ruona, 2001; Meissner and Wulf, 2013).

The objective of this work is to analyze the use of scenarios during the evaluation and selection of innovation projects focusing on digital transformation determining how they influence the trajectory of telecommunications operators towards the desired state, and to offer a theoretical and conceptual framework that integrates prospective scenarios to the evaluation and selection of projects. The intent is that such framework can assist these organizations to conduct their digital transformation, more effectively through capability building efforts.

The relevance of this study can be perceived under the economic impact expected for such phenomenon in various economic sectors. According to World Economic Forum, digital transformation will be responsible for injecting up to US $ 100 trillion by 2025, being that the portion that relates to the telecommunications sector, considering its potential to influence other interdepending sectors (energy, logistics, automotive industry, retail, and media) it can reach up to 10% of this total (Wef, 2017b).

II. METHOD

The GTM - grounded theory method, applied in this study is a logically consistent set of data collection added to analytical procedures that contribute to the development of a theory through inductive strategies. According to Charmaz (1996, p. 27) it offers "a set of strategies for conducting rigorous qualitative research", since it has a system for handling and modeling collected qualitative materials. The theory teaches that in addition to revealing relevant conditions, it determines how the stakeholders involved respond to these conditions and the consequences of their actions (Corbin & Strauss, 1990, 2001). In effect, the theory that emerges as a result of grounded theory application is based on the interviewees' voice, acts and experiences (Goulding, 2002). Halaweh, Fidler & McRobb (2008) assert that, typically, an analytical study conducted through grounded theory observes the following steps: coding, concepts, categories, and emerging theory. In essence, the collection and analysis of present work took place in parallel, and from the identification of previously studied concepts, the researchers identified and coded the incidents and events that were potential indicators of the use of scenarios in the evaluation and selection of projects aiming digital transformation.

Thus, the objective was not to obtain at the end of this study a generalization of a statistical nature, but on the other hand, an analytical perspective, once the intention is to use theories identified through various consecrated elements that will serve as a comparative support to the results collected in interviews conducted with executives in organizations in the telecommunications sector, with a focus on network operators.

The selection of organizations belonging to the telecommunications sector, which were the object of this study was based on the guidelines of the initiative of the World Economic Forum (Wef, 2017a) dedicated to exploring and expand the potential of digital transformation in different sectors: retail, automotive, logistics, energy, telecommunications, aviation, oil & gas, media, mining, and chemicals. In figure 1, theory emerges from the data collected, which are systematically analyzed, after their registration and comparison.

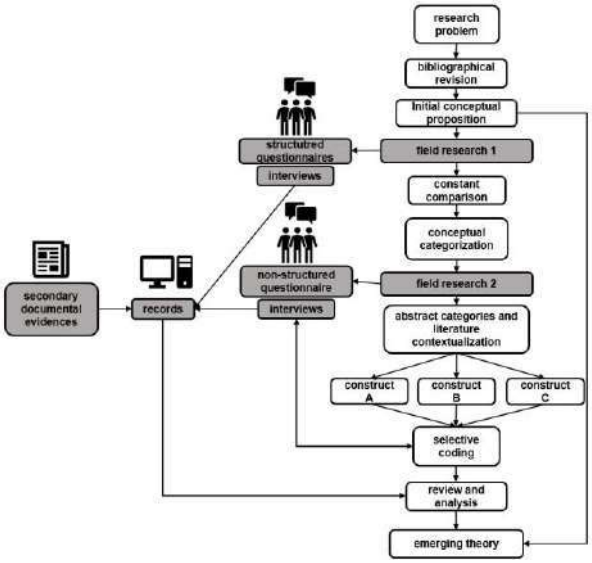

Fig.1: Adapted GTM flowchart integrated with case study

Source: Adapted from Goulding (2002) and Halaweh, Fidler & McRobb (2008)

Seventeen interviewed executives were approached using the following strategy. Upon initial identification from authors contact network, nine of them were pre-qualified based on adherence to strict criteria presented in the theoretical framework. In total eighteen interview sessions were conducted following grounded theory principles. Two executives declined to participate alluding sensitive information could not be shared, totaling seven executives that fit into research study objectives.

III. RESULTS

The proposed framework, which integrates the use of scenarios into the processes of evaluating and selecting projects, was obtained from the collection of field data and its intersection with studied concepts. During the use of grounded theory method based on iterations throughout data collected, the initial conceptual framework had macro concepts developed throughout the literature review. This initial conceptual framework evolved, along the study allowing the resulted framework to emerge from the collection and analysis of data and could be portrayed in figure 2. Conceived framework elucidates the interrelationships between the thirteen constructs identified during the interviews in such a way that it is possible to notice how the construction of scenarios, centerpiece of this study, is derived from these elements. It is possible to notice that the decision-making process in ICTs (ICTD) and the environment scenarios (ESCN) are central and are influenced directly or indirectly by others related to technological trends (TTND), building blocks of digital transformation (DTBB), innovative strategies (INST) and typology of business models (BMTP). The dilemma of business models and servitization (BMDS) represents the main barrier to the design of projects related to more disruptive changes in the current business model (IFPT). Supported by the vision of the experts (VEXP) and the project, program, and portfolio management information systems (PPMS), the project management office (PMOT) has an important role in the framework as it aggregates a specific organizational structure that can support desired degree of business transformation (DGBT). From the transformation brought about by the digital capabilities created, it is possible to perceive the generation of value through ICTs (VICT).

Aspects that could not be correctly mapped and identified during the collection and analysis were refuted by research team. Refinements and detailing of the product of this research were conducted during the analysis of collected data under the light of grounded theory method, considering required degree of abstraction used to facilitate the manipulation of key concepts, evaluated by criteria such as: credibility (how the research was conducted), transferability (possible generalization), reliability (systematic, documentable, and traceable) and finally, its conformability (extraction of theory from the data). In a comparative perspective of the three observation groups, research team mapped the tools, techniques, strategies, and processes that were identified along the application of grounded theory method. Table 1 illustrates specific objectives of this study and its relationship with the hypotheses woven (as listed on table 3 under conclusions), connected through the categories, subcategories and selective coding established while processing grounded theory collected data.

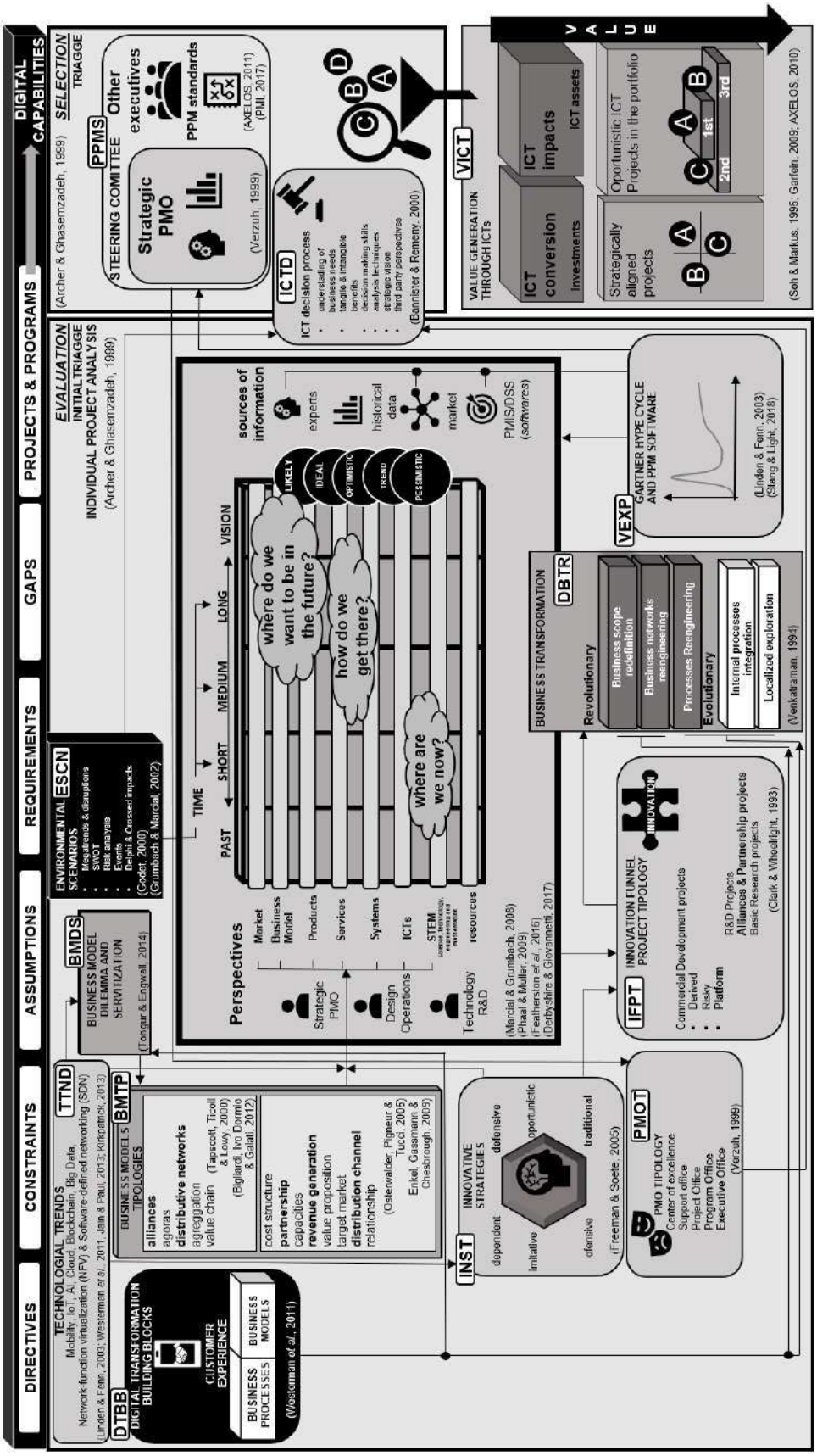

Fig.2: Proposed and validated conceptual framework
Source: the authors

Table 1 – Comparative analysis and identified hypotheses

operator	tools	techniques	strategies	evaluation and selection processes	technologies assessed in the portfolio	identified hypotheses
A1 fixed	Scrum, Design Thinking, Pilot project, PPMS	steering committee, business case, 2 short term scenarios	tactical PMO, focus on business processes, yearly strategic planning cycles, strong matrix organizational structure	final decision investment within a steering committee, reduced portfolio importance	big data and artificial intelligence	H1 and H2
A2 fixed	ideation, voting, PPMS, agile methods	scoring, risk analysis	new organizational structure, Strategic PMO, customer experience focuses and new B2B business models, open innovation	mature portfolio management, governance processes well established	big data, mobility, IoT and cloud computing	H2
B1 mobile	PPMS, Kanban	project war room, innovation squads	strategic acquisitions, focus on new business models, strategic PMO at VP level, open innovation	conflicting interests: corporate PMO x agile processes	big data, artificial intelligence, BI and apps	H2
B2 mobile	PPMS, ideation,	brainstorming and Delphi techniques for creation of 3 future scenarios	strategic PMO, projectized organizational structure, external consultancy support, HQ guidance and partnerships	stringent portfolio governance, project rankings	big data, IoT, cloud computing, virtual reality, and artificial intelligence	H3
C1 multimedia	proof of concept, pilot project, PPMS	scenario generation supported by 3rd party experts	strategic and tactical PMOs, projectized organizational structure, innovation centers (R&D), strategic acquisitions with emphasis on new business models and customer experience, open innovation (hackathons)	stringent portfolio governance, quarterly portfolio reviews influenced by scenarios	software defining network (SDN), network function virtualization NFV), IoT, computing, and artificial intelligence	H3
C2 multimedia	business case, partnerships for project development	meetings, brainstorming	new product development, intermediate scenarios x project scope changes, inexistent PMO	final decision investment within a steering committee, small portfolio, low maturity in project management	cloud computing, IoT	H1
C3 multimedia	partnerships, pilot project, PPMS	meetings	inexistent PMO, product launched on multiplatform strategy	low maturity in project management, main executive with nearly total decision power	software defining network (SDN), network function virtualization NFV), cloud computing	H1

Source: the authors

IV. DISCUSSION

ICTs and business value

For the correct understanding of the term ICTs - information and communication technologies, it is vital to consider its inherent potential to add value to the business and organizations. Considering long term, it is about equipping the organization through digital transformation, with capability to generate a flow of ICT projects that generate value (Soh & Markus, 1995; It Governance Institute, 2008; Garfein, 2009; Hess, 2016). From the perspective of Kane et al. (2015) the strategic flow of value presented in figure 3 is related to a persistent management effectiveness or the balance of costs and benefits (Axelos, 2010) as it results in the satisfaction of needs when generating benefits for the business with the optimized use of the resources employed.

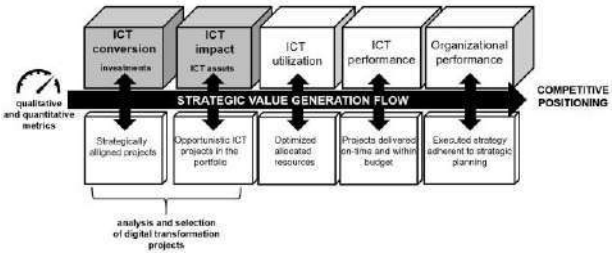

Fig.3: Value generation for business through ICTs

Source: Adapted from Soh & Markus (1995, p.37), Garfein (2009, p.51) and Axelos (2010, p.39)

Although there is a rapid assimilation of ICTs in different sectors to a higher or reduced degree, it is necessary to clearly establish how it can initially change business processes (often automating something that was previously done manually) and at a more advanced stages, these technologies can enable new and disruptive business models. Venkatraman (1994) called these stages evolutionary and revolutionary in the measure of its ability to innovate at five levels aiming at the transformation of the business. In the same perspective, new studies of innovation theory with focus on servitization pointed to strategies that creates value through innovations in the value proposition offered to customers, which in the perspective of Barnett et al. (2013), starts to drain more investments than typical research and development purely of a technological nature.

Digital transformation and innovation

The term digital transformation, as a phenomenon begins to appear in scientific articles and specialized literature from the seminal definition of Andal-Ancion, Cartwritgh & Yip (2003) in which they interpret it from its different mechanisms for the disintermediation, remediation, and mediation of interorganizational interactions based on ICTs, back then still referred to as NIT - new information technologies. These were also followed by studies conducted by Stolterman & Fors (2004, p.689), when positioning it as a set of "changes that digital technology causes or influences in all aspects of human life" that, due to their ubiquity, lead society to a world increasingly immersed in technology.

Another vision of digital transformation has been propagated, mostly by German-speaking countries, under the term Industry 4.0. For the purposes of this study and in line with Herman, Pentek & Otto (2016) and corroborated by de Azevedo (2017) in their thesis, this is the same phenomenon. In short, the digital transformation paradigm can be better understood with reference to its building blocks, as shown in figure 4. In highlight, the areas where digital transformation projects will be considered for the purposes of this study: business processes and business models that creates essential digital capabilities.

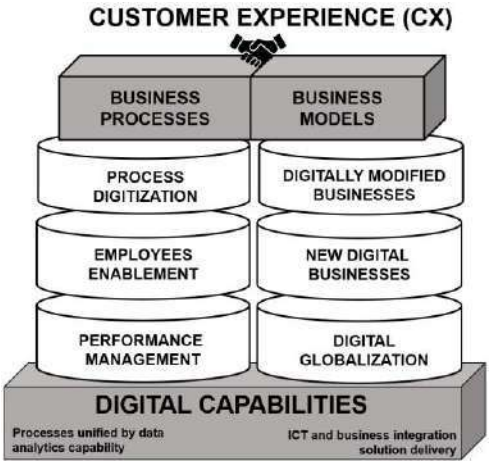

Fig.4: Digital transformation blocks.

Source: Adapted from Westerman *et al*. (2011, p.17)

ICT investment decision

Independently of its magnitude, ICTs investments must always happen in 3 different spheres, but intimately interrelated and known essentially for hardware, software, and people, as taught by Turban et al. (2010). However, it is not uncommon the expected benefits of ICTs to find as a limiting factor precisely the low adaptation of individuals to the innovations introduced by ICTs (Markus, 1983; Kalakota & Robinson, 1999; Laar et al., 2017). Correia Neto & Leite (2015) argue that despite investments in ICTs have

similarities with any other investment made in organizations, it brings aspects that are consistent with the investment decision model from the perspective of Bannister & Remenyi (2000) and illustrated in the figure 5 that guides some aspects of this study:

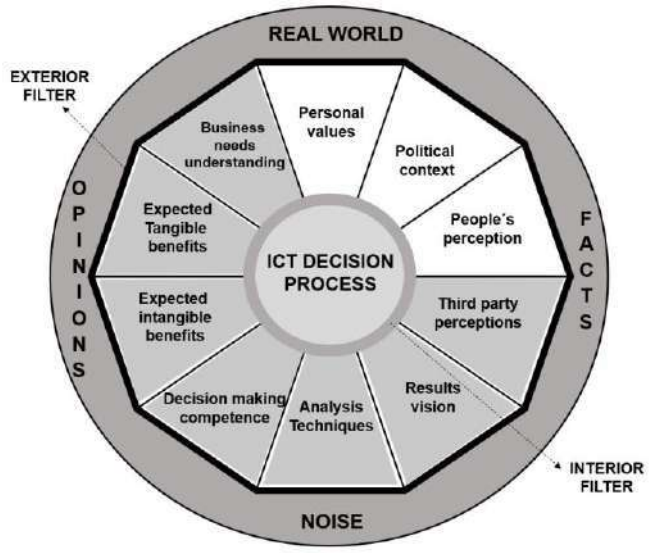

Fig.5: ICT decision process model.
Source: Adapted from Bannister & Remenyi (2000, p. 237)

In order to focus on the decision to invest in ICTs, taking as a parameter the decision analysis of their investment projects, this study will contemplate the gray regions of figure 5, which configure the most preponderant factors for such analysis (Venkatraman & Henderson, 1993; Soh & Markus, 1995; Bannister & Remenyi 2000).

ICTs and new business models.

At higher maturity stages in the use of ICTs, organizations obtain results that can reconfigure not only their business processes, but also create business models with value and scope proposals that are conceptually different from their original businesses (Venkatraman, 1994; Andal- Ancion, Cartwright & Yip, 2003; Osterwalder, Pigneur & Tucci, 2005; Chesbrough, 2010; Teece, 2010). However, as new business model projects bring with them a high degree of innovation and risk, they need to be addressed in multiple perspectives. It is known that for most organizations, rethinking their business model while repositioning themselves in the face of intense technological change such as digital transformation can be understood within what Christensen (2013) and Tongur & Engwall (2014) call business model dilemma.

Venkatraman, Henderson & Oldach (1993) proposed that business strategy provides clarification within the strategic fit model, which have a multiple cross-impact. Years later, these aspects were revisited and endorsed with the model conceived by Earl (1995). This fact reinforced the perspective of strategic choices, naming them as: business strategy, information technology strategy, organizational structure & processes and, finally, information technology infrastructure and processes.

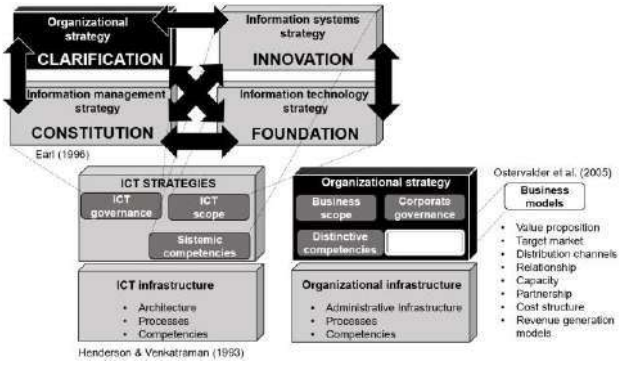

Fig.6: ICT and business models interactions
Source: Adapted from Earl (1995, p. 495), Henderson & Venkatraman (1993, p. 476) and Osterwalder, Pigneur & Tucci (2005, p.29)

Management of ICT portfolios and projects

Portfolio management from the point of view of investment diversification and consequent dilution of its inherent risks, seek to optimize the effectiveness of investments in new products, new processes, and even new business models (Osterwalder, Pigneur & Tucci, 2005). In the specific case of programs that aim is to digitally transform such organization, where this becomes especially important, once these transformational or strategic programs often include several component projects and continuous operations as taught by Archibald & Archibald (2016). Thus, the relationship between the business strategy and its interactions with the three layers of project portfolio management (project, program, and portfolio) are evident.

One of the strategies frequently adopted by organizations that need to manage increasingly complex projects distributed among its business areas, the resulting programs and their structuring portfolios also appear in the form of an organizational innovations (Hobbs, Aubry & Thuillier, 2008; Aubry et al., 2010; Drei & Silva. 2019). In this sense, project management offices known as PMO, have received special attention from organizations that recognize their maturity in the way they manage their projects, programs and portfolios may

depend on an organizational structure that offers guidance, standardization, and governance at these three management layers. Amongst numerous PMO functions is an economic-financial approach, using various techniques such as NPV - net present value, EVA - added economic value (Chen & Dodd, 1997), IRR - internal rate of return, discounted payback, where its first step is to scrutinize project in terms of its expenditures and revenues, in order to subsequently discount cash flows at present value, even if the technique is combined with the use of real options (Facó, 2017; Paiva, 2017) that also seek to value the decision to invest or delay project (Amram & Kulatilaka, 1999; Trigeorgis & Smit, 2004).

It is also clear that, even if the project is approved and initiated, it must undergo successive scrutiny at each phase closure, where an analysis of its performance indicators is normally conducted. If the project is not able to generate the expected results and benefits (including ones related to tax relief), it may cede its place and resources undertaken to other initiatives that will compose a refreshed portfolio (Archer & Ghasemzadeh, 1999; Cooper, Edgett & Kleinschmidt, 2001; Itikawa & Santiago, 2021). Archer & Ghasemzadeh (1999) proposed a model represented in figure 7 that aims at selecting project portfolios, where the individual analysis of projects is shown.

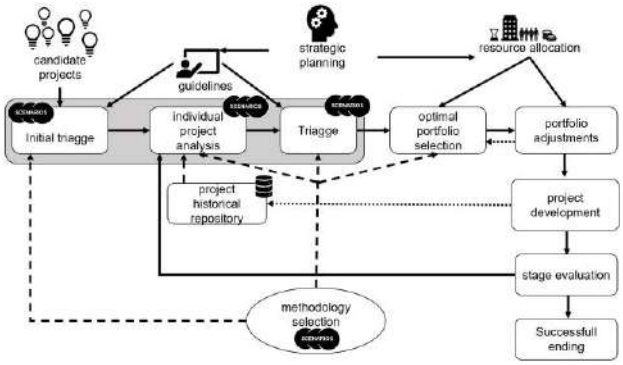

Fig.7: Project portfolio selection model
Source: Adapted from Archer & Ghasemzadeh (1999).

Business decision using scenarios

According to Chermack, Lynham & Ruona (2001) when searching for the roots of planning facilitated by scenarios, it became evident as well as several other techniques and scientific discoveries, that the term was coined in the military environment as early as the 1940s, where the former RAND Corporation, engaged in the development of armaments with great use of R&D and technology, where such term was conceived as future-now. From this point onwards, the interest of corporations increased dramatically during following years, in the face of the success obtained by Royal Dutch Shell´s executive and its understanding created by Schwartz (1996). Obviously, there are innumerable views regarding the use of scenarios for strategic planning purposes, among which Porter (1986) refers to it as "partial views, internally consistent of what the world will be in the future and that can be chosen to limit the set of circumstances that may occur". Such scenarios can be subdivided into three categories (feasible, probable, and desirable) according to Santos (2011).

Figure 8 shows the application of the environment scenario technique directly to prospective technological trajectories as recommended by Phaal & Muller (2009). The Grumbach scenario method also allows participation of experts quite common in the field of ICTs during the creative process and it is supported by specific software able to handle Bayesian networks to generate scenarios and probabilities.

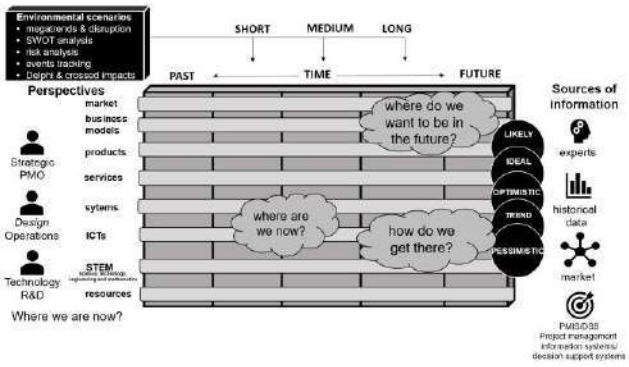

Fig.8: Environment scenarios and technological trajectory
Source: Adapted from Grumbach & Marcial (2008, p. 106),
Phaal & Muller (2009, p.40), and Santos (2011)

Proposition of a conceptual structure (framework)

The selection of operators was made based on the licenses issued by Brazilian regulatory agency, Anatel - national telecommunications agency, made until the first half of 2017. In table 2 it is possible to identify the characterization of the sampled operators as well as the interviewees, separated by observation group. For confidentiality and privacy reasons, each of the executives interviewed was assigned a number and the participating operators a letter followed by a number that associates it with the observation group to which it belongs. The proposed questions dealt with articulation of scenarios to understand the impact of emerging technologies for telecom sector, seeking to identify techniques, procedures, software, and methodologies used by decision makers in their quest for optimal decision

concerning digital transformation project portfolio. Thus, through these combined questions, it was also possible to identify in some cases the type of innovative strategies adopted by operators as per typology proposed by Freeman & Soete (2008).

Comparative analysis of observation groups

The first observable aspect is the centrality of the studied phenomenon centered on actions or observations of the interviewed executives whose statements were identified. The second aspect, which is equally important, is the context in which the studied phenomenon unfolds, which suggests that action and interaction strategies are taken. There may also be intervening conditions that limit or enable the action strategies defined in the context that can be individualized. And finally, the consequences are a product of the strategies selected by the observed organizations, in this case, the operators subdivided into their three observation groups (Golafshani, 2003; Halaweh, Fidler & Mcrobb, 2008).

In observation group A, of the fixed operators, there was a lower degree of integration of scenarios into the evaluation and selection process, while in group B, this element appears more present throughout the stages of the process. Paradoxically, in the case of observation group A, of fixed operators, scenarios were cited by executives 1 and 2 at a slightly higher level in comparison to observation group B (mobile), however, it was not possible to detect additional evidence in the tooling, processes and techniques that prove effective integration of scenarios in the evaluation and selection of projects in the ICT portfolios. Another interesting finding was that there was a strong concern with the digitization of processes, articulating artificial intelligence and big data tools, followed by several projects and programs to improve customer experience. Mentions to reposition current business model were also present, which may suggest that these operators are more concerned with their revenue generation capacity, especially when compared to observation group B (mobile) in which this concern was less latent.

Observation group B, of mobile operators, was the group with the highest number of projects dedicated to digital transformation and, therefore, where it was possible to identify a greater degree of integration of scenarios into the decision-making process with a great preponderance of the strategic PMO positioned in higher hierarchical levels. Executive 4 from operator B2 indicated that scenario generation process, given the mix of technologies contained in the portfolio, can reach up to 3 future scenarios. Although in this observation group, questions about new business models have emerged, only one of the executives indicated a high concern of the organization with the business model aspect, with 60% of the projects contributing to specific objectives related to partnerships.

It was possible to verify that, amongst three observation groups, group C of the multimedia operators was the most heterogeneous of them and one of the reasons for this fact, lies in the aspect that the operators of this group, besides acting in different niches (global networks and carrier operators) also had quite different sizes. On the other hand, according to the analysis of the data collected, in comparison with the other observation groups (A, fixed and B, mobile), executives of these operators were more affected by technological trends than the others, especially the C1 executive belonging to a global scale operation. In comparison with the other groups, this one demonstrated in the narratives, a high concern with future business models. One of the possible components that may have contributed to this perception would be linked to a greater dependence on organizational assets with a high risk of commoditization (physical networks), especially in the category known as operators of operators, which, unlike operator C3, have more developed digital capabilities in managed services via platforms that can be considered agnostic.

In the three observation groups, it was possible to identify pieces of digital marketing communicated to the market and shareholders, and participation in market events involving digital transformation efforts and discussions. In these secondary evidences, properly collected over the 14-month interval, it was possible to identify elements that emerged during the interviews, which allowed confirmation or any inconsistency of aspects brought by the executives interviewed.

Table 2 – Characterization of interviewed executives and operators.

observation group	interviewed executive / expertise in years	operator	products & services	size & market	portfolio nature	portfolio profile	position & function
A fixed	1 18 years 10 in PPM	A1	retail: voice (fixed and mobile), broadband, PayTV corporate: voice, broadband, value added services, cloud solutions operators: connectivity	large, national	focusing on business processes (80%) aiming cost reductions, operational costs optimization and customer experience (20%).	50 projects, 1 program	Senior Manager, PMO, corporate
	2 20 years in PPM	A2	retail: voice (fixed and mobile), broadband, PayTV corporate: voice, broadband, value added services, cloud solutions operators: connectivity	medium, regional	strong focus on business processes and repositioning of B2B business models	60 projects grouped in 3 programs, one of them connected to cultural aspects of agile teams	Governance and Strategy Manager, PMO corporate
B mobile	3 20 years 17 in PPM	B1	retail: voice (fixed and mobile), broadband, PayTV corporate: voice, broadband, value added services, cloud solutions operators: connectivity	large, International	main focus on business processes and customer experience (90%) with few evidences of projects dealing with business models	70 projects, 2 programs	Senior Manager, PMO corporate
	4 16 years 12 in PPM	B2	retail: voice (fixed and mobile), broadband, PayTV corporate: voice, broadband, value added services, cloud solutions operators: connectivity and equipment	large, international	business processes (40%) business models (60%), including partnerships and alliances	100 projecs, 4 programs	Chief Operations Officer - COO, PMO corporate
C multimedia	5 23 years 10 in PPM	C1	corporate: managed solutions (voice/data/video) with embbeded security and connectivity operators: connectivity, IP traffic	large, international	digitized products and services (40%) customer experience (30%) business models (30%)	130 projects, 6 programs	Latin America Director, Business unit

6 23 years 20 in PPM	C2	corporate: connectivity, advanced voice IP solutions and cloud operators: conectivity	small, regional	new products and services development (100%)	3 small projects	Chief Technology Officer - CTO, Top level executive
7 25 years 18 in PPM	C3	corporate: connectivity, operators: connectivity for remote and difficult locations (last mile)	medium, regional, operator of network operators	new multiplatform products and digitized processes	20 small projects and 10 large projects	Chief Executive Officer - CEO, Top level executive

Source: the authors

V. CONCLUSION

This study aimed to analyze the use of scenarios during the evaluation and selection of innovation projects with a specific focus on digital transformation, structured in portfolios of projects and programs, as well as determining how they influence the trajectory of telecommunications operators towards the desired state. The following aspects were established as specific objectives that sought to validate or refute the hypotheses constructed according to table 3:

Table 3 – Specific objectives and hypotheses

specific objectives	**hypothesis**		
	H1	**H2**	**H3**
identify tools, techniques, strategies, and processes utilized by organizations to determine technologies that will evolve into a dominant design.	researched organizations do not have at current stage of technology use, enough maturity to elaborate prospective scenarios to understand how digital transformation will affect their businesses;	researched organizations although recognize opportunities and threats brought by digital transformation, they can´t articulate a vision of future based on scenarios so they can interfere on portfolio management and guide its efforts. Digitally transformed organization under such hypothesis requires several intermediate transformational stages;	researched organizations seek effective ways to deal with future scenarios for digital transformation, even that still need external support (consultants) to achieve an optimal selection of projects within its digital transformation project portfolio;
analyze utilization of different scenarios for each technological alternative and understand how They affect desired state after project selection.			

Source: the authors

A sample of seven operators is representative, within established initial objectives for a exploratory and qualitative research, draws a panorama that may not represent in its entirety the reality of other organizations that could have been included in the study. On the other hand, in the case of fixed and mobile operators, where there is a high market concentration in Brazil, this aspect becomes less relevant for the reasons clarified by Halaweh, Fidler and McRobb (2008) where they maintain that integrating case study with grounded theory can be

considered satisfactory with the number of cases between 4 and 10. In the case of multimedia operators, due to their heterogeneity, an additional amount of researched organizations could contribute in order to correct asymmetries that could not be detected in the present study.

The tooling for articulation of scenarios proved to be more present in mature organizations from both project management and formal strategic planning perspectives. Thus, the proposed conceptual framework would lead to a more practical adaptation, aiming at its applicability by some of the executives of small operators, especially those called mirrors and operator of operators.

In relation to the second specific objective, which was to identify the use of different scenarios dedicated to exploring technological alternatives, it was possible to verify that only operators B2 (mobile) and C1 (multimedia), both of large size and international presence, clearly were influenced by articulated scenarios in their trajectories. In both cases, the operators worked with mechanisms to generate three or more scenarios with the help of external consultants. These were the two operators within the sample that showed adherence to hypothesis H3. Despite the size and the high revenue level, operator A1 demonstrated low integration of scenarios into strategic planning, especially in the stages of project evaluation and selection. In this same group, adhering to hypothesis H1, there were operators A1 (fixed), C2 and C3 (multimedia). In contrast, operators A1 and A2 (fixed) and B1 (mobile) showed adherence to hypothesis H2 due to the fact they utilize short-term scenarios, compatible techniques and tools for mapping risks, and ranking projects prior to their evaluation and selection.

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Analysis of stability for uniform rotations of a dumbbell system in an elliptic orbit

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***Keywords*—Tether systems, Control, mathematical modeling.**

Abstract*—*The evolution of space missions and related systems has been promoting innovation and creation of ideas for new technologies for decades. The search for innovative solutions that combine the optimization of resources and materials guide the recent research in the space area. The objective of this study is to analyze the behavior of two bodies connected by tethers and can be a solution for reducing costs in space missions, one of the concepts that have the potential to fulfill the objective of efficient transport space. In this paper it is discussed the motion of two massive bodies connected by tethers in keplerian motion in a central force field, their viability, the rotational dynamics and the system behavior in the space environment. Models will be created that simulate and explain the dynamics of the object and that analyzes the main parameters for determining the stability and the uniform rotations conditions.

I. INTRODUCTION

Tethered systems have many areas of application and has been studied in several published articles ([1]–[9]). Beletsky and Levin[1], begins by setting the scene for tethers in space summarizing possible applications and also discussing fact and fiction, analyzing clearly the main parameters and applications for Tethers Systems, as the density of the material the effective forces, orbital dynamics, mechanics models, attitude and possible disturbances for a flexible tethers with end masses, massless and massive variations.

The motion of tethers considering dumbbell oscillations, bodies in the central field of vibrating forces (Burov et al. ([10]–[14]), showing stability solutions for angles on the chaotic dynamics in elliptical orbit, analyzing the problem in another aspect of Moon-tethered pendulum, to considering the uniform rotations of a two-body tethered system in planar motion and the control the length of the tether [15]. In studies ([15]-[21]) were suggested methods of controlling the geometric configurationand Moon-tethered system with variable tether length in restricted three-body problem ([16] and [22]) were studied and demonstrated important results for tethers applications in systems.

II. DYNAMICS OF THE PROBLEM

Consider planar motion of a dumbbell body in the central Newtonian gravitational field (Fig.1). The tether length (l) is small compared to the orbit the system center of mass ($cm_{\otimes}$), moves along an elliptic keplerian orbit.

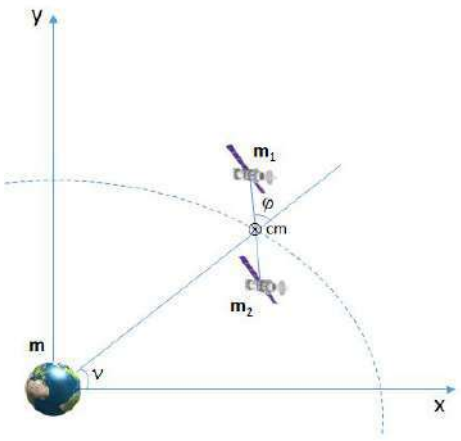

Fig.1: Geometry of the tether system in reference frame.

The body consists of two-point masses (m_1 and m_2) connected by a light tether

$$\rho = \frac{p}{1 + e\cos(\nu)} \tag{1}$$

where p is the focal parameter, e the eccentricity and ν the true anomaly of the orbit. The system coordinates are

$$\begin{cases} x_0 = \rho\cos(\nu) \\ y_0 = \rho\sin(\nu) \\ x_1 = x_0 + l_1\cos(\nu+\varphi) \\ y_1 = y_0 + l_1\sin(\nu+\varphi) \\ x_2 = x_0 - l_2\cos(\nu+\varphi) \\ y_2 = y_0 - l_2\sin(\nu+\varphi) \end{cases} \tag{2}$$

1.1. Potential and Kinetic Energy

The potential energy of the system can be obtained by the following expression,

$$V = -\frac{\mu_0 m_1}{|\vec{r_1}|} - \frac{\mu_0 m_2}{|\vec{r_2}|} \tag{3}$$

where m_i represents the mass of the point; $\vec{r_i}$the position of the point mass with respect to center of the Earth; $\mu_0 = GM$; G is the universal gravitational constant and M the mass of the Earth. Introduced the parameters, μ and m, given by

$$\mu = \frac{m_1}{m} \tag{4}$$

$$m = m_1 + m_2 \tag{5}$$

Substitute on Eq. (3)leads to

$$V = -\mu_0\mu\left(\frac{m}{\sqrt{x_1^2 + y_1^2}} + \frac{1-m}{\sqrt{x_2^2 + y_2^2}}\right) \tag{6}$$

The Eq. (7)is cumbersome and can be simplified, introducing a new parameter $\lambda = \frac{l}{p}$, and assuming $\lambda \ll 1$ the tether length is much smaller than the focal parameter p. The Taylor Series expansion up to the 2^{nd} order of λ for the potential energy is

$$V = -\frac{m\mu_0(1 + e\cos(\nu))}{p} + \frac{m(\mu-1)\mu\mu_0(1 + e\cos(\nu))^3(1 + 3\cos(2\varphi))\lambda^2}{4p} \tag{7}$$

The kinetic energy of the system can be written as

$$T = \frac{m_1|\vec{v_1}|^2}{2} + \frac{m_2|\vec{v_2}|^2}{2} \tag{8}$$

$$T = \frac{1}{4}m\left(\frac{2p^2(1 + e^2 + 2e\cos(\nu))\dot{\nu}^2}{(1 + e\cos(\nu))^4} - 2(\mu-1)\mu\left(l^2(\dot{\nu}+\dot{\varphi})^2 + \dot{l^2}\right)\right) \tag{9}$$

1.2. Lagrange Equations of Motion

For the subsequent analysis, the generalized coordinates φ and l are used and the system is assumed to be subject to the gravity-gradient forces.

$$\begin{cases} \frac{d}{dt}\left(\frac{\partial L}{\partial \dot{\varphi}}\right) - \frac{dL}{d\varphi} = 0 \\ \frac{d}{dt}\left(\frac{\partial L}{\partial \dot{l}}\right) - \frac{dL}{dl} = 0 \end{cases} \tag{10}$$

$$l\left(3\mu_0 sin(2\varphi)\left(1 + ecos(\nu)\right)^3 + 2p^3(\ddot{\nu}+\ddot{\varphi})\right) + 4p^3\dot{l}(\dot{\nu}+\dot{\varphi}) = 0 \tag{11}$$

The equation is rewritten as a function of the true anomaly ν (Eq. (11)- (12))

$$(\quad)' = \frac{d}{d\nu} \tag{12}$$

$$\frac{d}{dt} = \dot{\nu}\frac{d}{d\nu} = \omega_0(1 + e\cos(\nu))^2\frac{d}{d\nu} \tag{13}$$

with

$$\omega_0 = \frac{\mu_0}{p^3} \tag{14}$$

The equations of motion of the spacecraft can be written as

$$(1 + e\cos(\nu))\varphi'' + 2\left(\frac{l'}{l}(1 + e\cos(\nu)) - e\sin(\nu)\right)(\varphi' + 1) + 3\cos(\varphi)\sin(\varphi) = 0 \tag{15}$$

considering a movement with uniform rotations,

$$\varphi = \omega\nu + \varphi_0 \tag{16}$$

$$l(\nu) = \eta(\nu)\frac{l_0}{1 + e\cos(\nu)} \tag{17}$$

Suppose the following relation for the tether performance (Eq. \ref{equa16}), the Eq. \ref{equa14} with respect to the true anomaly ν takes the form:

$$\frac{\eta'(\nu)}{\eta(\nu)} = -\frac{3\sin\left(2(\omega\nu + \varphi_0)\right)}{4(\omega+1)(1 + e\cos(\nu))} \tag{18}$$

The analytical integration function is difficult but substituting values for the variable ω and solving the

equation with respect to the variable η, it is possible to obtain the following solutions (Table 1 and Figures \ref{fig2} - \ref{fig5}). Analytical solutions were found for this ω values previously chosen. The values for $\omega = \left(\pm\frac{1}{4}, \pm\frac{3}{4}, \pm\frac{5}{4}, \pm\frac{7}{4}, \pm\frac{9}{4}, \pm\frac{11}{4}, \pm\frac{13}{4}, \pm\frac{15}{4}\right)$ closed-form no solution. For $\omega = 0$ was examined in previous studies [12] where the relative equilibrium was studied.

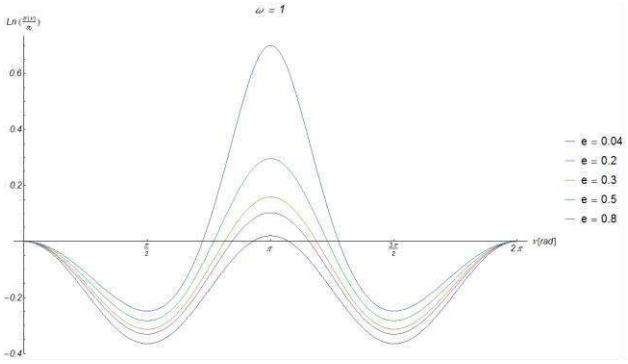

Fig.2: Tether length control for $\omega = 1$.

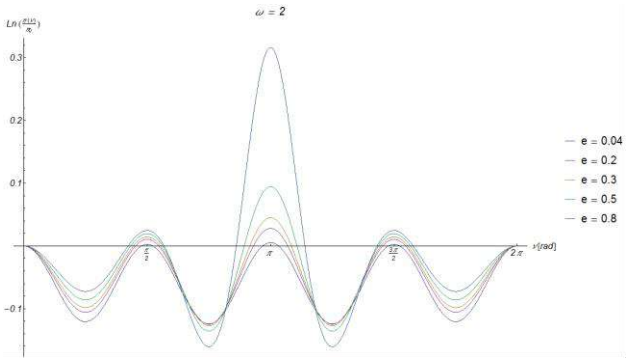

Fig.3: Tether length control for $\omega = 2$.

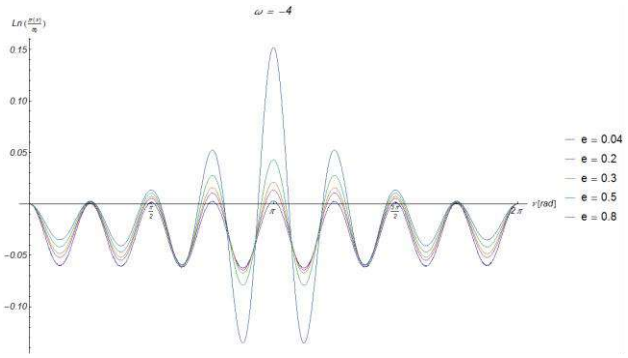

Figure 4 -Tether length control for $\omega = -4$

The control laws are periodic in true anomaly (ν). In Fig.2to Figure 4describe the change in tether length depending for different eccentricities,$e = (0.04, 0.2, 0.3, 0.5, 0.8)$. The formulation also guarantees uniform rotation for fractional values of ω, as seen in Figures6–9.

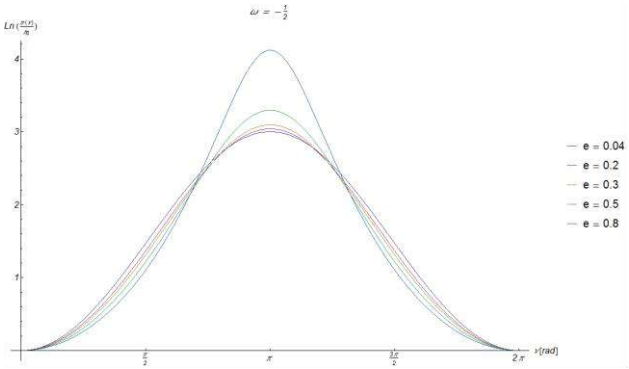

Fig.5: Tether length control for $\omega = -\frac{1}{2}$

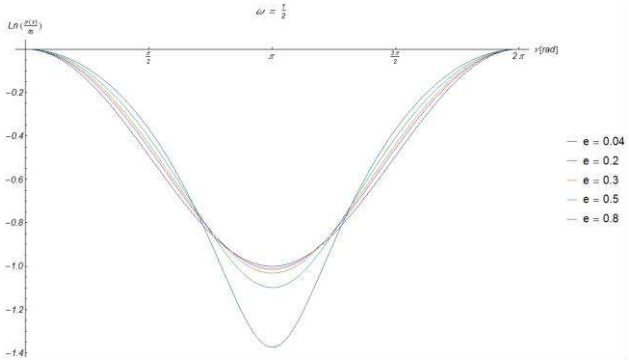

Fig.6: Tether length control for $\omega = \frac{1}{2}$

1.3. Uniform Rotations: $\varphi = \omega\nu + \varphi_0$

Substitute ($\varphi = \omega\nu + \varphi_0$) to Eq. (14)) and considering Eq. (17), it is possible to obtain the nonlinear differential equation that describes the motion of the tether.

A general analytical integration for all values of ω cannot be found but for some values ω the closed form solutions obtain. A numerical integration has been performed, where ω and φ_0 were substituted previously, with the objective of analyzing the behavior of the cable system. The logarithmic plots of $\ln\left(\frac{\eta}{\eta_0}\right)$ for a number of fractional angular velocities (Figures 6 - 9) was made. For the particular case when the value of ω is zero ($\omega = 0$) and φ_0 is constant, there are a uniform for $\varphi_0 = \frac{(k)\pi}{2}$, $k = \{0,1,2,3,4,\ldots\}$.

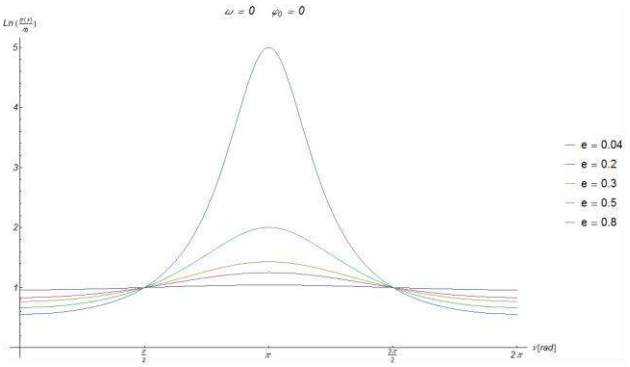

Fig.7: The control law for the tether length for $\omega = 0$ and $\varphi_0 = 0$.

An approximate solution for small eccentricities can be obtained using Taylor series in Eq. (17)and obtain applying the series of order 3, in the variable *e* obtain:

$$\frac{\eta'(\nu)}{\eta(\nu)} = \frac{3e^3\cos^3(\nu)\sin(2\nu\omega)}{4(\omega+1)} - \frac{3e^2\cos^2(\nu)\sin(2\nu\omega)}{4(\omega+1)} + \frac{3e\cos(\nu)\sin(2\nu\omega)}{4(\omega+1)} - \frac{3\sin(2\nu\omega)}{4(\omega+1)} \quad (19)$$

One obtains the expression that has analytical integration, however this procedure introduces impossibilities in the system and restricts the solutions to the variable ω, which after integration generates singularities for values: $\omega = \left(-\frac{3}{2}, -1, -\frac{1}{2}, 0, \frac{1}{2}, 1, \frac{3}{2}\right)$. Increasing the expansion terms for order 5, the singularities also increase, $\omega = \left(-\frac{5}{2}, -2, -\frac{3}{2}, -1, -\frac{1}{2}, 0, \frac{1}{2}, 1, \frac{3}{2}, 2, \frac{5}{2}\right)$.

1.4. Stability Conditions

We study stability using to the Floquet Theory, let´s linearize the equation of motion in the vicinity of solution (Eq. (16)), it is possible to check the stability analyzing system behavior around small oscillations. Considering Eq. (19)andEq. (20)analyzing the neighborhood of the point $\varphi_0 = 0$, it follows:

$$\varphi = \omega\nu + \delta\varphi \quad (20)$$

Substituting Eq. (17)in Eq.(15)one obtains:

$$4(\omega+1+\delta\varphi')(1+e\cos(\nu))\frac{\eta'(\nu)}{\eta(\nu)} + 3\sin\big(2(\omega\nu+\delta\varphi)\big) + 2(1+e\cos(\nu))\delta\varphi'' = 0 \quad (21)$$

Replacing Eq. (18), concerning the $\eta(\nu)$ variable,

$$\delta\varphi''(1+e\cos(\nu)) + 3\cos(2\omega\nu+\delta\varphi)\sin(\delta\varphi) - \frac{3\sin(\delta\varphi')}{2(\omega+1)} = 0 \quad (22)$$

This is the nonlinear equation of the perturbed motion \cite{ref16}. The linearized equation is

$$(1+e\cos(\nu))\delta\varphi'' + \frac{3}{2}\left(2\cos(2\omega\nu)\,\delta\varphi - \frac{\sin(2\omega\nu)\,\delta\varphi'}{\omega+1}\right) = 0 \quad (23)$$

Applying the Floquet theory find the monodromy matrix (A) for this system, one is obtained numerically by integrating a periodic orbit (2π) and the variation equations (Eq. (23)).

A good numerical method to refine the closure of the orbit is essential to obtain an accurate monodromy matrix (A), which is obtained to analyze to stability with respect to small perturbations ($\delta\varphi$) of the orientation angle φ. It is possible to analyze the stability using the Floquet theory, since this equation is a differential equation of the second order. The linearized equation constricts this analysis to small variations of φ. The stability monodromy matrix (A) has some important properties, which are ([13] and [19]):

1. det(A)=1;
2. $\{\lambda_1 = \lambda; \lambda_2 = \lambda^{-1}\}$eigenvalues;
3. $Tr(A) = 2 + \sum_i \lambda_i$

The indicator of stability $2 - |Tr(A)|$ is given by $Tr(A)$ between 0 and 2 $(0 < 2 - |Tr(A)| \leq 2)$ \cite{ref13}, where $Tr(A)$ means Trace of the matrix A. Positive values between the described boundaries correspond to stable solutions (linear approximation), negative values correspond to instability and zero values correspond to critical cases. The conditions of stability for ω are demonstrated in Figures 8 -- 18, where the positive values of ω correspond to direct rotations (direction of the orbital motion).

Table 1 - Intervals of stability.

ω	e
-4	[0, 0.2956] U [0.9063, 0.9334]
-3.75	[0.7821, 0.8333]
-3.5	[0, 0.0966] U [0.6824, 0.7690]
-3.25	[0.6328, 0.7542]
-3	[0, 0.7895]
-2.75	[0, 0.6370]
-2.5	[0, 0.4906]

-2.25	[0, 0.1935]
-2	[0, 0.5453]
-1.75	No Solutions found
-1.5	No Solutions found
-1.25	No Solutions found
-1	-
-0.75	No Solutions found
-0.5	0
-0.25	[0.4521, 0.9999]
0	[0, 0.9999]
0.25	No Solutions found
0.5	No Solutions found
0.75	[0.0177, 0.0325]
1	[0.8789, 0.8805]
1.25	No Solutions found
1.5	[0.0, 0.1338]
1.75	[0.0, 0.2684]
2	[0, 0.5539] U [0.9778, 0.9789]
2.25	[0, 0.5820]
2.5	[0, 0.6451]
2.75	[0.6426, 0.7665]
3	[0, 0.0989] U [0.9666, 0.9859]
3.25	[0, 0.0890] U [0.7768, 0.8296]
3.5	[0, 0.2961] U [0.7656, 0.8173]
3.75	[0, 0.3412] U [0.8506, 0.8792]
4	[0, 0.4207]

The regions of stability with solutions (Figures 8–18 and Table 1) have been shown for a number of $\omega \in [-4,4]$. When $\omega = -1$ there is no solution and when $\omega = 1$ there is a small stable range (Table 1). The Table 1 shows the complete set of stable solutions for the monodromy matrix, as a function of the eccentricity and of the true anomaly.

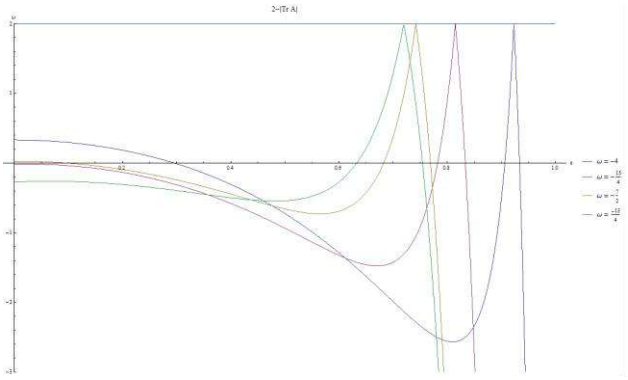

Fig.8: Stability region for $\omega = \left\{-4; -\frac{15}{4}; -\frac{7}{2}; -\frac{13}{4}\right\}$.

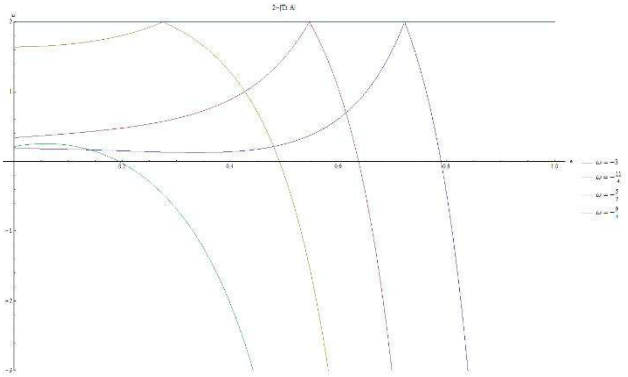

Fig.9: Stability curve for $\omega = \left\{-3; -\frac{11}{4}; -\frac{5}{2}; -\frac{9}{4}\right\}$

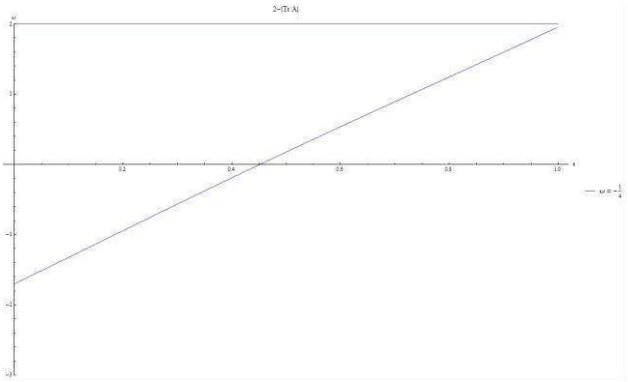

Fig.10: Stability curve for $\omega = \left\{-\frac{1}{4}\right\}$.

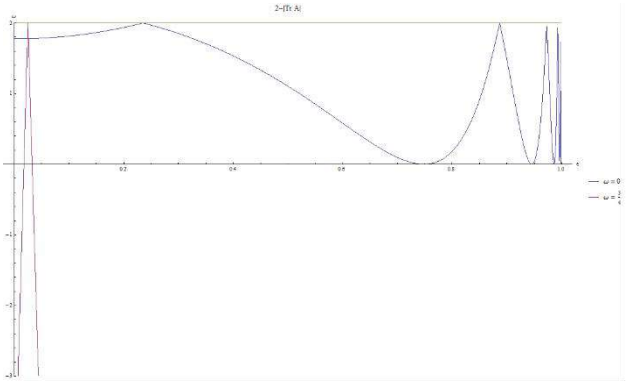

Fig.11: Stability curve for $\omega = \left\{0; \frac{3}{4}\right\}$.

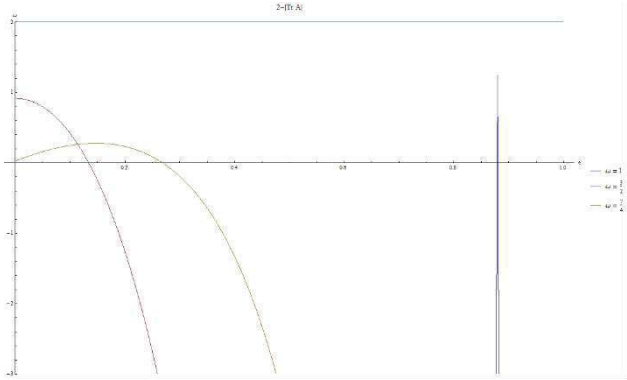

Fig.12: Stability curve for $\omega = \left\{1; \frac{3}{2}; \frac{7}{2}\right\}$.

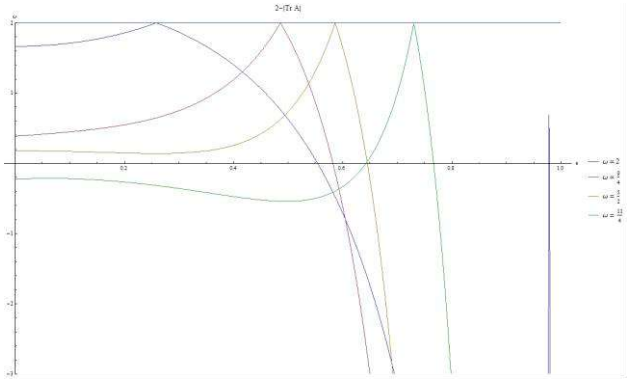

Fig.13: Stability curve for $\omega = \left\{2; \frac{9}{4}; \frac{5}{2}; \frac{11}{4}\right\}$

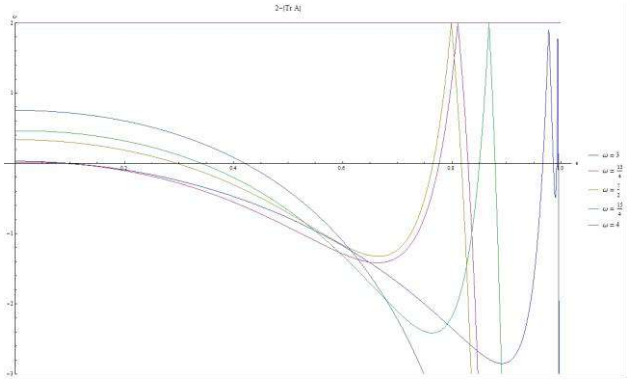

Fig.14: Stability curve for $\omega = \left\{3; \frac{13}{4}; \frac{7}{2}; \frac{15}{4}; 4\right\}$.

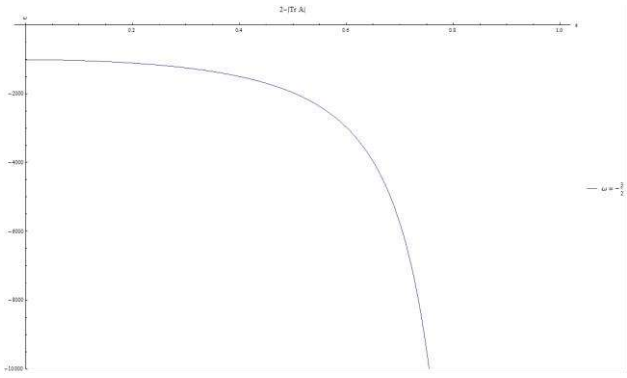

Fig.15: Stability curve for $\omega = \left\{-\frac{3}{2}\right\}$.

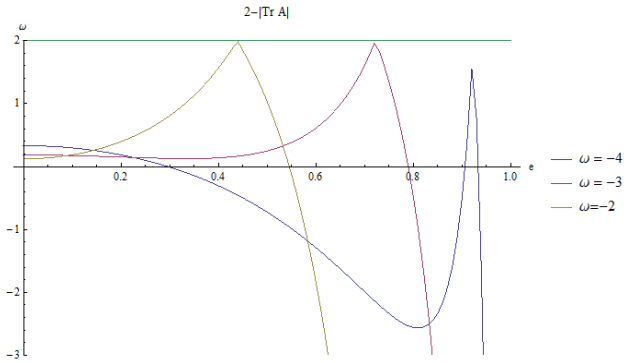

Fig.16: Stability curve for $\omega = \{-4;\ -3;\ -2\}$.

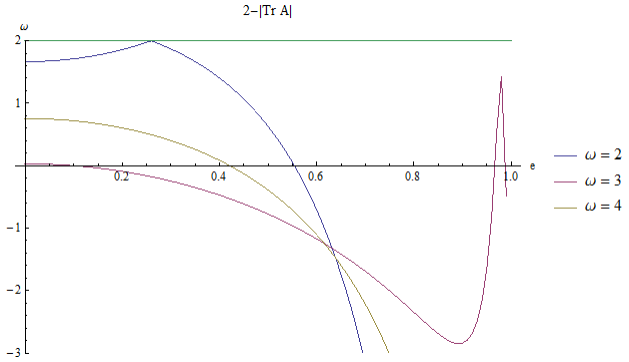

Fig.17: Stability curve for $\omega = \{2;\ 3;\ 4\}$.

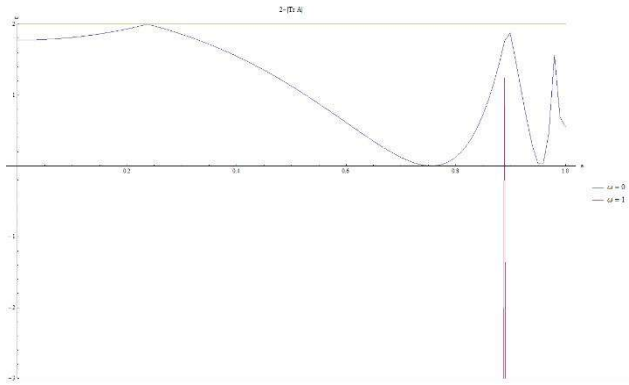

Fig.18: Stability curve for $\omega = \{\ 0;\ 1\}$.

The stability analysis suggests the system's viability. Some parameters for the system are shown in monodromy matrix.

III. FORCES IN TETHERS

The force on the tethers can be calculated using the relation of the forces involved in the problem, applied to the tether,

$$m_1 \ddot{r_1} = -\mu_0 \frac{m_1}{|\vec{r_1}|^3} \vec{r_1} + \vec{T} \qquad (24)$$

The force on the tether for a system composed of: $m_1 = m_2 = 1000$ kg, $l_0 = 100$km, p = 7000km, the

direction is tether length (l) and sense m_1 to m_2, and $T$is magnitude of the tether force, solving the Eq.(16) with respect to l, it is possible to show that the cable suffers a large variation in tension and that these values are periodic and, in some cases, increase with grows to the eccentricity (Figures 19 -- 32).

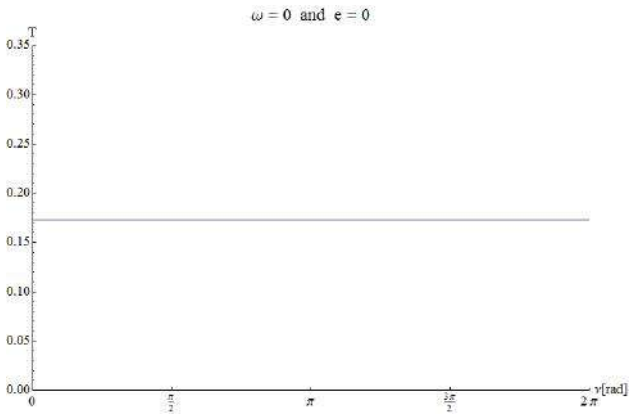

Fig.19: Tether Force T for $\omega = 0$ *and e = 0.*

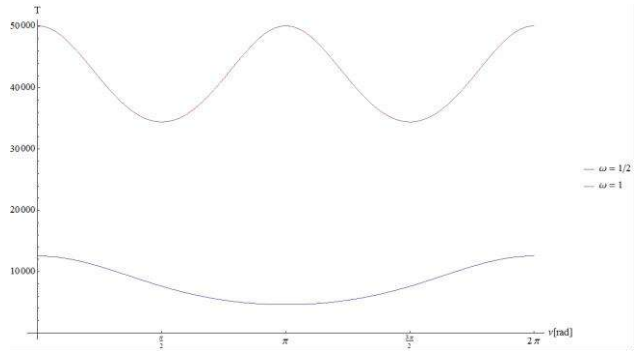

Fig.20: Tether Force T for $\omega = \left\{\frac{1}{2}, 1\right\}$ *and e=0.*

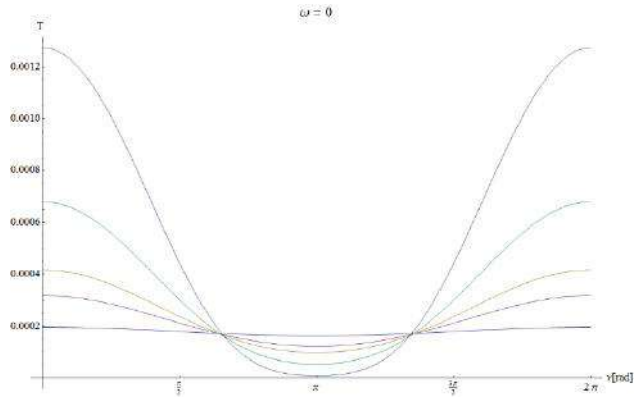

Fig.21: Tether Force T for $\omega = 0$.

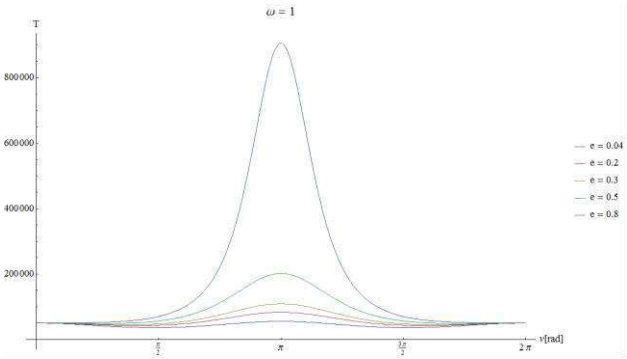

Fig.22: Tether Force T for $\omega = 1$.

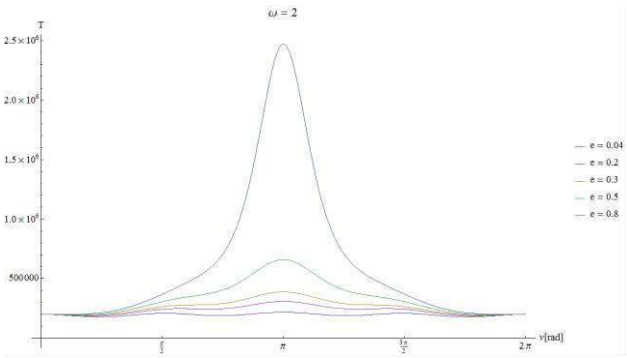

Fig.23: Tether Force T for $\omega = 2$.

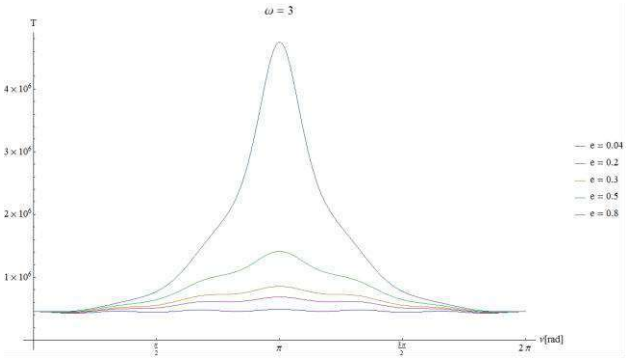

Fig.24: Tether Force T for $\omega = 3$.

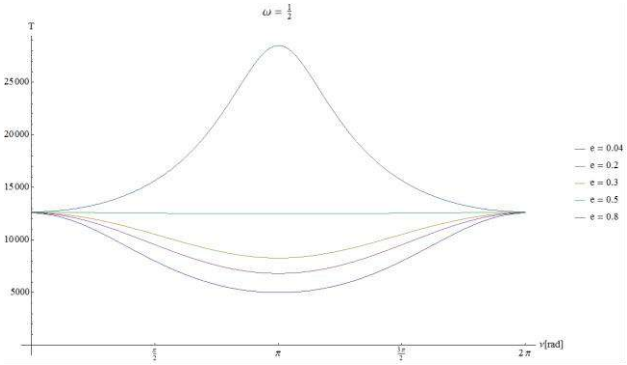

Fig.25: Tether Force T for $\omega = \frac{1}{2}$.

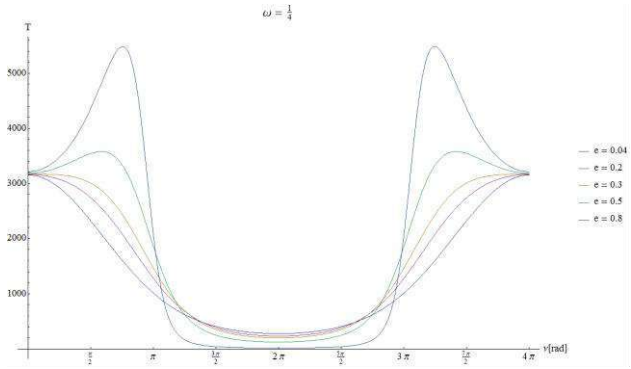

Fig.26: Tether Force T for $\omega = \frac{1}{4}$.

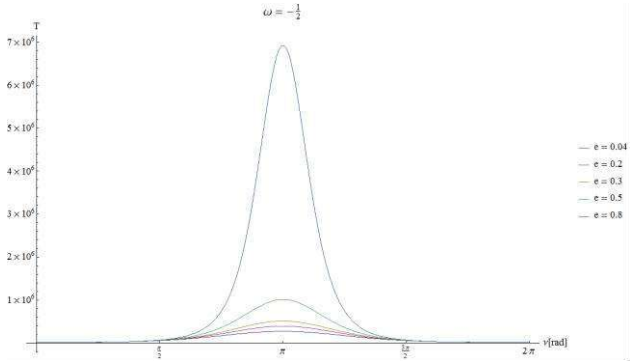

Fig.27: Tether Force T for $\omega = -\frac{1}{2}$.

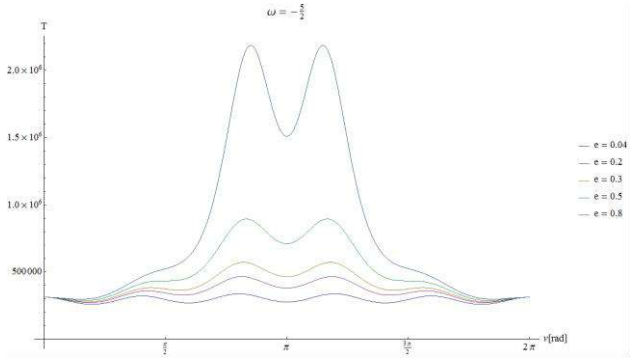

Fig.28: Tether Force T for $\omega = -\frac{5}{2}$.

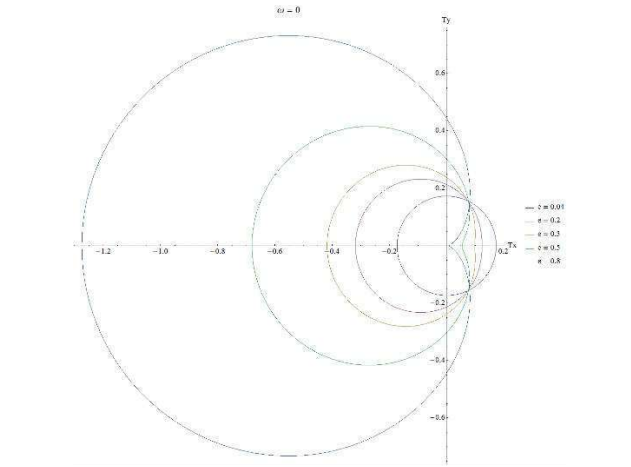

Fig.29: Tether Force $(\vec{T})$ *with* $\omega = 0$ *for several eccentricities (e).*

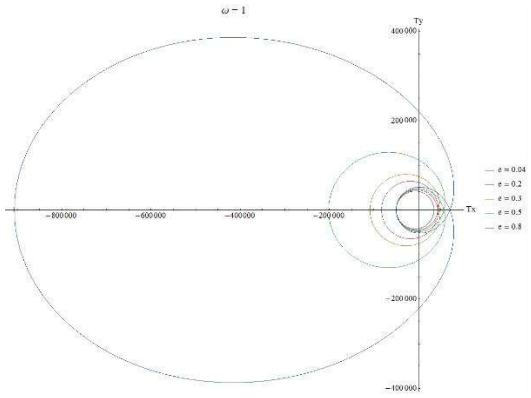

Fig.30: Tether Force $(\vec{T})$ *with* $\omega = 1$ *for several eccentricities (e).*

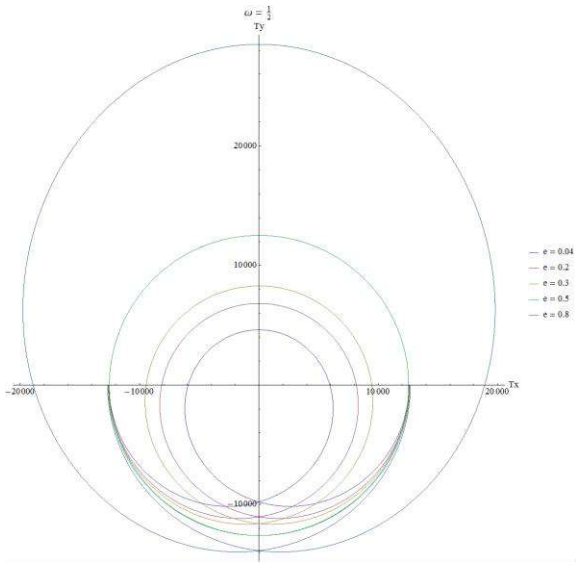

Fig.31: Tether Force $(\vec{T})$ *with* $\omega = \frac{1}{2}$ *for several eccentricities (e).*

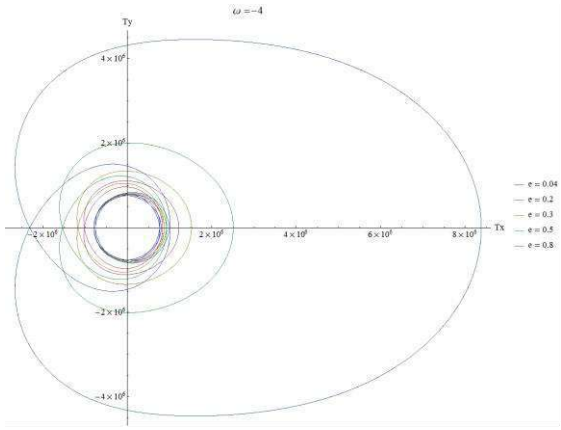

Fig.32: Tether Force $(\vec{T})$ *with* $\omega = -4$ *for several eccentricities (e).*

IV. CONCLUSION

The uniform rotations of a dumbbell and with several possibilities are considered in the present study, as well as the stability analysis and the viable control laws. In some cases are possible obtain solutions closes-form, in other cases only numerical solutions for the control of the tether systems are available. The necessary conditions of stability for uniform rotations were analyzed using the parameters ω and the eccentricity of the orbit, generating the control laws for the cable length.

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PID Controller Implementation For Temperature Control In Leakage Current Test Chamber 20kv Insulator

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***Keywords*— chamber, leakage current, temperature, insulator, PID controller**

***Abstract*—** *The Isolator is a device used in electric power systems which is very important to separate between conductor of the electric power systems transmission. Isolators are very influential on environmental conditions such as temperature, humidity and other pollutants. A suitable testing condition is needed to ensure the insulator will do properly. Therefore, it is necessary to test the insulator at a similaractual environment. This test is carried out using a chamber with temperature and humidity settings to determine the characteristics of the leakage current in the insulator. In this paper, a PID Controller is implemented to control the temperature in the chamber. The PID controller is applied in the Arduino R3 microcontroller using a DHT22 sensor and a thermoelectric cooling actuator (TEC12706.) Experimental results show that the PID controller can maintain the chamber temperature at the desired set point with K_p = 200, K_i = 10, K_d = 5. The system can reduce the temperature up to 23.6 °C with a rise time of 198 seconds with a peak time of 218 seconds at a temperature of 24.8 °C. The system can reach at a preset temperature value with a response time of 32 seconds.*

I. INTRODUCTION

Electrical isolators are an important component in electricity to support the safety of electricity operations and implementations. Insulators must consider a specified standard in order to work properly.The insulators must be tested in such a way to determine their performance. One of method used to test the insulator is to determinethe leakage current using a chamber with temperature and humidity settings in order to get a suitable condition environment. Therefore a test room that is controlled with a precise controller is proposed. PID control is implemented in the test room where PID control is a popular feedback controller [1][2].This controller consists of three combined methods, namely proportional, integral, and derivative. The controller uses an Arduino Uno microcontroller with a DHT22 sensor and an actuator in the form of a TEC12706 Peltier. The DHT 22 sensor was chosen because it has high accuracy at-40 – 80^{o}C and humidity measurement of 0-100% RH[3].

In previous research, an on-off control method was applied by Lastoni Wibowo[4].It wasdesigned to a 20 kV isolator leakage test room with temperature and humidity controls.The research work appliedan on-off control method applied in an Arduino Uno Rev.3.The control systems can manipulate the test room to resemble a certain environment conditions to getaccurate test results. In the paper, the temperature setting is carried out at three set points which are a maximum temperature at 33°C with a minimum humidity at 58%, an average temperature at 27°C with an average humidity at 82% and a minimum temperature at 21°C with a maximum humidity at 91%. The experimental results show that the maximum temperature setting with the minimum humidity, the highest temperature is 33.30°C and the lowest humidity is 58.25%. In the average temperature with an average humidity, the measurement results are close to the set point. In this condition, a temperature is 27.25°C with a humidity is 81.60%. In next experimental work, a minimum temperature with maximum humidity, the measurement results are the closest to the set point and the temperature is 25.35°C with humidity is 91.50%.

A Proportional Integral (PI) controller that has been carried out by Bayu Rudianto [5] is used to adjust an automatic expansion valve control of an evaporator. In this

study, the performance of the PI control system got a good response at parameter values of K_p=20 and K_i=10. In this parameter configuration, it takes 251 seconds to reach the presettemperature with a lower maximum overshoot value is -2.4˚C. The experimental work using an automatic expansion valve control system showed a faster cooling process. The energy required is more efficient, which is equal to 0.265 kWh. In this study, it is proposed to apply a PID controller as temperature control for a 20kv isolator test chamber using microcontroller Arduino Uno R.3. Peltier 12706 is implemented to the cooling process.

II. BASIC OF THEORY

2.1 20 Kv Leakage Current Test Chamber

An insulator must have good insulation properties at high voltage and low voltage applications. Also, It must have a good performance and high resistance, which is indicated by the amount of leakage current in the insulator. Generally, polymer materials have better dielectric properties compared to ceramic, glass, and porcelain materials. Factors that greatly affect the performance of the insulator are temperature, rain, humidity, ultraviolet light, condensation, and contaminants [6] therefore the leakage current is tested on the insulator. Several records showed that the flashover voltage in wet conditions is smaller than in dry conditions[7]. Research conducted by J.Y.Li et al [3] is testing the characteristics of leakage currents in a single suspension isolator with varying contamination and humidity Leakage current testing on the insulator is carried out in a fog chamber that is a test chamber with adjustable humidity. A schematic diagram of the fog chamber system and a sketch of a single suspension insulator are shown in Fig. 1. The test results show the normal threshold of leakage current is <50 ma. This result is used as a threshold to help give an early warning before pollution causes a flashover that can damage the insulator.. To carry out the leakage current test, a conditional chamber must be set up as shown in Figure 1. It was recorded in [3] that the leakage current test room was designed using the on-off control method. Testing using a chamber with an Arduino R3 microcontroller controller and actuators in the form of a cooler, heater, humidifier, and fan. In the setting of the highest temperature point set 33°C with the lowest set point humidity 58 %, the highest temperature achievement results occurred in the 22nd minute with a temperature measurement of 33.30 ° C with a humidity of 58.65%, while the results of achieving the lowest humidity occurred at 23 minutes with a humidity measurement of 58.25% with a temperature of 33.25°C. At the highest temperature setting with the lowest humidity, it is carried out in a duration of 53 minutes.

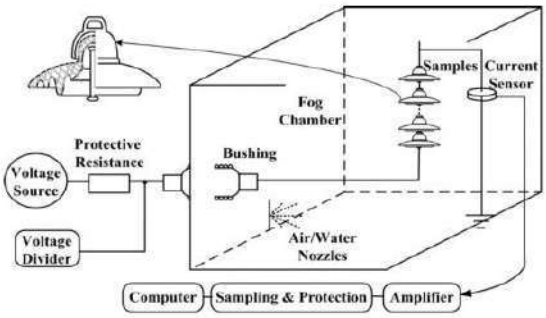

Fig.1: Diagram of the fog chamber system and sketch of single suspension isolator[7]

2.2 Effect of temperature on leakage current

It is common that the isolator design has to have a breakdown voltage higher than its flashover voltage. The dielectric strength and voltage value can be estimated from three basic characteristics of the insulator, i.e. alternating flashover voltage in dry conditions, alternating flashover voltage in wet conditions, and time-voltage characteristics obtained from standard surge voltage [3]. The testing condition for the insulator must follow standard requirement mentioned in Table 1. Table 1 shows the standard conditions of barometric pressure, ambient temperature, and absolute humidity based on the Japanese Industrial Standard (JIS) C3801 and the Japanese Electrotechnical Committee (JEC) standard 106.

Table.1 Japan Industrial Standart [8]

	Value	Unit
Barometer Pressure	760	mmHg
Environment Temperature	20	°C
Absoulte Humidity	11	Gram/m^3

Because the flashover voltage is always influenced by thestate of the air, so to be able to compare test results with existing normalization tables, we need formulas that canvchange these results into results in standard conditions. This is needed to be able to find out whether the tested specimen meets the requirements or not. To correct the voltage during testing (V) against airpressure and temperature, a formula is used:

$$V = \delta . Vs \quad (1)$$

Where Vs is flashover voltage of isolator at standard state, V is flashover voltage of isolator at the time of testing, and δ is air correction factor

$$\delta = \frac{b}{760} \times \frac{273+20}{273+T} = \frac{0{,}386b}{273+T} \quad (2)$$

Where T is ambient temperature at the time of testing (°C) and b is air pressure at the time of testing (mmHg). The voltage of the insulator's flashover will get lower with increasing humidity in the air. If Vs is the isolator's flashovervoltage under standard air conditions and humidity of 11 gr/m3, the isolator's flashover voltage at any temperature, pressure and humidity can be determined as follows:

$$V = \frac{\delta . V_S}{k_h} \quad (3)$$

Where kh is the air humidity correction factor. To find out the relationship of the flashover voltage to the leakage current, the formula is used:

$$V = I . R \quad (4)$$

Where I is the current and R is the resistance The relationship between humidity (kh) to the leakage current (I) can be known by entering equation (4) into equation (3) it is obtained:

$$R = \frac{V_S}{I.k_h} \quad (5)$$

In equation (5) it can be seen that for fixed values of Vs and I, the value of kh is inversely proportional to the value of R. While in equation (4) it is seen that for a fixed value of V, the value of R is inversely related to the value of I. So the relationship between kh, R and I are:

$$k_h \uparrow : R \downarrow : I \uparrow$$

note: ↑ means increase / height
↓ means decrease / low

While the relationship between temperature (T) to leakage current (I) can be known by entering equation (1) into equation (4), it is obtained:

$$R = \frac{\delta . V_S}{I} \quad (6)$$

In equation (6) it can be seen that for fixed Vs and I, the value of δ is directly proportional to the value of R. Where as in equation (4) it is seen that for a fixed value of V, the value of R is inversely related to the value of I, So the value of δ is inversely proportional to the value I. So for the relationship of temperature (T) to leakage current (I), according to equation (2) for fixed b, T is inversely proportional to δ, then T is directly proportional to I.[8]

2.3 PID Controller

PID control is one type of controller that is widely used in industrial systems and other general applications[9].Since the controller has a good performance, this system can be combined with other systems [1]. PID control actually consists of three combined methods, namely Proportional, Integral, and Derivative with their respectiveparameters so that they can work properly as shown in Figure 2. These parameters are called constant.

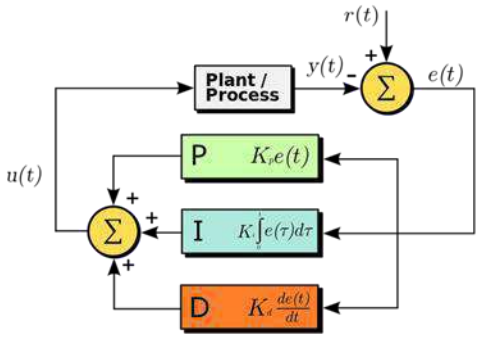

Fig.2: PID Controller Block Diagram

The PID controller in Figure 2 can be written as follows [8]:

$$u(t) = K_p(e)t + K_i \int_0^t e(t)dt + K_d \frac{d}{dt} e(t) \quad (7)$$

where $u(t)$is system output, K_p is a proportional constant, K_i is an Integrator constant and K_d is a proportional constant[9].

Table.2 PID Controller Kp,Ki,Kd characteristic

Close Loop Response	Rise Time	Over shoot	Settling Time	SS Error
Kp	Increase	Increase	Small Change	Decrease
Ki	Decrease	Increase	Increase	Eliminate
Kd	Minor Change	Decrease	Decrease	No Effect

2.4 Arduino Rev.3 Microcontroller

Arduino Uno R3 is a microcontroller board based on ATmega328. It has 14 digital input/output pins (6 pins can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header and a reset button. The featuresare contain in one chip to support the microcontroller[10]. Arduino can be programmed easily because the programming language has been simplified and uses open source systems[11].Pins for analog inputare addressed in A0 - A5. Digital pins from pin is located in pin 2 to pin 13, with a special pin Pulse Width Modulation (PWM) on pins 3,5,6,9,10,11. Arduino can be supplied by 9v to 30v DC using an external power supply as shown in Figure 3 and Figure 4.

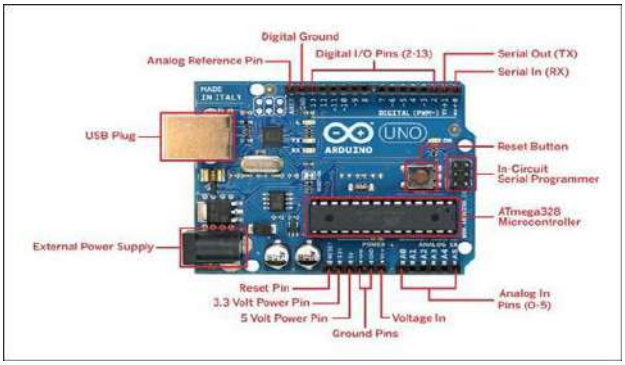

Fig.3: Ardiuino Rev.3Microcontroller

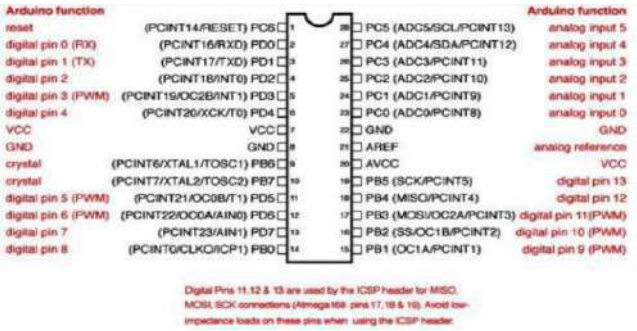

Fig.4: Arduino Rev.3 Microcontroler Pin Mapping[11]

2.5 Thermo Electric Cooler (TEC)

Thermoelectric cooler (TEC) also called aPeltier modules composed of ceramics that contain bismuth telluride. Peltier has two different sides, namely a hot side and a cold side. It can be used for cooling and heating. The principle of Thermo-Electric cooling was first discovered in 1834 by Jean Peltier, so that his invention is often called "Peltier Cooler". When two conductors are connected in electrical contact, electrons will flow from the conductor that has less electrons to the conductor with the more bonded electrons. The most commonly used Thermo-Electric semiconductor material today is Bismuth Telluride (Bi2Te3) [12] as shown in Figure 5 and 6. Thermo-Electric is built by two different semiconductors, one type N and the other type P. A Thermo-Electric will produce a maximum temperature difference of 70°C between its hot and cold sides. The efficiency is reduced when the Thermo-Electric become hotter. Thermo-Electric has an efficiency of about 10% - 15%, while the efficiency of conventional models is between 40% - 60%[11]. TEC 12706 performance as shown in table 3

Table.3 TEC 12706 Performance[13]

Hot Side Temperature (ºC)	25ºC	50ºC
Qmax (Watts)	50	57
Delta Tmax (ºC)	66	75
Imax (Amps)	6.4	6.4
Vmax (Volts)	14.4	16.4
Module Resistance (Ohms)	1.98	2.30
Hot Side Temperature (ºC)	25ºC	50ºC

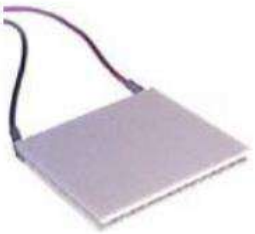

Fig.5: Peltier TEC 12706 [13]

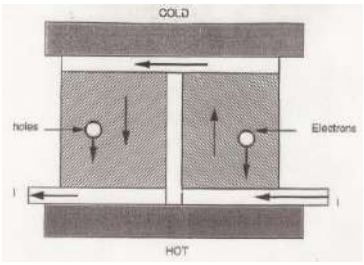

Fig.6: Thermoelectric Schematic Diagram

2.6 DHT 22 Sensor

DHT 22 is a temperature and humidity sensor with 8 bit single chip calibrated output as depicted in Figure 7. The DHT22 consists of a polymer capacitor with a temperature sensing range of -40 - 80°C and a humidity of 0 - 100% RH [3]. The output of the DHT22 or AM2302 is digitally calibrated It employs a proprietary digital signal-gathering technique and moisture sensing technology, ensuring reliability and stability. Its sensing element is connected to a single 8-bit chip. Each sensor of this model is temperature compensated and calibrated in the accurate calibration chamber and the calibration coefficient is stored in the program type in OTP memory, when the sensor detects it will quote the coefficient from memory. Small size & low consumption & long transmission distance (100m) allows the AM2302 or DHT 22 to be adapted in all kinds of demanding applications[14]

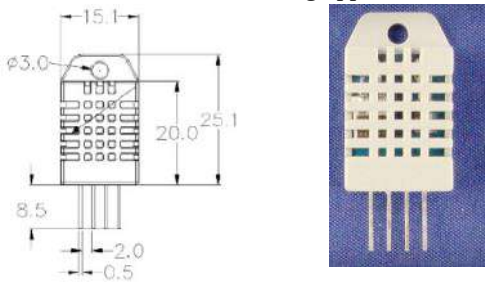

Fig.7: DHT22 Sensor Dimension[15]

Table.4 DHT22 Sensor Technical Data [15]

DHT 22 Technical Data

Power Supply	3.3-6V DC
Output Signal	digital signal via single-bus
Sensing Element	Polymer capacitor
Operating Range	humidity 0-100%RH; temperature -40~80Celsius
Accuracy	humidity +-2%RH(Max +-5%RH); temperature <+-0.5Celsius
Resolution	humidity 0.1%RH; temperature 0.1 Celsius
Repeatibility	humidity +-1%RH; temperature +-0.2Celsius
Humidity Hysteresis	+-0.3%RH
Long Term Stability	+-0.5%RH/year
Sensing Period	Average: 2s
Interchangebility	fully interchangeable
Dimensions	small size 14*18*5.5mm; big size 22*28*5mm

III. METHODS

3.1 Hardware Design

In this reserch work,the PID controller will be programmed in an Arduino Rev.3 microcontroller as shown in Figure 8.Some Thermo electric cooler (TEC) actuatorsare used to reduce the temperature of the test chamber. The TEC is controlled by a Pulse Width Modulation (PWM) signal that is determined according to the PID computation embedded in the microcontroller. Setpoint value is set at 20°C. Firstly, the controller will take a temperature reading on the test chamber room and send it to pin 8 Arduino. PID method will try to control based on the differences between this value to the setpoint or preset value.

Block diagram of the implemented control temperature system for test chamber can be seen in Figure 8. Two TEC units will be installed in the test chamber room for cooling step. The cooling components are driven by a driver as seen in the figure. This driver will amplify the PWM signal coming from Arduino microcontroller to the TEC. As shown in the figure, PWM signal is provide by microcontroller as an output of PID controller. The width or duration depend on the deviation between feedback signal and preset value or setpoint.

Test room or chamber is developed by using a plastic box which has size of 510 x 360 x 290 mm.

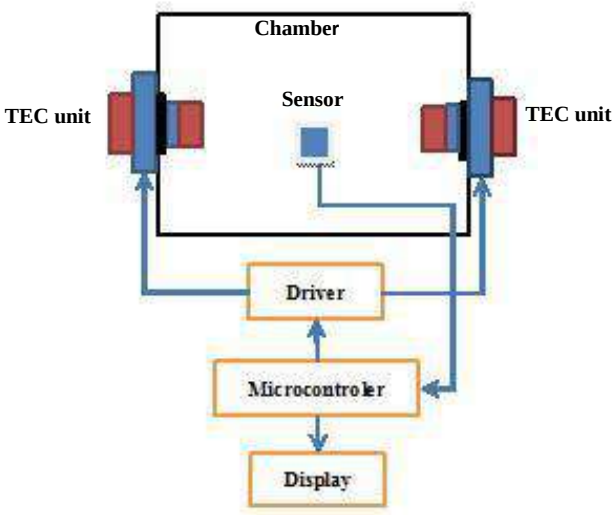

Figure 8. Block Diagram

The PID controller will be implemented using Arduino as mentioned before. The PID algorithm will be programmed using C language. In order to realize the PID controller, a flow chart as shown in Figure 9 is created to determine theprocess for controlling the temperature step by step.

Initially, some variables or constant must be given a value. Then a controlling process will be started at reading a setting point or preset value. The process will be continued by reading the actual temperature value. This value can be taken from a sensor used in this temperature control systems and this value is called feedback signal. As mentioned above, this temperature value is taken from DHT sensor through a dedicated protocol communication.The deviation between setting value and feedback signal value will be used by PID controller to determine the width of PWM signal. This algorithm is applied during controlling process until the temperature is reach to the setting value. The actual temperature value will be displayed on the LCD screen. It can be seen the actual temperature value by looking at the LCD display text. The flow chart which is programmed in Arduino can be seen as shown in Figure 9.

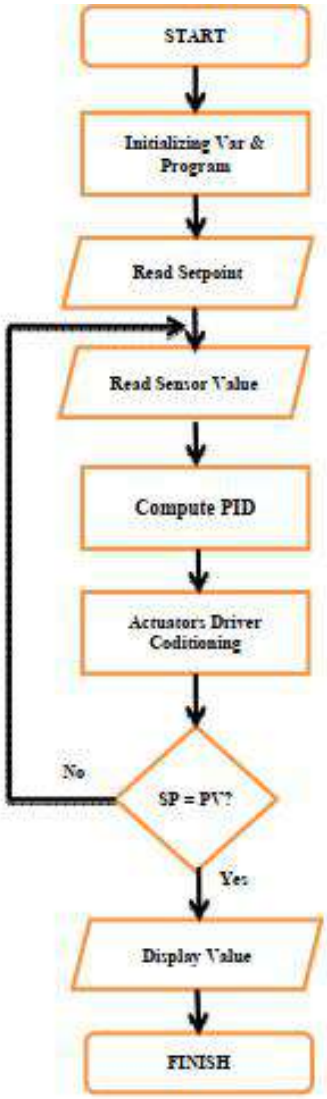

Fig.9: Systems Flow Chart

3.2 Open loop Test

Some experimental work must be done to ensure that the temperature control systems working properly. Open loop thermoelectric test is conducted before the control process is carried out.The first trial is done by giving a 100% PWM duty cycle to the Peltier driver, then the data is recorded in second intervalsas shown in Figure 10.

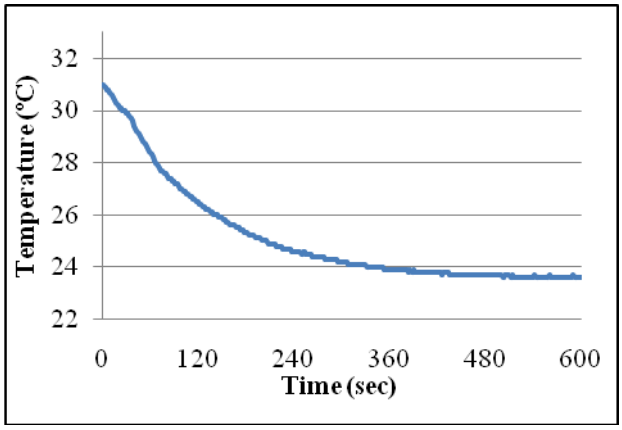

Fig.10: Open Loop Responses

It can be seen that cooling mechanism can be performed by the control system as depicted in Figure 10. It is shown that the system can reduce the temperature from 31°C to 24.6 ° C at 500 seconds. The first experimental work shows that open loop system is working fine.

3.3 PID Controller Test

The PID control process is carried out using a setpoint value of 25°C.ParametersK_p is set to 200,K_i is set to 10 and K_d is set to 5. It is shown in Figure 11 that temperature can be controlled by the control systems. Temperature can be reduced to reach the setting point value. It is also shown that when the temperature is too low, it can be raised up to maintain the predetermine temperature.

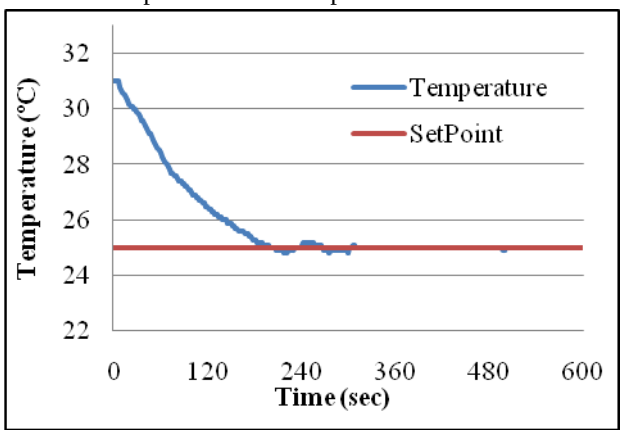

Fig.11: System Responses

Figure 12 show that the set point has been changed from 25ºC to 26ºC.It can be seen the system response. The temperature follows the setpoint with a change in response time of 32 seconds.

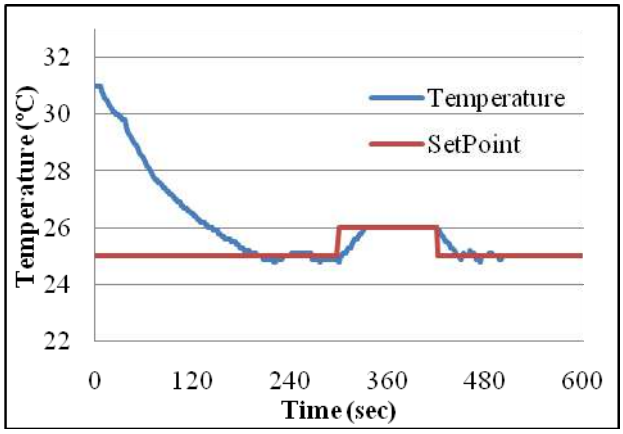

Fig.12: The system response if the setpoint is changed

IV. CONCLUTION

Testing and experimental work for temperature control has been done. The control system will be used in Test chamber as specified in previous section. Based on the experimental results of the implementation of PID control in the 20 kv isolator leakage test room , the temperature can be reduced up to 23.6°C.The rising time is 198 seconds with a peak time of 218 seconds at a temperature of 24.8°C. It is shown also the performance of the temperature control systems. Changing the setpoint of temperature can be tracked by the control systems. The temperature can follow the setpoint with the response time 32 seconds until it reaches steady state.

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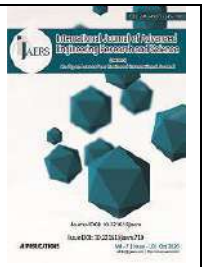

Institutional Theory and the Isomorphic Pressures in the Search for Knowledge: A Study in an APL of Goiás – Brazil

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***Keywords*— Institutional Theory, Local Productive Arrangement (APL), Management and Regionality, Organizational isomorphism, Search knowledge**

***Abstract*–** *The institutional theory provides a greater understanding of organizational phenomena, especially in relation to the reaction of organizations to the pressures of the environment in which they operate. These pressures, which can be mimetic, coercive, and normative, force companies to become increasingly homogeneous, through isomorphic mechanisms, and can even influence the search for exploratory and exploitative knowledge. This study was carried out with the intention of verifying how the pressures exerted by organizational isomorphism affect the search for knowledge. The study was conducted in the underwear companies of APL Taquaral in the state of Goiás Brazil. The results revealed that the organizational isomorphism does exert some pressure on the companies of APL in its three forms. As to whether it influences the search for knowledge, it was demonstrated that the influence of exploitative knowledge is quite noticeable and the exploratory knowledge practically does not occur. The companies demonstrated technical and or financial inability to invest in R&D, which occurs because of the characteristics of the companies of the pole, in addition to the evident lack of public policies.*

I. INTRODUCTION

The institutional theory originates from the acceptance and legitimacy of certain practices in organizations, which, therefore, are adopted to face the competitive pressures of the environment (CARDONA et al., 2020).

Organizations tend to imitate behavioral norms of other actors in the organizational field, which according to DiMaggio & Powell (1983), is very important, as it helps in producing similar services or products and have structural equivalence and connectivity. This increases the flow of information and development of mutual knowledge among the participants of the organizations.

By associating relevant stakeholders to institutional theory, DiMaggio and Powell (1983) proposed the idea of dividing predominant sources of institutional pressure on decision makers into three dimensions: coercive pressure, normative pressure, and mimetic pressure.

Institutional coercive pressure stems from organizations facing cultural and social expectations. After all, the company operates within the society and, therefore, inevitably fits into both formal and informal pressures from other organizations, such as government agencies and regulatory standards (DIMAGGIO and POWELL, 1983). Government agencies illustrate perfectly how powerful groups can influence the actions of an organization (RIVERA, 2004).

The normative pressure occurs due to professional codes, which assume that professionals will follow specific

guidelines aligned with formal education conventions and the professional community (DIMAGGIO AND POWELL, 1983). Due to social legitimacy, each company is expected to consider or follow standards, norms and expectations of its external *stakeholders* (MCFARLAND et al. , 2008; LAI et al. , 2006). In normal cases, customer demand shapes a central normative pressure (ZHU, SARKIS, 2007; HALL, 2000).

Mimetic pressure arises when an organization copies other successful competitors in the market. As organizations are embedded in social networks (MCFARLAND et al., 2008), companies in these networks tend to imitate the behaviors of other network members (HENISZ and DELIOS 2001). In particular, when the organization does not have clarity in establishing its organizational objective or understanding the technology, there is a greater chance of imitating other companies (DIMAGGIO E POWELL, 1983; LIANG et al., 2007).

Regarding the subject of isomorphism, some researchers assert that it can have a negative impact on organizations, simply because they are involved exclusively with copies of models. Over the years, this will significantly affect their competitiveness, taking away any kind of advantage they may have in the face of competition, which may lead the organization to cease to exist (SCOTT, 1987; KONDRA and HININGS, 1998; OLIVER, 1991).

However, in an uncertain industrial environment, organizations adopt obedient, adaptive attitudes to mediate the stress caused by the environment to achieve the legitimacy of survival. In the gradual process resulting from organizational isomorphism, uncertainty decreases, which can lead to a decrease in the risk of failure of the company's objectives, allowing companies to study and accumulate knowledge and technology quickly, which can increase their own innovation capabilities (MATHEWS, 2002; HAUSMAN, 2005; SHILLER, 2005; HARGRAVE and VAN DE VEN, 2006; SALMERON and BUENO, 2006). Based on studies that demonstrate the presence of isomorphism in its various forms in the development and institutional survival, this phenomenon will be studied in the Local Productive Arrangement (APL) of Taquaral confections in Goiás.

APLs are the subject of different academic studies (CASSIOLATO and LASTRES, 2003; BRAZIL, 2010; MACHADO, 2003; AMATO NETO, 2009), in which issues such as regional economic development are raised due to the creation of these structures, as well as job and income generation analysis. These researches observe issues such as dissemination of knowledge and learning among APL member companies and their business partners, with the objective of demonstrating how these agglomerations develop and have access to new markets, starting with the supply of services and products.

According to Poletto (2009), recent reports show that local development models should be based on the concept that the basic factor for development and competitiveness of a given territory are directly supported by the capacity to act in an integrated manner, with the effort of the members of the agglomeration themselves, based on the resources available in their territory. The capacity to generate, disseminate, and use new knowledge goes beyond the individual firm, becoming continuously dependent on the interaction between firms and those with different institutions in different fields. Such a scenario makes the APLs, generators of savings in clusters of diverse productive aspects. Within this reasoning, Poletto (2009) stated that the concept of productive arrangements is related to cooperation between local actors, a situation in which they use the tacit knowledge of a given territory, creating and developing innovative techniques that enable the design of new services and products.

The development of APLs requires a series of integrated measures that provide: local autonomy, an environment of inclusion, the constitution and elevation of social capital, environmental protection, integration among the various participating actors, the process of innovation, respect for labor relations, and the reduction of social inequalities (LIMA et al. , 2013).

Lastres and Cassiolato (2003) believe that the main advantages of studies on the APLs is the fact that they represent a somewhat traditional unit of analysis, based on individual organization, sector or production chain, in which it is possible to make a relationship between the territory and its economic activities, so groups of agents and activities associated with production and innovation are focused. Such activities include spaces where learning takes place, and productive and innovative training actions and the development of tacit knowledge are conceived, besides representing levels related to the policies of access to learning and conception of training.

Therefore, this study makes a relevant contribution to the academic area. Its results expand the knowledge about the dynamics of the APLs, by studying the behavior of organizations in the face of isomorphic pressures according to the vision of institutional theory, and how this can influence the search for *exploratory and exploitative* knowledge, which can contribute to the development of this type of cluster.

II. THEORETICAL REFERENCE

In this research topic, the concepts and theoretical bases on institutional theory, organizational isomorphism, and APL will be addressed. Such concepts are essential for the development of the proposed work, since these theoretical bases are related to the objective of the research.

2.1 Institutional theory

Institutional theory originates from the acceptance and legitimacy of certain practices in organizations, which are therefore adopted to face the competitive pressures of the environment. In this sense, it predicts that organizations tend to imitate behavioral norms of other actors in the field. According to DiMaggio & Powell (1983), the concept of organizational field is very important because it is used to denominate organizations that constitute a recognized area of institutional life. That is, they produce similar services or products and have structural and connectivity equivalence. In this sense, they consider that the fields are institutionally defined or structured through a process involving four components:

a) The increase of interaction between organizations.

(b) The emergence of rapidly defined inter-institutional structures with coalition standards.

(c) Increasing the flow of information between organizations.

(d) The development of mutual knowledge among the participants in the organizations.

In this way, a line of work is generated, incorporating several organizations that seek to find market policies, social groups, practices and organizational forms, which serve as guidance and constitute a globalized organizational behavior, appropriate and legitimate within the field. It is difficult to carry out a process of change from this perspective because the objectives may be changed or new practices may be developed, but in the long run the organizational actors build an environment of homogeneity that limits their ability to change. From this perspective, the organizations would not respond to their own environment, but to the organization's environment responses (CARDONA et al. , 2020).

Institutional theory has proven to be a powerful and popular explanatory tool for analyzing organizational change and behavior. While classic approaches emphasize the idea that organizations are dominated by the role of individuals, rational actors and their personal preferences and interests, the new institutionalism places great emphasis on the formative role of institutions. The central postulate is that organizational actors always pursue their interests within certain institutional constraints (GREENWOOD et al. 2008). From this point of view, the patterns of organizational actions are shaped more by institutional forces, such as cultural itineraries and norms, than by instrumental calculations (DIMAGGIO and POWELL 1983; MEYER and ROWAN, 1977).

Organizations are considered to be deeply rooted in social environments, suggesting that organizational procedures and structures are often a reflection of environmental expectations. Subsequently, the institutional theory assumes that organizations try to react to the demands of their institutional environment to gain legitimacy (MEYER and ROWAN, 1977).

Based on these studies, institutional theory has institutionalism at its center, which seeks the motivational explanation of organizations, incorporates practices and procedures defined by the concepts that predominate in the organizational environment and are institutionalized in society.

For institutional theory, companies are not only profit-seeking entities, but they also recognize the importance of achieving social legitimacy. Such legitimacy can be understood as the widespread perception or assumption that the actions of an entity are appropriate within some socially constructed system of norms, values, beliefs, and definitions (SUCHMAN, 1995).

Institutions can be understood as regulatory, normative, and cultural cognitive elements that, grouped with activities and resources, provide stability and meaning to social life (SCOTT, 2008; LI; CAI, 2014).

For Scott (2008), institutions can be detailed through a series of conceptions, in which

(i) institutions are social structures that have achieved a high degree of recomposition;
(ii) institutions are combinations of cognitive-cultural, normative and regulatory elements, which are related to activities and resources, providing stability and meaning to social life;
(iii) institutions are conducted by various types of carriers, including symbolic system, relational system, routines, and artifacts;
(iv) institutions operate at various levels of jurisdiction, from the global system for localized interpersonal relations; and
(v) institutions by definition relate to stability, but are subject to the process of change, whether incremental or discontinuous.

Institutions regulate economic activities, defining the rules of the game as the basis for production, exchange, and distribution. Thus, it is essential that companies follow

the established rules, norms and belief systems to gain legitimacy and mobilize their political, social, and economic resources to adapt to specific institutional environments. This further helps strengthen the company's performance and its acceptance before *stakeholders*. Thus, a process of institutionalization is necessary for the success of such adaptation (YANG; SU, 2014).

Institutional theory shows that institutionalization places the organization as a culture, in which there is a system of shared meaning among the members. When this entity achieves institutional permanence, acceptable modes of behavior become legitimate and accepted by its participants, and effigies of institutional isomorphism are visualized (QUINELLO, 2007).

Institutional theory seeks to explain the motivators of certain behavioral conducts and processes of behavior change on the part of organizations, which strengthens its applicability in the study of organizations (ALVARENGA and RODRIGUEZ, 2017).

Zhang and Hu (2017) proposed that according to institutional theory, an institutional environment has the power to make organizations within it perceive similar rules, norms, and cognitive and cultural pressures, allowing them to act in a similar manner to gain recognition and approval, and thus, increase their legitimacy. In turn, they can receive the support and resources, and homogeneity is gradually formed.

Companies operating in the same segment that are in the same area of operation and face similar circumstances, try to change their state of resource occupation for survival. To compete, small companies tend to imitate larger ones, new companies learn from old companies, and cluster companies share technical and professional innovations. Therefore, to gain legitimacy and survive in a cluster, companies gradually become isomorphic through coercive, mimetic, and regulatory institutional mechanisms. In conclusion, it can be said that isomorphism is a process of strategic choice necessary for cluster companies (ZHANG and HU, 2017).

Institutional theory studies the different types of pressure that institutions suffer, be it economic, social or political, and the effects of these pressures on management practices. As per Oliver (1991), the influence of institutional theory on organizational behavior is mainly characterized by the restriction and rationality that organizations show in relation to the pressures they receive from the outside world, as well as the external demands to which the organizations' need to respond. Obviously such a theory unfolds in its specific components—coercive pressure, normative pressure, and mimetic pressure—a conjuncture that can serve as an important driver of firm supply chain management practices, as any company must face institutional factors in its management practices (ZENG et al., 2016).

To meet the requirements of regulators, consumers, and the public, an increasing number of companies have integrated products and services for consumers (HOEJMOSE et al., 2012; VEZZOLI et al., 2012). Government policies, laws, and regulations can have positive impacts on the productive chains of agglomerate companies (LINTON et al., 2007; ZHU et al., 2005). In addition, policy documents issued by non-governmental organizations such as trade unions, trade associations, club of legal executives, etc., may also encourage companies to adapt institutionally to the pressures they face (AHI and SEARCY, 2013; PHAN and BAIRD, 2015). Studies by Gualandris et al. (2014) and Dubey et al. (2015) also show that institutional pressure is an important factor shaping business management strategy in Italy, India, and other regions.

2.2 Organizational isomorphism

Organizations exist and operate in an environment undergoing institutional changes due to the adoption of new laws, the emergence of new norms or rules, and the development of new practices and designs (MENKES and ALUCHNA, 2018). Institutional change at the macro level requires a series of changes and adaptations at the micro-organizational level (AOKI, 2007). The patterns of the organization's response to institutional change are extensively studied by institutional theory (DIMAGGIO and POWELL, 1983; MEYER and ROWAN, 1977; MIZRUCHI and FEIN, 1999) explaining how elements of organizations, including structures, practices, and professions, are created and disseminated in society (GREVE, 2003). The theory states that the institutional environment can strongly influence the development of these elements, often more deeply than market pressures (MEYER and ROWAN, 1977).

The reason for this is the fact that organizations are striving for legitimacy with their constituents, which is considered crucial for their continuity by providing access to environmental resources (DEEPHOUSE, 1996; MIZRUCHI and FEIN, 1999). This approach corresponds to the proposal of legitimacy by Aprile and Magnaghi (2012), which emphasize the "social contract" between a company and society.

Faced with this, it is not competition or an objective requirement of efficiency, but the search for legitimacy of organizations, which leads the company to adopt practices and structures in line with socially prescribed dictates on how the organization should act to achieve its objectives (MIZRUCHI and FEIN, 1999).

The response of organizations to institutional pressures and the experience of interactions with their peers lead to isomorphism, which means that companies become similar following the same management practice (DIMAGGIO and POWELL, 1983).

Organizational isomorphism is a coercive process that forces an organization in a given population to resemble other units facing the same set of environmental conditions (DIMAGGIO and POWELL, 1983). Many scholars have discussed this phenomenon previously (MESSNER et al., 2008; CAROLAN, 2008; DIMAGGIO and POWELL, 1983; SCOTT, 1987; FUENTES, 2014; (MENKES and ALUCHNA, 2018).

According to institutional theory, isomorphism among organizations is beneficial, not as a primary means of increasing competitiveness or increasing operational efficiency, but as a legitimate form of survival by consolidating opportunities to survive in a hostile and also, unknown environment (SCOTT, 1987; XINXIAN, 2000).

When investigating cluster isomorphism from a network perspective, Tan et al. (2013) did a study in which they proposed to go beyond the classification given to institutional and competitive isomorphism by some scholars (DIMAGGIO and POWELL, 1983; FENNELL, 1980; MEYER, 1979). In this path, institutional isomorphism is considered to be that which arises from the movement of institutional forces (DIMAGGIO and POWELL, 1983; SCOTT, 1995) and competitive isomorphism is imitation under competitive pressures (HANNAN and FREEMAN, 1977; PORTER, 1990). In this context, the study conducted on Xindu furniture cluster, located in Sichuan Province, Southwest China, examined both institutional and competitive isomorphism simultaneously, because the cluster represents an institutional context mixed with characteristics of market competition, a fact that occurs due to the economic reforms that have occurred in China, where the government institutionally influences the companies in the cluster (TAN, 2006).

Krause et al. (2019) disclosed that institutional theorists have long recognized that relationship situations serve as sources of information, which in times of uncertainty can facilitate mimetic isomorphism. In contrast, the capacity of coercive isomorphism comes as a response to direct coercion rather than uncertainty, to propagate through those frames of relationships that remain unknown.

Zang and Hu (2017) asserted that there is no clear consensus on the relationship between organizational isomorphism and innovation performance of companies, opening space for further studies on the subject. A study that considered Chinese cluster companies as a research object the detailed influence of organizational isomorphism on their innovation performance, as well as the search for knowledge intermediates this influence.

2.2.1 Coercive isomorphism

This refers to the influence exerted by norms, laws, and government agencies on organizations (DIMAGGIO; POWELL, 1983; KILBOURNE; BECKMANN, THELEN, 2002; ZHU et al. , 2010). The pressures that are mainly linked to issues of political influence and legitimacy problems arise from the results of formal or informal pressures. (QUINELLO, 2007). Hence these pressures are powerful inducers for the inclusion of management practices in organizations. Government demands are everyday examples that influence the actions of an organization's practices (RIVERA, 2004).

2.2.2 Mimetic isomorphism

They occur when an organization imitates the actions of successful competitors in the market by creating a benchmark for organizational practices (AERTS; CORMIER; MAGNAN, 2006; DIMAGGIO; POWELL, 1983; ZHU et al. , 2010). Thus, mimetic pressures are mainly linked to the patterns of certain social groups as a response to environmental uncertainties and often represent a powerful force in the imitation process (QUINELLO, 2007).

2.2.3 Normative isomorphism

They are usually exercised by the parties interested in the organization, whether internal or external, aiming at full efficiency and professionalization (DIMAGGIO; POWELL, 1983; ZHU et al., 2010). Basically originating from professionalization owing to normative pressures, normative isomorphism arises from a collective effort of members of a given occupation to define methods and conditions for their work, in which they establish and create controls on cognitive bases and legitimate for their occupational autonomies (QUINELLO, 2007).

2.3 Organizational isomorphism and institutional pressures

Organizational isomorphism is the phenomenon of effective conduction of organizations to the process of institutionalization. Such a phenomenon is directed to a homogeneous character of the use of practices, processes, and management by organizations (DIMAGGIO; POWELL, 1983; POLLACH; 2015). According to these researchers, there are three mechanisms that exert pressure on organizations and promote this isomorphic conduction: normative, coercive, and mimetic.

In this context, it is reinforced that normative pressures are usually exercised by internal and external stakeholders who have an interest in the organization, in

which full efficiency and professionalism are sought (DIMAGGIO; POWELL, 1983; ZHU et al., 2010).

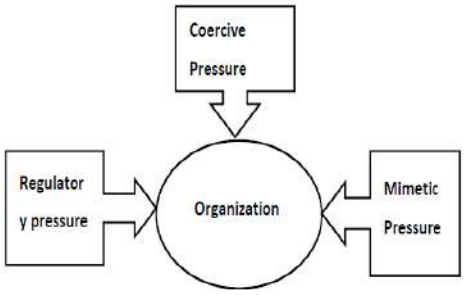
For Ball and Craig (2010), normative pressure is an important inductor for industries to adopt environmentally responsible behaviors, and there is also the fact that institutional research is necessary for the understanding of new social rules, such as ethical values and ecological thinking.

The aspects such as formal and legitimate education and the elaboration of professional networks that dictate new management models as in the areas of logistics, information technology, quality, and environment are included in normative pressure(QUINELLO, 2007). It is worth noting that normative pressures also arise from values and standards of conduct promoted by industrial associations and academic institutions (RIVERA, 2004; TATE; ELLRAM; DOOLEY, 2011).

Under these conditions, a company may develop practices if it wants to be recognized as legitimate and professional in dealing with its responsibilities (BERRONE et al., 2010; KETCHEN & GIUNIPERO, 2004). This, in turn, implies that the organization will engage, for example, in environmental practices, such as Green Supply Chain Management, where it is driven by industry associations, competitive pressures, and the need for legitimacy (KETCHEN & GIUNIPERO, 2004).

In coercive pressures occur the influence exerted by norms, laws, and government agencies (DIMAGGIO; POWELL, 1983; KILBOURNE; BECKMANN; THELEN, 2002; ZHU et al. , 2010). Such pressures are a powerful driver for the inclusion of management practices in organizations. Government demands are everyday examples that can influence an organization's actions on its practices (RIVERA, 2004).

Mimetic pressures occur when an organization imitates the actions of successful competitors in the market by creating a benchmark of organizational practices (AERTS; CORMIER; MAGNAN, 2002; DIMAGGIO; POWELL, 1983; ZHU et al., 2010). When companies are confronted with a new technology, and even in the absence of previous experience in this area, such organizations tend to act in a similar way to others in order to be successful in this aspect (HENISZ; DELIOS, 2001). Thus, Figure 01 presents the model of the isomorphic pressures suffered by organizations.



Source: Adapted from DiMaggio and Powell (1983).

2.4 Local Productive Arrangement - APL

According to Cassiolato and Lastres (2003), productive arrangements are agglomerations in which interdependence, articulation, and consistent bonds result in interaction, cooperation, and learning, with the potential to generate increased endogenous innovative capacity, competitiveness and local development. Cunha (2008) pointed out that foreign literature does not conceptualize APL. This terminology was thus named by the researchers of the Research Network on Local Productive and Innovative Systems and Arrangements (REDESIST), and there is no specific translation or conceptualization in other countries.

Cassiolato and Lastres (2003, p. 27), define APL as follows:

Territorial agglomerations of economic, political, and social agents—focusing on a specific set of economic activities—that have even incipient links. They usually involve the participation and interaction of companies and their various forms of representation and association. They also include public and private institutions focused on the formation and training of human resources; research, development and engineering; politics, promotion and financing.

From this perspective, Brasil (2010) states that when studying APL, it is necessary to consider actors, activities, and regions that are generally excluded from the policy agenda. This can help overcome specific and unisectoral policies, following the understanding that productive and innovative development depends on the articulation between actors of a given productive chain and other economic, political, and social actors that are part of different systems and arrangements, including those responsible for knowledge production, financing and support.

Cassiolato and Lastres (2003) opined that in APL's approach, the focus of the analysis is on the relationship between companies, and between companies and the institutions, and not on the individual actions of

the company. In other words, it is suggested that the focus should be on all agents and not one alone.

Amato Neto (2009) highlighted the fact that externalities can benefit the companies that make up APL, taking into account their geographic location, infrastructure, road network, labor, easily accessible raw material and good location to consumer markets, factors that decrease costs, increase profitability, and provide greater competitiveness.

In such agglomerations, interaction between competition and cooperation can also be observed, and this coexistence is possible because it occurs between different actors and in different dimensions, allied to the fact that competition between the companies that make up an industrial agglomeration is fundamental for the development of APL. Moreover, this competition can lead to the search for external markets, increased productivity and the search for innovations (PORTER, 1998).

III. METHODS

Aligned with the theoretical bases of the research, the methodological path chosen in this work characterizes the steps taken to achieve the proposed objectives, brings more information about the research environment, and the process of delimiting the *corpus* for the analysis of observed data.

3.1 Characterization and type of survey

This research can be characterized as exploratory and descriptive, since it seeks to provide familiarity with the problem, enhancing the knowledge of the researcher in relation to it, serving as a starting point for future studies (COLLIS; HUSSEY, 2005), establishes relationships between the variables (GIL, 2010), and enables the researcher to maximize his knowledge about a given phenomenon or problem (TRIVINÖS, 1990).

The research strategy used in this study was the mixed design, in which the researcher collects and analyzes the data, integrates the findings and extracts inferences using quantitative and qualitative methods in a single study or research problem (CRESWELL; TASHAKKORI, 2007).

Among the advantages of using mixed methods is the ability to provide more evidence about the study of a research problem, helping to answer questions that cannot be answered by one approach alone (quantitative or qualitative); thus, providing a link between quantitative and qualitative approaches enabling the adoption of multiple world views.

3.2 Population and Sample

This study is based on the population of clothing companies belonging to APL Taquaral in Goiás. The sample was selected for the following reasons: the apparel companies present characteristics of organizational isomorphism, the apparel companies of this APL belong to endogenous industrial clusters, where the scale of most companies is the same with a small degree of product differentiation, and the degree of homogeneity quite evident (ZACARELLI ET AL, 2008).

As it was a relatively small geographical region with companies grouped together, the survey was expected to include the entire population or as large a number as possible. However, it was not possible to survey the entire population i.e., 144 companies, instead, 109 companies were surveyed, representing the sample.

The survey was conducted in two stages: the first classified as a *survey*, using the scale created by Zhang & Hu (2017). With this procedure, direct questioning was sought with the companies that make up APL. The second stage consisted of a qualitative survey, in which APL managers and entrepreneurs were interviewed.

IV. RESULTS AND DISCUSSIONS

The results were achieved with the treatment of the data obtained through the application of the questionnaire; the semi-structured interviews were analyzed and discussed, as detailed in the methodological path followed in this research and explained previously in this work.

4.1 Results and Discussion of the Basic Descriptive Analysis

Descriptive statistical tests were carried out to check preliminary information on the results.

The average age of the companies was 7.8 years, with companies between the ages of 1 and 5 making up 41.3% of the total; between 6 and 10 years, 30.3%; and more than 11 years, 28.4%. The oldest company was 36 years old, which coincides with the end of the 1980s, the time mark of the first clothing companies in the city. The average value of the capital stock of the companies was R$ 22.900,00, a low value due to the large number of Individual Micro Entrepreneurs (MEI) that exists in the city. These companies employ 564 people, distributed as follows: 1 to 5 employees correspond to 26.6% of the total; 6 to 20, 41.3%; and more than 11, 32.1%. The company that employs the most has 28 employees, which by local standards is a major employer.

4.1.1 Results Questionnaire

In Table 1, questions 01 to 03 represent coercive isomorphism; questions 04 to 06, normative isomorphism;

questions 07 to 09, mimetic isomorphism; questions 10 to 13, *exploratory* knowledge and 14 to 17, *exploratory knowledge;* 18 to 21, innovative performance; and 22 to 24 business environment. The descriptive statistics are also presented.

Table 1: Descriptive statistics

Questions	Average	Median	Fashion	Standard deviation
Question 01	3,92	4,00	6	1,939
Question 02	3,37	3,00	1	1,869
Question 03	4,28	4,00	4	1,738
Coercive Isomorphism	**3,86**	**4,00**	**4**	**1,520**
Question 04	4,56	5,00	6	1,675
Question 05	5,72	6,00	7	1,508
Question 06	5,55	6,00	7	1,613
Normative Isomorphism	**5,28**	**5,33**	**5**	**1,263**
Question 07	4,98	5,00	6	1,622
Question 08	4,21	5,00	5	1,896
Question 09	4,95	5,00	6	1,601
Mimetic Isomorphism	**4,72**	**5,00**	**6**	**1,374**
Question 10	4,69	5,00	5	1,736
Question 11	4,48	4,00	3	1,730
Question 12	4,67	5,00	5	1,673
Question 13	5,15	6,00	7	1,779
Exploratory Knowledge	**4,75**	**4,75**	**5**	**1,396**
Question 14	4,56	5,00	5	1,713
Question 15	4,63	5,00	4	1,665
Question 16	5,05	5,00	6	1,524
Question 17	4,90	5,00	6	1,699
Exploitative Knowledge	**4,78**	**5,00**	**6**	**1,405**
Question 18	4,28	5,00	5	1,621
Question 19	4,40	5,00	5	1,522
Question 20	4,48	5,00	5	1,501
Question 21	4,42	4,00	4	1,499
Innovative Performance	**4,39**	**4,50**	**4**	**1,312**
Question 22	4,92	5	6	1,727
Question 23	5,16	6,00	6	1,617
Question 24	5,62	6,00	7	1,353
Question 25	4,83	5,00	5	1,533
Business Environment	**5,13**	**5,25**	**6**	**1,242**

Source: Elaborated by the author

4.2 Analysis of Results and Discussion of Interviews

Seven entrepreneurs from the city of Taquaral were interviewed, with the intention of checking the consistency of the data presented in the questionnaire with the answers of the interviews. To detect how the coercive isomorphism, normative isomorphism, mimetic isomorphism, exert pressure in the search for *exploratory* knowledge and *exploitative knowledge* in APL, the interviewees were presented a brief explanation of the constructs evaluated, so that they could understand the terminologies used. It was informed that the answers are in italics and the parts considered most important are in bold.

The interviews aimed to seek sources that may indicate the presence or origin of organizational isomorphism and the search for knowledge in APL Taquaral, as seen in table 2, considering the main terms of the questionnaires of organizational isomorphism and search for knowledge. To facilitate understanding within each table, there are question numbers that represent the variable, applied in the questionnaire. The results indicated that the Government, Brazilian Micro and Small Business Support Service (SEBRAE), customers, suppliers, and local companies in a certain way pressure and influence the search for knowledge, affecting the innovative performance of companies. But what is more relevant is the way in which the Internet, through social networks (Instagram, Facebook, WhatsApp groups, and YouTube), plays a prominent role in the access to news in the clothing industry, which is apparently due to the ease the companies have in accessing such information through these media that do not have filters. This context is also combined with the fact that practically all of them have some kind of access to these networks.

The mimetic isomorphism was perceived in the interviews as the most relevant, given the high degree of imitation perceived among companies, ranging from models, trends, materials, etc. It seems that this generalized imitation occurs mainly in the production process of pieces, because it is easier and simpler to copy, not depending so much on access to new technologies and/or greater financial disbursement, which may indicate innovation in the case of new companies (NIOSI, 2012; MACEDO and BATAGLIA, 2012; CAULKINS et al., 2007; LEÃES, 2008).

The normative isomorphism is presented by the interest of entrepreneurs in professionalizing themselves, demonstrating interest in partnerships with universities and research institutes for the educational and professional formation of entrepreneurs; thus, seeking professional efficiency (DIMAGGIO; POWELL, 1983; ZHU et al., 2010). It was expected that there would be signs of cooperation among firms (ZACARELLI et al, 2008), but no organized cooperation among firms was seen.

The coercive isomorphism shows that government and clients exert pressure on companies as confirmed by the literature (DIMAGGIO; POWELL, 1983; KILBOURNE; BECKMANN, THELEN, 2002; ZHU et al., 2010). In some cases, the interviewees claimed that they do not have governmental benefits, we consider that this thought occurs because the pole is considered an APL, but the governmental demands are examples of what can influence the actions of an organization and its practices (RIVERA, 2004).

For *exploratory* knowledge, the interviews demonstrated very little capacity of the companies to generate innovative solutions or ideas owing to the fact that APL is composed mainly of micro companies. About 90% of the companies fall into this type, and the fact that on an average the initial capital stock is R$ 20,000.00, these companies will hardly be able to invest in R&D that

would be the source of *exploratory* knowledge. The low level of investments in R&D and marketing, which is the characteristic of Small and Micro Enterprises (SMEs), causes inability to radically develop a product, realize complex innovations and customized products (KACHBA AND KAZUO, 2013).

With regard to *exploitative* knowledge, it has been demonstrated that companies obtain this knowledge through social networks to ensure future operation (MCDONALD and WESTPHAL, 2003). However, this knowledge acquisition does not occur because of the degree of relationship of the companies, between themselves and or with customers and/or suppliers, but because of their similarities (BROWN and EISENHARDT, 1997).

Table 2: Results indicated in the interviews pointing out the sources that provide evidence for the existence of the constructs

Company	Coercive Isomorphism	Normative Isomorphism	Mimetic Isomorphism	Exploratory Knowledge	Exploitative Knowledge
Company 1, 4 employees, 11 years of operation (ME)	1. Government (tax benefits, events. It does not see norms, 2. Local companies (those that want to impose themselves) and 3. Customers require models	4. Little training of entrepreneurs. SEBRAE training courses, 5. companies universities 6. internship students UFG Universities (COTEC, UFG, UFG)	7. Before local companies, but now Instagram, customers. INTERNET (social networks) 8. through social networks mainly 9. specifically models and trends	10, 11, 12. Little technology, but those that come by these means: COTEC, SEBRAE, INTERNET (social networks), customers and suppliers	13. Doesn't understand new technologies only models and fabrics 14, 15. Main channels are INTERNET (social networks), customers (for bringing the models and materials they want).
Company 2, 05 employees, 03 years of operation (ME)	1. Government (few benefits and regulation), 2. (no) local businesses and customers 3. (models)	4. No, 5, 6. partnerships with SEBRAE, Universities (COTEC, UEG, UFG)	7, 8, 9. Imitations by local companies, through employees, customers, INTERNET (social networks	10. Yes, but cannot deploy, 11, 12. Suppliers, INTERNET (social networks)	13. yes, through observation of local companies (models and trends), 14, 15. INTERNET (social networks), suppliers
Company 3, 08 employees, 11 years of operation (EPP)	1. Government (credit lines, regulation), 2. local companies (price interference, wages) 3. customers (take suggestions)	4. No (little experience, different training) 5. 6. yes (has interest)	7, 8, 9. Yes, through local companies, customer employees, INTERNET (social networks)	10. No, 11, 12 vendors and social networks.	13. Yes, 14, 15. suppliers, customers, SEBRAE local companies (shop windows and social networks).
Company 4, 07 employees, 15 to operating (ME)	1. Government (does not offer anything only charges) ,2. restrictions (prices, materials) 3. customers (suggestions)	4. No (little experience/know ledge) 5, 6. No (no longer interested)	7, 8, 9. Local companies, employees, customers, INTERNET (social networks), mainly modeling	10 not (precise, but does not recognize) 11, 12. Imitating colleagues, social networks (Instagram) suppliers	13. Yes, through local companies, 14, 15. INTERNET (social networks), suppliers, customers, closest colleagues.
Company 5, 09 employees, 12 years of operation (EPP)	1. Government (public policies, credit lines, tax incentives and regulation) 2. Yes, by local companies (prices, materials), 3. customers (larger, require materials, models)	4. No (persons with various training) 5, 6. Yes (Universities , UEG, UFG)	7, 8, 9. Yes (material, model, color, trends) Local companies INTERNET (social networks)	10. Yes (but cannot use) 11, 12. Suppliers, local companies, customers	13. Yes (cannot replicate production process) 14, 15. INTERNET (social networks. WhatsApp). SEBRAE
Company 6, 12 employees, 07 years of operation (ME)	1. Government (regulation) 2. No, 3. Supplier (condition to acquire materials) customer	4. Little similarity (more or less equal) 5, 6. No (already has a way of working)	7, 8, 9. Yes, local companies, customers (models)	10, 11, 12 . No (intends to achieve, has no contacts or representatives for this).	13. Yes, partially (modeling yes, machines and equipment . no) 14, 15. Clients, INTERNET (social networks . Instagram, WhatsApp)
Company 7, 12 employees, 33 years of operation (EPP)	1. Government (regulation), 2. local companies (price) 3. customers, suppliers (requirements)	4. Yes (they have the same education, professional no) 5, 6 . Yes (for the need of more technology) universities	7, 8, 9. Local companies (model imitation)	10. Yes (identifies, but cannot implement) 11, 12. INTERNET (social networks. Instagram)	13. Yes (through imitation, of the companies that are ahead), 14, 15. Local companies, INTERNET (social networks. Instagram, Facebook and WhatsApp groups), vendors

Source: Prepared by the author.

Based on the results of the interviews, Table 3 was prepared, which visualizes the intensity of the isomorphic pressure and the search for knowledge at APL Taquaral. This indicates the low capacity of companies to recognize and utilize *exploratory and exploitative knowledge*, apparently due to the technical inability to obtain new knowledge and implement it in addition to the financial restrictions. As already mentioned, they are micro and small companies that do not have the capacity to invest in R&D or even in the modernization of production processes, while the organizational isomorphism stands out, leading to believe that imitation in creation and manufacturing is the main tool that companies need to employ to maintain themselves.

Table 3: Results indicated in the interviews regarding the intensity with which the organizational isomorphism of the search for knowledge occurs

Company	Coercive Isomorphism	Normative Isomorphism	Mimetic Isomorphism	Exploratory Knowledge	Exploitative Knowledge
Company 1, 4 employees, 11 years of operation (ME)					
Company 2, 05 employees, 03 years of operation (ME)					
Company 3, 08 employees, 11 years of operation (EPP)					
Company 4, 07 employees, 15 to operating (ME)					
Company 5, 09 employees, 12 years of operation (EPP)					
Company 6, 12 employees, 07 years of operation (ME)					
Company 7, 12 employees, 33 years of operation (EPP)					

Legend:
Higher intensity
Medium intensity
Lower intensity

Source: Prepared by the author.

4.3 Results and discussion of the joint analysis of survey *and interviews*

After the interviews it was verified that the analyzed constructs appear, in a certain way with an incipient indication, which suggests that the companies practice organizational isomorphism (coercitive, normative, and mimetic), *exploratory* knowledge search and *exploitative* knowledge search in a very timid way. The existence of mimetic pressure emerged in a very definite way in the interviews, which confirms research data (HENISZ; DELIOS, 2001) as companies end up following the most successful ones. As for normative pressure, it appears as the most significant form with an accumulated average of 5.29—the highest among the evaluated constructions, which may represent a search for efficiency and professionalization on the part of companies in their ambition to obtain the results of those that are successful. Moreover, the fact that entrepreneurs do not have similar professional and school qualifications corroborates this result, since they seek business and management efficiency that come through qualification (DIMAGGIO; POWELL, 1983; ZHU et al., 2010).

Thus, the interviews confirmed what was apparent in the questionnaire responses: the existence of organizational isomorphism in its three models due to the rapidity of changes in this market, this in a certain way

decreases uncertainties and may reduce the risk of failure (ZHANG and HU, 2017).

It was quite explicit how much the companies imitate themselves in the production of their models, a situation facilitated by technology (the Internet). When comparing the results presented in the questionnaire and the interviews, the information obtained is similar, especially in the poor capacity to seek knowledge and apply it even with the isomorphic pressure, due to technical-operational disability or financial limitations. This may lead to the failure of many companies in the future (LEONARD BARTON, 1992; LEVINTHAL and MARCH, 1993).

This happens because of the visible inability of companies to work in a cooperative or associated manner. The unstructured nature of relationships between APL actors (companies, educational and research institutions, and government agencies) creates a culture that does not present support for effective and efficient processes of code design and product development (CARBONARA, 2005), a situation that was perceived while comparing data from the interviews with the results of the questionnaire.

4.3.1 Outcome and General Objective Discussion

Considering the general objective of identifying and verifying the occurrence of organizational isomorphism and the search for innovative knowledge in APL Taquaral Goiás, and identifying its influence on the innovative performance of the arrangement, the findings are as below.

Taking into account the results from the questionnaire and the interviews, it was observed that organizational isomorphism occurs in APL Taquaral. From the questionnaire responses, the existence of the three types of isomorphism was evident, with 66.72% of responses leading to this understanding, which confirms the findings of other studies (MESSNER, et al, 2008; CAROLAN, 2008; DIMAGGIO and POWELL, 1983; SCOTT, 1987; FUENTES, 2014; MENKES and ALUCHNA, 2018). The emphasis was on the normative isomorphism, with 75.5% of responses indicating this practice, aiming at efficiency and professionalization (DIMAGGIO; POWELL, 1983; ZHU et al., 2010). The interviews also confirmed this, but with emphasis on mimetic isomorphism, in view of the indication of the high degree of imitation among companies, corroborating studies by other authors (HENISZ; DELIOS, 2001; QUINELLO, 2007).

The search for knowledge was characterized as existing in the questionnaire responses (68.14%), indicating the presence of the search for exploratory and exploitative knowledge. Even though the companies could identify innovative knowledge, they do not have the capacity to implement it, due to a certain technical and operational incapacity, in addition to the financial restrictions.

When analyzed separately, it can be seen that there is practically no exploratory knowledge search, as SMEs do not have the capacity to invest in innovation specifically R&D which would generate exploratory knowledge (KACHBA AND KAZUO, 2013).

What became quite visible was that APL's companies, in terms of innovation, are very attached to product imitation (modeling, colors, fabrics etc.), which confirms other studies that imitation is what leads to innovation in clothing industries (NIOSI, 2012; MACEDO and BATAGLIA, 2012; CAULKINS et al., 2007; LEÃES, 2008). It is noted that to meet the demands of consumers, it is necessary to constantly search for production quality and novelties, also to meet a market that is characterized by high adaptability and flexibility (MDIC & IEL, 2005; PINHEIRO & ARAÚJO, 2006; RÜTHSCHILLING, 2009).

These results confirm that organizational isomorphism, through the pressures it exerts, has a mediating effect on the search for knowledge (SINGH, 2005; KEE-HUNG et al., 2006). The processes of isomorphic pressure verified complement the search for knowledge at APL, which reflect on the innovative performance of companies, even if it happens incipiently.

V. CONCLUSION

Through this study carried out at APL Taquaral de Goiás, the goal of our research was achieved, which verified how organizational isomorphism occurred (coercive, normative, and mimetic) and search for knowledge (exploratory and exploitative), in light of the institutional theory.

Regarding the pressures exerted by organizational isomorphism, it can be seen that it manifests in its three forms (DIMAGGIO and POWELL, 1983.)

The presence of effective public policies that are essential in building localized competitive advantages was not perceived, even with the perception of government coercive pressure by entrepreneurs. The types of public policies aimed at promoting APLs are generally fiscal incentives—investments in urban infrastructure, and construction of public equipment (roads, airports, land concessions, paving, extension of power lines, and telephone networks, etc.), which come into foray when companies talk about government (AMATO NETO, 2009; PEREIRA; CARVALHO, 2008).

Entrepreneurs have different professional and educational backgrounds, they see the partnerships with research institutes and universities with optimism, which may show their interest in professionalization ((DIMAGGIO and

POWELL, 2005) according to the interviews. This was further confirmed through the evaluation of the questionnaire. However, these partnerships occur in a manner that some companies do not perceive, which may indicate the incipient management by APL's managers, who should plan and execute innovative strategies to help companies develop competitive products in the market where they operate or wish to operate.

When the search for knowledge was analyzed (*exploratory and exploitative*), the exploratory knowledge was evaluated with 67.71% on the ability to seek new technologies. The interviews indicate that there is no defined way to obtain new external knowledge; it occurs in an almost imperceptible way, linked to an inability to operate it. This is possibly because it is a micro and small business environment, with little or no resources to invest in R&D (KACHBA AND KAZUO, 2013). Without the capacity to obtain funding through development agencies (a situation that may also indicate the absence of public policies), the APL companies unable to seek new technologies due to the lack of technical-operational skills and means to finance innovation. This confirms the observation that was made regarding the massive imitation that occurs in the pole studied.

About 68.29% of the answers indicate the capacity of APL companies to seek and implement technologies when it comes to exploitative knowledge. As for exploratory knowledge this capacity is not perceived due to the characteristics of the companies that make up the cluster (KACHBA AND KAZUO, 2013). From the interviews, it is perceived that this information comes from the Internet and it plays a leading role, with the suppliers and close colleagues, and some buyers bringing different models. According to Zhang and Hu (2017), the use of new equipment and acquisition of new knowledge in modeling and new materials, is an acceptable practice that seeks to give legitimacy to companies owing to the fact that the cluster is relatively new. However, this practice, over time, could negatively influence APL's companies, which could lead to the inactivity of some.

It was possible to verify the existence of institutional practices and strategic actions among the organizations of the cluster that have coercive, normative, and mimetic isomorphic characteristics (ZHANG and HU, 2017). These characteristics occur individually most of the time and almost never in an integrated way. This is because it was perceived that the APL companies do not actually act with the appearance of a network, perhaps because the pole is relatively new and there is no professionalism among most companies (AMATO, 2009; ZACARELLI ET AL, 2008), However, this did not prevent the origin of a strong environmental isomorphism, especially mimetic (DIMAGGIO E POWEL, 2005), among the companies that make up APL.

Thus, it is verified that according to institutional theory, the isomorphic pressures (especially, mimetic pressure, due to the high rate of imitation) occur in a marked way in the APL studied, but this pressure does not result in appropriation of knowledge by companies. There are other factors that must be observed for this—public policies aimed at development, financial capacity, interaction with research institutes, among others.

It is recommended that new research be conducted in other APLs, clusters or poles, to verify whether what was observed in Taquaral de Goiás applies similarly or not in other poles of clothing.

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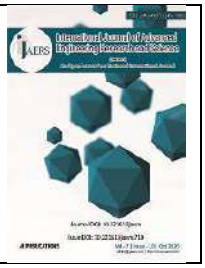

Chilling System Insulation Hatch Design Using Refrigeration For 3GT Sized Vessels

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***Keywords*— Hatch, Insulation, Refrigeration, COP.**

***Abstract*—** *A fast cooling process is needed to maintain the quality of the fish caught. In this research, the chilling system insulated hatch using refrigerant with a capacity of 80-100 kg for a 3 GT sized vessels. The insulation hatch is bolted from fiber material where the walls are cast with polyurethane material. Polyurethane consists of 2 (two) types, namely A and B, where when the two materials are mixed it will expand and form insulation. This hatch making research uses a trial and learn system. To be able to draw heat from the cooling room, the evaporator with a coil length of 30 meters is specially designed, that is, it is wrapped around the shape of the hatch and attached to the aluminum plate. The length of the capillary pipe used is 3.00 cm with a diameter of 0.26 to produce a load temperature of 2^0C - 4.4^0C. The test of the chilling system insulation using refrigerant was carried out at the cooling workshop SUPM Waiheru Ambon. The test materials used were sea water as much as 84 kg / L and whole tuna fish with a size of 28 kilograms. The design of this chilling hatch uses a 1/3 HP hermatic compressor with the factory standard Freon R134a. The condenser used is a copper tube type 19U aluminum fin. Based on the test results, the cooling component works well.*

I. INTRODUCTION

Seafood products are high perusable food which is more prone to spoilage. The high content of osmoregulatory in the form of nitrogen protein makes fishery products very susceptible to bacterial growth. In addition, the average habitat for fishery products is in cold water temperatures, so that bacterial flora will be very difficult to inhibit compared to animal and plant flora using cold temperature treatment. This condition has an impact on the decreasing selling value of fish received by fishermen.

The system of storing fish into the hold, especially on traditional fishing vessels, often does not pay attention to the value of the Stowage Rate or storage level according to good quality standards of cargo. Due to this kind of action, it can reduce the quality of the fish. (Amiruddin at.al 2013)[1]. Insulated hatches can be a solution to fish quality problems. An insulated cooler box can be used to preserve fish using low temperatures (Susanti, M. T et.al 2008)[2].

One alternative effort to increase fish handling on ships is the application of a refrigeration system on board to increase the storage capacity of fish caught by fishermen (Ahmad Fauzi, 2017)[3]. The chilling system or cooling seawater in the cooling process of fishery products has several advantages such as relatively small physical damage to fish, temperatures that can drop quickly, and being stable and evenly distributed (Ahmat Fauzi, at.al 2018)[4].

The process of absorbing heat from an airtight-closed room and then moving the heat out of the room is called the refrigeration principle. This refrigeration principle will work in a system called a cooling engine. The refrigeration system of this cooling machine is developing very rapidly. According to Dossat (1961)[5] apart from being a support

as well as for the production process and as a requirement for Air Conditioning (AC), a cooling machine can also function as a refrigerator, freezer or chiller.

The results of the research conducted (Rifki Efendi et.al, SINTEK) that the impact of refrigeration is divided by the compression work, the COP value is 4.5708. Untung B, et.al (2013)[6] tested using R22 on the design of the Sea Water Refrigerant system, the COP value was 4.5708 within 30 minutes. Refrigerant will absorb heat at lower temperature and pressure and release it at higher temperature and pressure (Wang, 2005)[7].

Research on the design of the chilling system insulation hatch using refrigerant aims to determine the effect of cooling load on the work of the cooling system. The performance of this cooling system includes refrigeration capacity, compressed power, Coofisient of Performance (COP) and the time required for cooling in the cold room. This research is expected that the chilling system insulation hatch can work properly and efficiently.

II. RESEARCH METHODS

There are two methods used in this research, namely: (a). comparative method, where the theoretical comparisons are made and the realities in the field, (b). The trial and learn method is that after the tool is made or assembled, then calculations are carried out to ensure the design results are appropriate or not. From the Trial and Learn results, the desired hatch design results will be obtained.

The tools and materials used in the manufacture of chilling hatches are fiber and mat, resin, catalyst, 5 x 3 wood, dye, polyurethane, nails, plywood, grinder, saws. Meanwhile, the tools and materials for the cooling component are 1/3 HP hermatic compressor, 19U aluminum fin copper tube condenser, Ø 0.26 capillary tube, astn pipe ¼ x 0.55 in x 15 m for evaporator, filter dryer, 0.5 aluminum plate. mm, pipe bender (tube bedding spring), pipe widen (swaging and flaring), pipe cutter (tubbing cutter), welding tool, toolkit, vacuum pump, measuring tool, freon 134a, manifold, brass welding wire, cable, MCB 10A, thermostate control and temperature measuring instrument

Insulation Hatch Design

Based on preliminary field data, the box or sterofoam box measuring 120 x 40 x 32 with ice cubes is still the main choice for traditional tuna fishermen. The weakness of using this sterofoam box is that fishermen cannot regulate the temperature so that before arriving at the auction site, the quality has deteriorated. The tools and materials for making the insulation hold consist of fiber mat, resin, catalyst, dye, 3 mm multiples, wood glue, saw, drill, hammer, pliers. As for the insulation using polyurethane material.

Polyurethane is usually used in various forms. Apart from being a coating, polyurethane is also used as an adhesive because it has fiber and foam and is easily formed in a variety of components (Kim S. H et.al 2010)[8].

This research, an insulation hatch will be made using polyurethane as the insulation material. As for the size of the manufacture of this insulation hatch, namely :

Table 1. Size of the hatch

Dimension	Size
Long	100 cm
Wide	100 cm
High	80 cm
Cavity thickness	10 cm
Hatch capacity	0,384 cm^3

Table 2. Size the insulation Space

Dimension	Size
Inner length	80 cm
Outer length	100 cm
Inner width	80 cm
Outherwidtg	100 cm
Inner height	60 cm
Outher height	80 cm
Insulation thickness	10 cm

Table 3. Ukuran ruang pendingin

Dimension	Size
Long	80 cm
Wide	80 cm
High	60 cm

Hatch Assembly Proses

a. Coating or laminating the fiber glass layer after the gel coat has dried on the mold
b. Remove the hatch from the mold when it dries
c. Place the aluminum plate in the middle of the box according to the specified size, and make sure it is in the center position before casting using polyurethane

d. check gradually on the results of work if there are defects

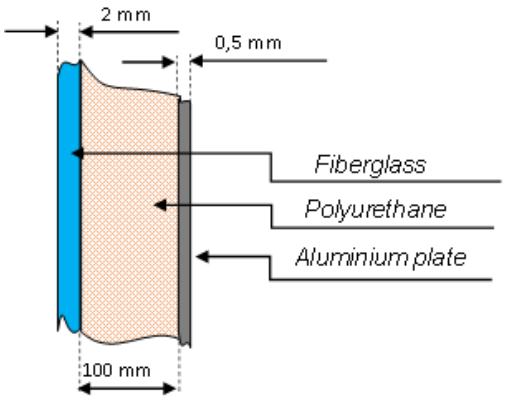

Fig. 1: Hatch material

heat load on the hold use formula :

$$Q = U \,.\, A \,.\, \Delta T \quad (1)$$

By :

Q : load wall (watt)

U : Overall heat transfer coefficient

A : Difference temperature through the walls (^{0}C)

ΔT : Outer wall area in m^2

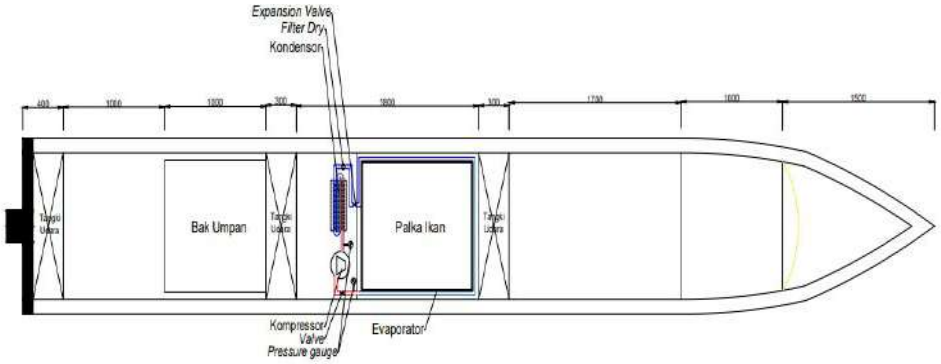

Fig. 2. Placement of insulating hatches and cooling component on vessels

To calculate load product, use formula :

$$Q_p = \frac{m \,.cp \,.\Delta t}{long\ cooling\ time} \quad (2)$$

Q$_p$: load cool of product

m : mass (kg)

cp : specific heat of material (kJ/kg)

ΔT : range of temperature (^{0}C)

To find the overall heat coefficient, use formula :

$$U = \frac{1}{\frac{1}{f1}+\frac{X1}{K1}+\frac{X2}{K2}+\frac{X3}{K3}+\frac{1}{f0}} \quad (3)$$

$1/f_0$ = 22,7 W (m^{2}K)

$1/f_1$ = 0,56 W (m^{2}K)

U = 0,16 W (m^{2}K)

Total heat load through the wall is 19,3 Watt

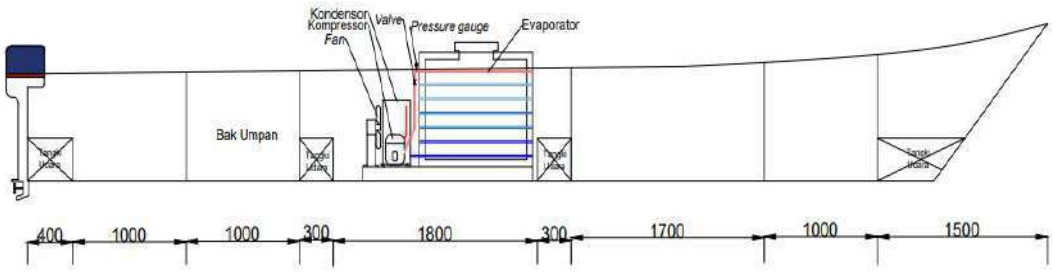

Fig. 3. Position of the hatch on the side view head

Refrigeration System

A. **Working principle of the chilling system insulation hatch**

The working principle of a cooling engine is basically the same as other cooling systems such as refrigerators, air conditioners, Frezzers, which draw heat on objects to reach the desired low temperature. The working principle of the chilling system insulation hatch is that the refrigerant is flowed to the evaporator through a capillary tube which functions to convert high pressure liquid refrigerant into low pressure liquid refrigerant by injecting it through a small hole.

Furthermore, the liquid refrigerant into the evaporator and take the heat out of saltwater, fish or air so refrigrant liquid turns into a gas. After the refrigerant has changed in the form of gas-temperature and low-pressure compressor and mengkompresikannya on to become refrigrant-temperature and high-pressure gas is then entered into a condenser and then refrigerant gas is converted into liquid, with water or air.

Refrigerated sea water in the hold space. The seawater used must be clean, which is not contaminated by toxic materials that can cause toxicity to humans. Sea water is cooled in the hold before the fish are put into the hold. The fish that have been caught are then put into the hold with the ratio of sea water to fish is 3: 1.

In this process, if the sea water mixed with fish becomes dirty, the sea water in the hold can be removed and replaced gradually with new sea water. And so on in order to maintain water quality which has an impact on the freshness of the fish itself.

B. **Cooling System Component**

Several cooling system components are used in the insulation hatch of the chilling system, among other :

- Compressor 1/3 HP,
- Aluminum fin condenser 19U,
- ASTN pipe 1/4 x 0.55 x 15,
- Capillary tube
- Filter

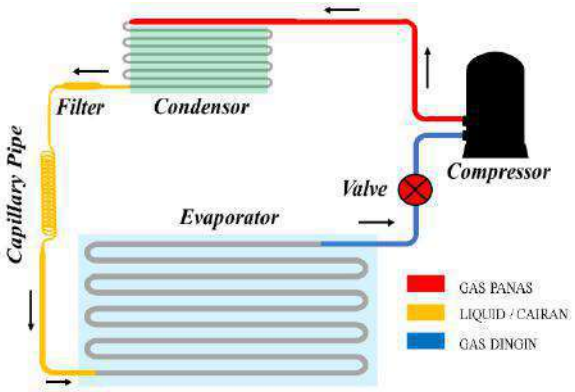

Fig. 4: Cooling system scheme

C. Basic Calculate of Compressor, Condensor and Evaporaor

- Compressor

The compression process occurs in the compressor where the refrigerant phase that enters the compressor is saturated vapor with low temperature and pressure. To calculated compression work, use formula :

$$Wk = h1-h2 \quad (4)$$

By :

Wk : compression work (kJ/kg)

h1 : enthalpy refrigerant enters the compressor (kJ/kg)

h2 : entalphy refrigerant out of compressor (kJ/kg)

- Condenser

This process occurs in the condenser, where the refrigerant temperature is higher than ambient temperature, the heat of refrigerant Anas will be released through the condenser pipe wall to the surrounding environment. Condenser disposed heat calculated, use formula :

$$Qc = h2 – h3 \quad (5)$$

By :

Qc : Heat disposed condenser (kJ/kg)

h2 : entalphy refrigerant enter the condenser (kJ/kg)

h3 : entalphy refrigerant out of condenser

- Kapiler

This process occurs in the capillary tube, where after the refrigerant releases heat in the condenser,

the liquid refrigerant will flow into the capillary tube to lower its pressure and temperature. The temperature that occurs is expected to be lower so that heat can be absorbed while in the evaporator. Because there is a process of receiving and releasing energy, the entaphy value becomes constant.

h3 = h4

- Evaporator

Process takes place in the evaporator, where the temperature of the refrigerant in the evaporator is made lower than the refrigeration room, so that the evaporation process takes heat. Heat absorbed by the evaporator is calculated use formula :

$$Q_e = h1 - h4 \quad (6)$$

By :

Qe : heat absorbed by the evaporator (kJ/kg)

h1 : entalphy refrigerant out of evaporator (kJ/kg)

h4 : entalphy refrigerant enter enterthe condenser (kJ/kg)

III. RESULT AND DISCUSSION

By using the coolpack application, the enthalpy point and pressure are determined on the p-h diagram, see *Fig. 5*.

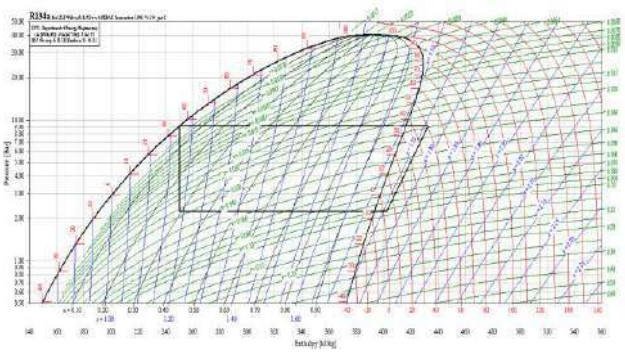

Fig. 5. P-h diagram

Enthalpy value obtained through the calculation is as follows, see *Table 4.*.

Table 4. Table of result entalphy

Point	T (^{0}C)	P (Bar)	v (m^{-3}/kg)	h (kJ/kg)	s (kJ/kg^{0}K)
1	2,800	2,238	0,093724	401,835	1,7590
2	51,354	9,371	0,023723	433,026	1,7590
3	51,354	9,371	0,023723	251,697	1,7590
4	37,00	9,371	N/A	251,697	N/A

The highest enthalpy value in the table above (h1) is 401,835 kJ/kg.

Coofisien of Performance

Calculate the value coofisien of performance used formula :

$$COP = \frac{h1-h4}{h2-h1} \; or \; \frac{Qe}{Wk} \quad (7)$$

Result of COP calculation is 4,81

Machine work efficiency

Value of the work efficiency of the machine is 80%

IV. CONCLUSION

The test results were carried out on the work of the refrigerant mass unit compressor (W) was 31.192 kJ / kg, the heat released by the condenser (Qc) was 181.329 kJ / kg and the heat that could be absorbed by the evaporator (Qe) was 150.138 kJ / kg. The COP value in the chilling system insulation hatch design using refrigerant after testing is 4.18, meaning that the COP value is included in the SNI COP Limits.

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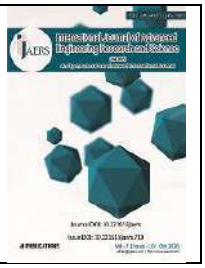

Action of *Matricaria Recutita* in the Management of Oral Mucositis in Animal Model: Systematic Literature Review

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***Keywords*— Oral Mucositis, Matricaria, Chamomile, Fluorouracil, Inflamatory citokynes.**

***Abstract*—** *Oral mucositis comprises an acute inflammatory condition frequent in cancer patients.To date, therapeutics have only alleviated the clinical aspect of lesions. Chamomile stands out as one of the most used plants in the world for medicinal purposes, as it has several beneficial characteristics. The aim of this study was to evaluate the effect of topical chamomile in the oral mucositis with clinical and/or histological parameters in an animal model. It was a systematic review, which sought articles of the "experimental study" in an animal model according to the PRISMA parameters. The databases used were PubMed, Cochrane Library, and Bireme. Crossing descriptors were selected from DeCs/MeSh with the operators AND and OR, and the ARRIVE strategy was applied. The search found 43 publications. After all the refinement steps, two articles evaluating the effects of the fluid extract of chamomile (Ad-Muc®) on chemo-induced oral mucositis were selected. The total sample included 141 female hamsters and the two studies used the same methodology to induce the lesion. The results showed that, applying chamomile in oral mucositis in hamsters was effective, both from a clinical ($p < 0.0001$) and histological parameters, with a significant reduction in pro-inflammatory cytokines ($p < 0.05$). The ARRIVE strategy, 15 recommendations were implemented out of 20 criteria in both studies.The application of topical chamomile in the treatment of chemo-induced oral mucositis in hamsters seems to be recommended due to the clinical/histopathological results demonstrated and its capability to reduce the levels of some pro-inflammatory cytokines.*

I. INTRODUCTION

Oral mucositis (OM) comprises an acute inflammatory condition frequent in cancer patients undergoing myeloablative cytotoxic chemotherapy and/or radiotherapy in the head and neck regions. Clinically, it manifests as erythematous areas, painful ulcers, pseudomembranes, edema, and hemorrhage [1,2]. Its presence directly interferes with the patient's general health, further developing severe complications, such as dysgeusia, dysphagia, opportunistic infections, in addition to increasing treatment costs, which may require the change or even interruption of antineoplastic treatment, with a direct consequence on tumor response and patient survival [3].

The mechanism of action of OM is not completely elucidated; however, it is known that inflammatory reactions arising from this condition occur due to a complex series of interactions between molecules and direct/indirect cell events that affect the epithelial and submucosal tissues of the oral mucosa [1,4]. Although the pathogenesis of OM is a dynamic process, Sonis [5,6] proposed the sequence of its biological development basing on five phases: initiation, generation of messenger signals, signaling and amplification, ulceration, and healing. The initiation phase occurs immediately after exposure to antineoplastic therapy, directly damaging the epithelial cells DNA and the underlying connective tissue, simultaneously forming reactive oxygen species (ROS). In the generation of messenger signals, a series of transcription factors are activated, especially the nuclear factor *kappa B* (NF-κB), which induces the expression of genes encoding pro-inflammatory cytokines, such as tumor necrosis factor α (TNF-α), interleukin 1ß (IL-1ß) and interleukin 6 (IL-6). In the signaling and amplification phase, these cytokines have a direct harmful effect on the cells of the oral mucosa and indirectly amplify cellular signaling. The ulcerative phase is the most important from a clinical parameter, as it comprises the phase of painful symptoms associated with loss of function. In the healing phase, ulcers heal spontaneously after the end of antineoplastic treatment, through signals from the extracellular matrix.

To date, therapeutics have alleviated the clinical aspect of lesions, reduced infections, and painful symptoms associated with OM, since no therapy is capable of preventing or completely treating this condition [7]. For this reason, the continuous search for new agents that act effectively in the management of OM has become important for the scientific community, consequently increasing studies focusing on natural agents. Natural medicine proposes that the possible therapeutic effects of herbal medicines, including analgesic, anti-inflammatory, and tissue repair actions make these products well tolerated, which has provided a progressive increase in their consumption and recommendation [8]. Chamomile, also known as *Matricaria Chamomilla L.*,*Chamomilla recutita (L.)* Rauschert, *Matricaria recutita L.*, and *Matricaria suaveolens L.*, stands out as one of the most used plants in the world for medicinal purposes, as it has several beneficial characteristics with its anti-inflammatory, antimicrobial and sedative properties [9]. Studies carried out in humans [10] and animals [4,11,12] recommend chamomile to treat several diseases in the oral cavity, including mucositis, aphthous, and traumatic ulcers.

Thus, this study aimed to carry out a systematic review on the evaluation of the effect of the use of topical chamomile in the management of OM with clinical and histological parameters in an animal model.

II. MATERIAL AND METHODS

It was a systematic literature review carried out in January to August 2020, which aimed to search for articles of the experimental study type in animal model according to the PRISMAparameters (*Preferred Reporting Items for Systematic Reviews and Meta-Analysis*), used to assist in the construction of systematic reviews and meta-analyses [13], and was registered at the PROSPERO database (CRD42020204008). The research used the *PubMed*, *Cochrane Library*, and *Bireme* databases. To maximize the evaluation and use the information presented by the studies, the ARRIVE (*Animal Research: Reporting In Vivo Experiments*) strategy was used, which is based on guiding essential information that is necessary in animal studies in order to improve researchers' communication, make the study reproducible, orderly, transparent, and accurate [14].

The relevant and specific question for this study was, "Is topical chamomile capable of preventing and/or treating oral mucositis in an animal model?" To do so, the DeCs/MeSh descriptors and free terms were crossed using the Boolean operators AND & OR. The research strategy included only terms related to chamomile, oral mucositis, radiotherapy, chemotherapy, radiotherapy, and chemotherapy, as described in Table I.

Inclusion criteria

Experimental studies in animals were included, in which OM was induced by chemotherapy, radiotherapy in the head and neck region or both, and the therapeutic approach for this condition was exclusively topical chamomile in different concentrations, without association with other therapeutic agents. As for the language, only studies in

English were selected; however, no restriction for the publication period were putted, given the scarcity of studies on this theme.

Table I: The search strategy with selected descriptors.

Mucositis	("Mucositis" OR Mucositides OR "Stomatitis" OR Stomatitides OR “Oral Mucositis” OR “Oral Mucositides” OR “Oromucositis” OR “Oromucositides”). ('mucosa inflammation' OR 'mucosa irritation' OR 'mucositis' OR 'Mucositides' OR 'Oromucositis' OR 'Oromucositides' OR 'cancrum oris’ OR ‘denture stomatitis’ OR ‘mouth epithelium inflammation’ OR ‘mouth inflammation, ulcerative’ OR ‘mouth inflammation, ulcerous’ OR ‘mouth mucosa inflammation’ OR ‘oral inflammation, ulcerative’ OR ‘stomatitis ulcerativa’ OR ‘stomatitis ulcerosa’ OR ‘stomatitis, OR ‘stomatitis, ulcerative’ OR ‘stomatitis, ulcerous’ OR ‘ulcerative mouth inflammation’ OR ‘ulcerative oral inflammation’).
Chamomile	(“Chamomile” OR “Chamomiles” OR “Chamomilla recutita” OR “Matricaria” OR “Matricaria chamomilla” OR “Marticaria recutita” OR “Matricarias” OR “Chamomillas” OR “Matricaria recutitas”). (‘Chamomille tea’ OR ‘Chamomille infusion’ OR ´Chamomiles tea’ OR ‘Wild camomille’).

Source: own authorship.

Exclusion criteria

Studies whose therapeutic approach systemic use of chamomile, and studies with human beings were excluded. Theses, dissertations were also not included, because according to the scale of scientific evidence in the Cochrane Manual for Systematic Reviews of Interventions, these modalities fit with a low level of scientific evidence [15].

Selection of articles

Articles were selected by analyzing the title, abstract, and full text, based on the previously established criteria. Two examiners (JD and GM) performed the selection independently in the previously selected databases. In case of disagreement between them, a third author would be requested, which was not necessary. Data were extracted using the inclusion and exclusion criteria and according to ethical aspects, clear methodology, and presence of results. Duplicate articles were considered only once.

Data extraction

Two examiners (JD and GM) performed the data extraction by searching for the following variables in each study: main author and collaborators, year and country of publication; study’s objective, total sample (n) and sample description, methodology, chamomile characteristics (concentration, dosage, application days), characteristics of the comparative groups (concentration, dosage, application days), evaluated parameters (clinical, histological), and main results.

III. RESULTS

The initial database search found 43 articles addressing the use of topical chamomile in OM induced in animals. After the first analysis, this number reduced to 28 articles by excluding duplicate texts. After applying the inclusion/exclusion criteria, 25 articles were removed by reading the title and abstract. Three articles were read in full, and of these, only two met the inclusion criteria after all stages of search selection and refinement according to the flowchart in Figure 1, based on the PRISMA model [13].

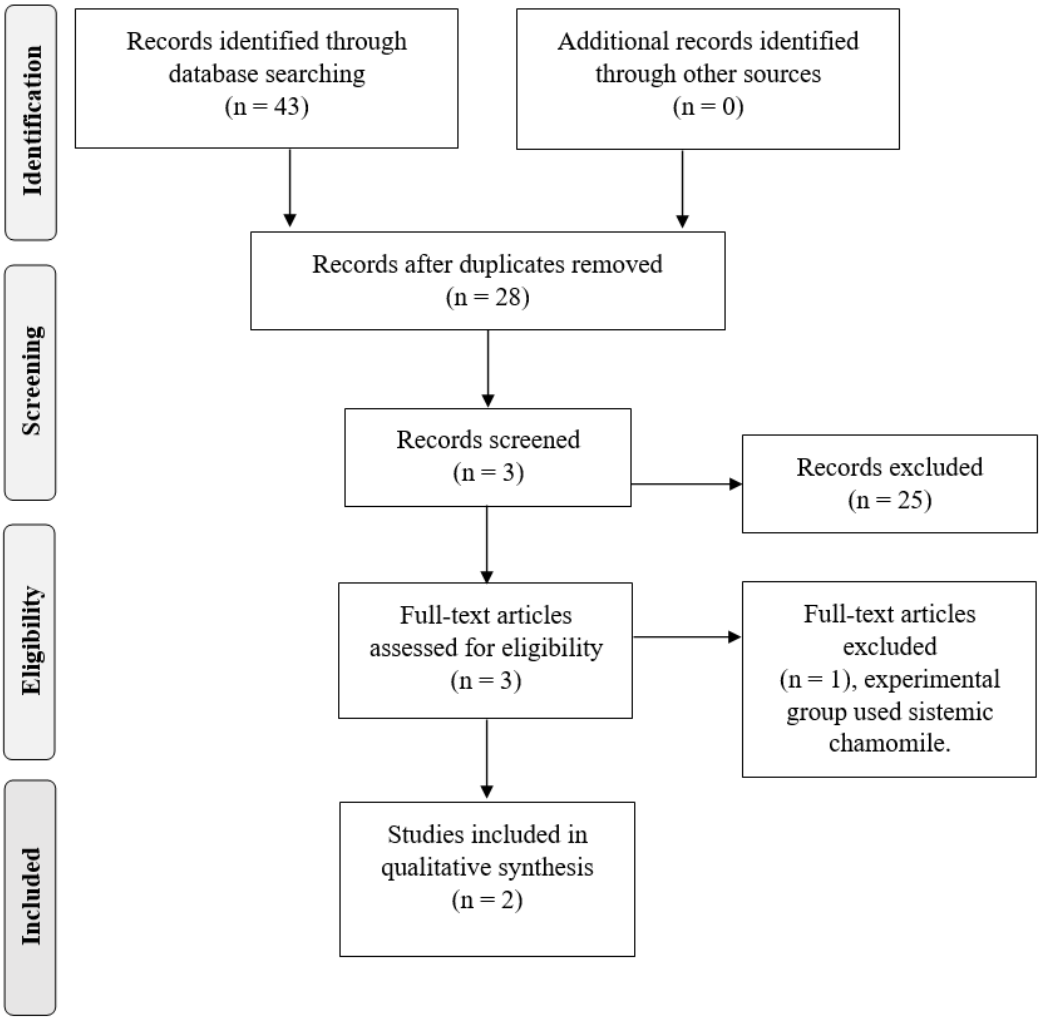

Figure 1: Flowchart of identification to selection of articles.

Two studies that compared the effects of chamomile in OM in hamsters, using clinical parameters [12] and histological [4,12], were then used to prepare this review. Pavesi *et al*. (2011) [12], evaluated clinical healing with a scoring system ranging from zero to three, proposed by Lima *et al.* (2005) [16]. Both publications performed a histological analysis; however, Pavesi *et al*. (2011) [12], using a graduation scale,evaluated the presence of inflammatory infiltrate, vasodilation, hyperemia, bleeding, ulcer, and abscess with hematoxylin & eosin and Sirius red histological staining techniques. Curra *et al.* (2013) [4], performed a qualitative and semi-quantitative analysis of pro-inflammatory cytokines IL-1β and TNF-α according to the criteria established by Grundtman *et al.* (2007) [17], with the immunohistochemical staining technique. The authors consolidated the results, as shown in Table II.

Both were carried out by the same research group. These articles used a total of 141 animals, all of which were female hamsters. Both studies used the same methodology to induce OM in animals, which was based on the administration of intraperitoneal injection of 60 mg/kg of chemotherapy 5-fluorouracil on day zero of the experiment, and on day two, an infusion of 40 mg/kg of the same antineoplastic agent. The induction of the wound in the cheek mucosa followed the same protocol for both studies, in which a sterile needle was used on days 3 and 4 after the chemotherapy administration. The application of the chamomile started on the day 5 of the experiment for the two studies. Regarding the form of presentation and use of chamomile, both studies standardized in an identical way, which included the use of the ointment with 100 mg of fluid extract of chamomile, commercially known as Ad-Muc®. The application occurred with a flexible cotton swab, twice a day (morning and night), as described in Table II [4,12].

As for the outcome of the selected studies, the application of topical chamomile in chemo-induced OM in hamsters was effective, from both a clinical [12] and histological parameters [4,12]. The study by Pavesi *et al.* (2010) [12] performed a clinical and histopathological analysis in all

four periods evaluated and the fluid extract group of chamomile (Ad-Muc®) revealed to be superior in relation to the corticosteroid group (Celestone®) and in the group without treatment (Control), with statistical significance ($p<0.0001$). In addition, in some animals of the corticoid group, bacteria can be colonized in ulcers on the 8th, 10th, 12th and 14th day of evaluation. In the study by Curra *et al*. (2013) [4], histological analysis showed that pro-inflammatory cytokines were found in all groups; however, on day 10 of the experiment, the fluid extract of chamomile had a lower score compared with the corticosteroid group, with statistical significance ($p<0.05$). Nonetheless, it showed no difference in relation to the group without treatment.

Regarding the application of the ARRIVE strategy, notably, in the two studies [4,12], 15 recommendations were implemented out of 20 previously established criteria, with little limitation in both methodologies, which makes them reproducible, transparent articles, ordered logically, well conducted and with precise objectives. Table II shows the criteria that were not considered.

Table II: General characteristics of the included studies (ICS, UFBA, 2020).

AUTHOR COUNTRY OF STUDY	PURPOSE	SAMPLE (n) AND SAMPLE DESCRIPTION	METHODS	HOW TO USE CHAMOMILE	CONTROL GROUP OR COMPARISON GROUP	EVALUATED PARAMETERS	OUTCOMES	GUIDELINE ARRIVE
Curra *et al.* [4] Brazil Experimental	To evaluate the presence and intensity of pro-inflammatory cytokines (IL-1β and TNF-α) during the development of OM after infusion with chemotherapy 5-FU.	36 adult female hamsters allocated in three groups: Group I Control (n = 12), without treatment; group II (n = 12), fluid extract of chamomile (Ad-Muc®); Group III (n = 12), corticosteroid betamethasone elixir (Celestone®).	After induction of OM in the cheek mucosa, the products were applied. Three animals per group were sacrificed on days 0, 5, 10, and 14, removing the cheek mucosa for analysis.	Topical chamomile (Ad-Muc®): for each 1g of ointment: 100 mg of fluid extract of *Chamomilla recutita (L.)*Rauschert, twice a day(morning and night).	Group I (without treatment) and Group III (corticosteroid betamethasone elixir, Celestone®— standard treatment), twice a day (morning and night).	Qualitative and semi-quantitative histological analysis were performed. In the qualitative analysis, the distribution and location of IL-1β and TNF-α protein was recorded. In the semi-quantitative analysis, the quantification of IL-1β and TNF-α was performed at the site close to the injury, based on the percentage of stained tissue, as proposed by Grundtman *et al*. (2007).	According to the qualitative analysis, the distribution and location of IL-1β and TNF-α were similar in all groups, with the diffuse distribution in the connective tissue. In adipose and epithelial tissue, the result was negative for both proteins. According to the semi-quantitative analysis, the peak of IL-1β was found on day 10 in all groups; however, in the group II, the score was significantly lower ($p<0.05$) compared with the other groups. The semi-quantitative analysis of TNF-α had peak incidence on day 5 in all groups. On day 10 of the experiment, group II was superior to group III, according to the levels of TNF-α ($p = 0.0304$). However, it did not differfrom Group I.	Total: 15/20

Pavesi *et al.* [12] Brazil Experimental	To evaluate clinically and histologically the effect of topical chamomile in 5-FU-induced OM.	105 female hamsters divided into three groups: Group I: Control (n = 35), without treatment; Group II: (n = 35), fluid extract of chamomile (Ad-Muc®); Group III: (n = 35) corticosteroid betamethasone elixir (Celestone®).	After induction of OM in the cheek mucosa, the products were applied. Three animals per group were sacrificed on days 0, 2, 5, 8, 10, 12, 14, and 16 of the experiment, removing the cheek mucosa for histological analysis.	Topical chamomile (Ad-Muc®): for each 1g of ointment: 100 mg of fluid extract of *Chamomilla recutita (L.)*Rauschert, Twice aday(morning and night).	Group I (without treatment) and Group III (corticosteroid betamethasone elixir, Celestone®-standard treatment), twice a day (morning and night).	Macroscopic analysis: erythema, hyperemia, bleeding, ulcer, and abscess. Histological parameters: inflammatory infiltrate, vasodilation, hyperemia, areas of bleeding, ulcer,and abscess. Lima *et al*. (2005) proposed the two graduation scales, with a score from 0 (absent) to 3 (severe).	Clinically and histopathologically, groups I and III had more severe OM throughout the experiment when compared with group II. On experiment days 8, 10, 12, and 14, groups I and III demonstrated severe histological changes ($p < 0.0001$) in relation to group II, with extensive areas of ulcer and bleeding, severe hyperemia and edema, and diffuse inflammatory infiltrate. Group II showed mild hyperemia and inflammatory infiltrate, in addition to the absence of ulcers.	Total: 15/20

IV. DISCUSSION

This study aimed to carry out a systematic literature review on the effectiveness of using topical chamomile in the management of OM, based on clinical and histological parameters with experimental studies in animal model. The two studies included in this review suggest that applying the fluid extract of chamomile in lesions of MO chemo-induced by 5-fluorouracil contributed to the process of tissue repair and anti-inflammatory action [4,12].

Concerning the application of Guideline ARRIVE, the two studies presented similar results, with the presence of 15 items out of 20 [4,12]. This is probably because both studies belong to the same research group. Among the unidentified items, we highlight the lack of justification for choosing the animal model and the identification of whether there was a sample calculation.

According to the methodology used for the induction of OM, the form of use and presentation of chamomile, in addition to the sample description, the two studies adopted the same criteria, which favors the analysis of the results in a more reliable way. This is because the technique and the lesion induction were the same, as well as the sample, which included female hamsters that were subdivided into three groups: negative control (without treatment), positive control (betamethasone elixir, Celestone®) and experimental with chamomile (Ad-Muc®). That is, the evaluation of the tissue repair process followed the same pattern for all selected studies, which favors their analysis.

The studies differ in the pattern of histological analysis performed to assess the presence of inflammatory infiltrate. In the study by Pavesi *et al*. (2010) [12], the evaluation occurred with vasodilation, hyperemia, bleeding, ulcer, and abscess by the conventional staining technique of Hematoxylin & eosin and Sirius red. On the other hand, in the study by Curra *et al*. (2013) [4], the immunohistochemistry technique was adopted for qualitative and semi-quantitative measurement of specific pro-inflammatory cytokines that are known to manifest themselves in OM [1,5,6]. Although the techniques employed are different, it is worth mentioning that these analyses complement and do not contradict each other, as both allow the identification of tissue elements, which provide diagnosis. In case of the need to identify specific tissue elements, special immunohistochemistry techniques are used.

The study by Pavesi *et al.* (2010) [12] was the only one who underwent clinical analysis of chemo-induced OM among the groups. The results revealed the superiority of the fluid extract of chamomile in relation to the negative control group and the topical corticosteroid group, in

which the group treated with the natural agent developed a milder OM during the entire experiment. This result corroborates studies in which a clinical reduction of lesions of non-infectious origin occurred in the oral cavity, such as mucositis and traumatic ulcers through studies carried out in humans [10,18] and animals [11].

The clinical analysis revealed that the animals started to develop OM on day 5 after the infusion of 5-fluorouracil, with a peak of clinical [4,12] and histological [12] ulceration on the 10th day. These results corroborate with a previous study in humans, in which the clinical development of OM occurred around the 10th day, with variation between 7 to 14 days after the infusion of the chemotherapy [10]. Thus, the use of an animal model in an attempt to reproduce the findings in humans is justified, as the period of development of OM is similar for the two species.

Microscopic parameters were assessed by both studies. In accordance with histological analysis with conventional staining, Pavesi *et al*. (2010) [12] found that the use of chamomile in all periods of evaluation promoted mild hyperemia and inflammatory infiltrate, in addition to the absence of ulcers when using topical corticosteroids, which presented areas with ulcers, hemorrhage, severe hyperemia, and edema, in addition to infiltrate diffuse inflammatory disease, with a predominance of neutrophils. Complementarily, Curra *et al*. (2013) [4] with a semi-quantitative analysis of IL-1β and TNF-α, demonstrated that both pro-inflammatory cytokines were found in all groups; however, on the 10th day after the chemotherapy infusion, the chamomile group had a significantly lower score in relation to the other groups, which strengthens the theory about its anti-inflammatory effect. In general, the increase in these cytokines occurs because mucositis comprises a dynamic inflammatory phenomenon [1,5]. In a double-blind, placebo-controlled study conducted by Oton-Leite *et al*. (2015) [19], an increase in the expression of IL-1β e TNF-α was found with the technique of collecting unstimulated saliva, which was diluted in a phosphate-buffered saline solution containing a protease inhibitor, during the OM phase in humans. Although using different samples to identify the presence of cytokines, these studies consolidate the theory about the complex pathophysiology of mucositis proposed by Sonis, in 2004 [5], with the triggering of a series of biological events, which stimulate the expression of these pro-inflammatory cytokines in the initial phases of generation of messenger signals, increasing considerably in the subsequent signaling and amplification phase, in which these cytokines have a direct and indirect harmful effect on the cells of the oral mucosa. This theory can also be verified in the study by Curra *et al*. (2013) [4], in which the expression of IL-1β and TNF-α are visible from the histological parameters from the fifth day after infusion, representing the initial stages of mucositis histopathogenesis.

Regarding the final evaluation period of the mucositis lesion, the study by Pavesi *et al.* (2010) [12] followed up until the 16th day, while Curra *et al*. (2013) [4] evaluated until the 14th day after chemotherapy drug infusion. Regarding the analysis intervals, Pavesi *et al*. (2010) [12] evaluated eight different moments of the experiment (days 0, 2, 5, 8, 10, 12, 14, and 16), while Curra *et al*. (2013) [4] reduced this analysis to days 0, 5, 10, and 14, totaling four periods. Although the performance of multiple analyses has given additional results, with emphasis on the beginning of the peak of mucositis occurring on the eighth day after infusion [12], the four-period approach was enough, as it was able to obtain conclusive and similar results [4]. In both studies, the number of inflammatory cells reduced after application of the fluid extract of chamomile, and Curra *et al*. (2013) [4] observed that the period of greatest reduction in inflammatory cytokines occurred at the peak of mucositis severity (day 10 post-infusion), which emphasizes the action of chamomile on this repair process in lesions of chemo-induced mucositis.

The possible reasons for the favorable effect of topical chamomile on chemo-induced OM in hamsters, according to the studies, are that its medicinal properties are already proven, which includes anti-inflammatory, analgesic, and antimicrobial action [9,20]. According to studies carried out in animals [11] and in humans [10,18], this natural agent has shown to be effective as an adjunct therapy in the management of chemo-induced mucositis due to its beneficial actions, with emphasis on the ability to inhibit the production of cyclooxygenase-2 (COX-2). However, in the study by Fidler *et al*. (1996) [21], the results obtained did not find that topical chamomile was able to decrease the severity of OM induced by 5-fluorouracil in humans. A similar result can be seen in the recent systematic review by MASCC/ISOO, in which the scarcity of clinical studies with the use of chamomile in cancer patients was observed, and due to limited evidence, no guideline was possible [22]. The two studies included in this review demonstrated that the fluid extract of chamomile proved to be superior in relation to the corticosteroid group betamethasone elixir, both from a clinical and histopathological point of view, with a significant decrease in the inflammatory infiltrate, in addition to IL-1β and TNF-α, proving the anti-inflammatory effect of this natural agent.

The findings in the experiments may be contradictory because of the form of presentation of chamomile.

According to Fidler *et al*. (1996) [21], chamomile was administered three times a day as a mouthwash by diluting 30 drops of concentrated chamomile (ASTA Médica, Incorporated, Hackensack, NJ) in 100 mL of water for 14 days, starting on the first day of the cycle with 5-fluorouracil for the treatment of solid tumors. Regarding studies in humans demonstrating a positive effect of chamomile, dos Reis *et al*. (2016) [10] adopted the application of the infusion by preparing 10g of chamomile flower in 400 mL of water, which was later transformed into ice cubes and applied to the oral cavity for 30 minutes, starting five minutes before starting the infusion with 5-fluorouracil for the treatment of solid tumors. Braga *et al*. (2014) [18] used concentrations of 0.5%, 1%, and 2% of liquid chamomile extract from dehydrated flowers and strictly controlled in the form of mouthwash in adults submitted to conditioning for hematopoietic stem cell transplantation under different chemotherapy regimes. Patients were instructed to use 10 mL of the rinse for one minute, twice a day. The 1% group demonstrated a lower incidence, intensity and duration of OM compared to the control. In the studies selected [4,12], fluid extract of chamomile was used, where each 1g of ointment contained 100 mg of fluid extract of *Chamomilla recutita (L.)* Rauschert. The application occurred with a flexible cotton swab twice a day in the hamsters. The positive results suggest that the presentation form was a positive factor, given that the fluid extract has the capacity for greater adhesion in the oral cavity for a longer time.

Some variables must be discussed for the respective findings. Associating cryotherapy with chamomile may have benefited the study by Braga *et al*. (2014) [18]. This mechanism alone already prevents the mucositis induced by antineoplastic agents with a short half-life, such as melphalan and 5-fluorouracil, with local vasoconstriction, according to the mucositis management guideline proposed by MASCC/ISSO [7]. Thus, evidence shows that both cryotherapy and chamomile promoted the prevention of mucositis, that is, the beneficial effect was enhanced by the combination of these two therapies. In the studies of this review [4,12], topical chamomile was exclusively analyzed, excluding articles that addressed the association of therapies. The fluid extract was used in animals at room temperature, which strengthens the theory that its beneficial effect is due to the inherent properties of this agent because of phenolic compounds, mainly flavonoids, with emphasis on aspegenine, quercetin, patuletin, luteolin, and its glycosides [23,24].

According to the literature, the anti-inflammatory action of chamomile has a positive effect in relation to the healing process. Countless substances make up this natural agent, such as chamazulene, alpha bisabolol, bisabolol oxides, spirometers, and flavonoid compounds [23]. According to Braga *et al.* (2014) [18], the amount of aspegenin-7-glycoside, which represents a flavonoid compound, determines the anti-inflammatory activity of chamomile. These data can be confirmed with the study by Curra *et al*. (2013) [4], in which the levels of pro-inflammatory cytokines IL-1β and TNF-α reduced significantly in the group in which 100 mg of fluid topical chamomile extract was used.

Despite the analgesic potential of chamomile due to its ability to inhibit COX-2 [10,18], the experiments in the studies did not report information on analgesia and pain. This aspect can be justified by the fact that the evaluations were performed on animals. Although the analysis of this symptom in hamsters has limitations, notably, in the study conducted by Pavesi *et al*. (2010) [12], weight reduction was significantly less in the chamomile group compared with the negative control group, which may suggest a possible analgesic effect of this agent, with reduced interference in the feeding of the animals in this group. In a complementary way, studies in humans have demonstrated its analgesic effect by the application of a questionnaire [10], or by the decrease in the use of opioid analgesics in the group that used chamomile [18].

Considering that cancer patients generally use several medications due to their systemic impairment associated with the increased costs generated, the search for low-cost alternatives is necessary, which favors studies aimed at the use of chamomile. Allied to this fact, natural products are well tolerated by the body, which has led to a progressive increase in consumption [23], as shown by the study by Braga *et al*. (2014) [18], in which 84% of patients rated the chamomile mouthwash pleasant, and in the study by dos Reis *et al.* (2016) [10], in which the cryotherapy performed with chamomile infusion promoted approval of 85% of patients.

V. CONCLUSIONS

It is worth mentioning that tissue repair in the oral cavity of humans is more complex to be studied when compared to experimental animals, which requires further studies *in vivo* to make it possible to standardize specific therapeutic parameters for clinical use of chamomile topical in mucositis.

Conclusively, topical therapy with fluid extract of chamomile can be considered in the treatment of OM in hamsters as it showed positive clinical and histopathological results and the ability to reduce the levels of some pro-inflammatory cytokines. It is also a natural agent with easy access and low cost, although few studies that have evaluated this therapeutic resource are available.

Thus, scientific production on this topic should be encouraged, as it aims at determining useful protocols of this resource for the oncological population.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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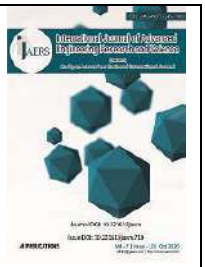

Degradability and gas production of diets enriched with additives in cattle or sheep inoculum[1]

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***Abstract*—** *The study of ruminal kinetics of feedstuffs and the influence of feed additives on degradability and gas production can contribute to the formulation of more efficient diets. This study proposes to examine cumulative gas production from rumen fermentation and the in vitro degradability of diets containing maize and cottonseed cake enriched with amylolytic enzyme, protected lysine, lysophospholipids or protected methionine. In the degradability trial, the samples were incubated in anaerobic medium for 0, 3, 6, 12, 24 and 48 h, at 39 °C. In vitro gas production was determined at the incubation times of 3, 6, 9, 12, 16, 24, 32, 48 and 72 h, and the use of cattle and sheep ruminal fluid was compared. The inclusion of lysophospholipid increased ($P<0.05$) the degradability of dry matter in the diet, whereas the addition of protected methionine reduced this variable. Gas production was greater in sheep inoculum up to 48 h of fermentation, and no differences were detected at 72 h. The amylolytic enzyme increased the gas production only up to 24 h of fermentation. After this time, none of the tested additives increased gas production.*

[1] Part of the first author's Master's dissertation.

I. INTRODUCTION

Ruminant finishing systems in Brazil range from extensive to intensive production types. The former require more time to produce the same unit of animal product, as a greater portion of the feed provided is used for the maintenance of vital activities in the animal. Thus, extensive farming is less efficient in terms of preserving the energy contained in the diet in the final product, be it meat, milk, or others. In these systems, grasses usually form the basis of the diet. In intensive finishing systems, on the other hand, the diet is more grain-based, which translates into superior conversion of the dietary energy into animal product.

Much of the energy lost during ruminal fermentation result from the elimination of gases (Lana *et al*., 1998). Approximately 99% of these gases are carbon dioxide and methane, with nitrous oxide corresponding to a very small portion (Kozloski, 2002).

Diets with higher proportions of concentrate generate larger volumes of cumulative gas per time unit, as they contain larger amounts of non-fibrous carbohydrates, which are rapidly digested in the rumen (Mertens, 1987).

Substrates with higher acetate production capacity (i.e., higher fiber content) produce proportionally larger amounts of gas, when compared with high-starch substrates. The latter, in turn, provide greater propionate production and less gas production per unit of fermented glucose (Blümmel *et al*., 1997). This can be demonstrated mainly by relating the amount of gas produced per unit of animal gain.

The study of ruminal kinetics of feedstuffs and the influence of dietary additives on the digestibility, digestion rate and potential of ruminal digestion, among others, can significantly contribute to the formulation of more economical and efficient diets that more adequately meet the requirements of ruminal microorganisms and compatibility between feed ingredients.

This study was conducted to examine cumulative gas production from rumen fermentation and the *in vitro* degradability of diets containing maize and cottonseed cake enriched with amylolytic enzyme, protected lysine, lysophospholipids or protected methionine, in cattle and sheep inocula.

II. MATERIAL AND METHODS

All procedures involving animals were approved by the Animal Use Ethics Committee of the Federal University of Goiás (CEUA-UFG) (approval no. 37288).

The evaluated diets were composed of ground maize, cottonseed cake and a vitamin-mineral premix (Table 1). The following treatments were tested: control (CON), amylolytic enzyme (ENZ), protected lysine (LYS), lysophospholipids (LIP) and protected methionine (MET).

Table 1. Percentage composition of ingredients (as-fed basis) and chemical composition of diets (dry-matter basis)

Ingredient	Treatment				
	CON	ENZ	LYS	LIP	MET
Cottonseed cake (%)	55.00	55.0	55.0	55.0	55.0
Grain maize (%)	42.0	42.0	41.7	42.0	41.9
Mineral-vitamin premix[a] (%)	3.0	3.0	3.0	3.0	3.0
Enzyme (%)	-	0.076	-	-	-
Lysine (%)	0.0845	0.0845	0.1183	0.0845	0.0845
Lysophospholipid (%)	-	-	-	0.0380	-
Methionine (%)	0.0425	0.0425	0.0425	0.0425	0.1555
Chemical composition					
Dry matter (%)	90.5	90.5	90.5	90.5	90.5
CP (% DM)	20.11	20.11	20.11	20.11	20.11
EE (% DM)	7.41	7.41	7.41	7.41	7.41
NDF (% DM)	34.23	34.23	34.23	34.23	34.23
ADF (% DM)	21.50	21.50	21.50	21.50	21.50
MM (% DM)	6.52	6.52	6.52	6.52	6.52

[a]Nutrient/kg of premix: calcium = 262 g, phosphorus = 60 g, sulfur = 50 g, magnesium = 40 g, sodium = 30 g, iron = 3000 mg, zinc = 1000 mg, manganese = 900 mg, fluorine = 600 mg, copper = 221 mg, iodine = 15 mg, selenium = 10 mg and cobalt = 5 mg.

The amylolytic enzyme was produced from the fungus *Aspergillus awamori* and used in freeze-dried form at a dose of 16.9 U/kg diet (as-fed basis). Enzyme production, characterization and evaluation were carried out at the Laboratories of Enzymology and Digestion Physiology of the Institute of Biological Sciences II, at the Federal University of Goiás. Amylase activity was determined by the saccharification method, which is based on the quantification of the reducing sugars produced by the enzymatic reaction (Miller, 1959). The protected methionine used in the experiment was supplied from the MetiPEARL® product (55.3% methionine, Kemin) and protected lysine from LysiPEARL® (48.5% L-lysine hydrochloride, Kemin). The lysophospholipid was supplied from the Lysoforte Booster Dry® product (Kemin).

In the *in vitro* degradability trial, approximately 2.0 L of rumen fluid were collected from a 24-month-old uncastrated bull that was previously acclimated to each diet for seven days. All materials (thermos, funnel, beakers and blender) involved in the handling of the collected fluid were previously heated to 39 ºC. The rumen fluid was mixed in the blender at high speed for 30 s to release part of the microorganisms adhered to the suspended material in it. Afterwards, the fluid was filtered through cotton fabric.

Four 0.4-L aliquots of filtered rumen fluid were separated and added to 1.6 L of Kansas buffer solution, resulting in four 2.0-L volumes. Each volume was placed in incubation jars (TECNAL), where the ANKOM® F57 incubation bags were placed. The four jars were then placed in the DAISY II TE-150 (TECNAL) *in vitro* incubator. All handling procedures involving rumen fluid occurred under constant CO_2 infusion.

Twelve ANKOM® F57 bags containing 0.5 g of sample were added to each jar. The samples were incubated in anaerobic medium for 0, 3, 6, 12, 24 and 48 h at 39 °C. Two bags were removed per jar at each incubation time, with an average value calculated for each jar. The average of the two bags from each jar at each time constituted a replicate; accordingly, there were four replicates for each removal time. Once removed from the incubator, the ANKOM® bags were placed in cold water to stop microbial activity and subsequently washed in running water until it was clear. After the excess water was removed, the bags were washed with acetone for five minutes and completely dried in a forced-air oven at 105 °C for 12 h. The bags were then placed in a desiccator for 30 min and their weight was recorded. The entire procedure was performed five times, with one treatment being incubated at a time. In this way, it was possible to avoid applying two treatments in the same jar and prevent the interaction of two additives in the same sample.

The *in vitro* fermentation of dry matter (DM) was achieved by the artificial-fermenter methodology described by Holden (1999). Dry matter degradability (DMD) was calculated using the formula described by Tilley & Terry (1963):

$$DMD\ (\%) = (A - (B - Br) \times 100)/A,$$

where A = weight of the initial DM of the bag plus the sample; B = weight of the residual DM of the bag plus the digested sample; and Br = weight of the bag without sample (termed 'blank').

Degradability data were adjusted using the Orskov & Mcdonald (1979) model, according to the following equation:

$$p = a + b\ (1 - e^{-c.t}),$$

where p = rate of degradation over time; a = rapidly degradable fraction; b = potentially degradable fraction; c = hourly rate of degradation of the potentially degradable fraction; e = natural logarithm; and t = incubation time. The sum of a and b must be less than or equal to 100%.

The values of a, b and c were used to calculate potential degradability (a + b), which represents the feed solubilized or degraded in the rumen when time is not the limiting factor, and effective degradability, by the following equation proposed by Orskov *et al*. (1980):

$$p = a + (b.c)/(c + Kp),$$

where p represents the rate of effective degradability and Kp is the estimated rate of passage of particles through the rumen per hour.

The *in vitro* gas production trial was carried out according to Theodorou *et al*. (1994) with modifications by Maurício *et al*. (1999). Samples of 1.0 g of the substrates to be evaluated were weighed and sealed in ANKOM® F57 degradability bags. For the fermentation of the samples, glass bottles with a volume of 160 mL were used, which were filled with CO_2. The bags containing the samples were placed in these bottles together with 90 mL of buffer medium and 10 mL of sheep or cattle rumen inoculum. Then, the bottles were filled again with CO_2 and sealed with rubber stoppers.

One bull and two rams (adult, castrated, rumen-fistulated) were used as donors of rumen fluid. The bull was kept in brachiaria pasture (*Brachiaria brizantha*), whereas the sheep was kept in a stall receiving fresh and chopped bermuda grass (*Cynodon dactylon*) in the trough. Mineral mixture and water were freely available to all animals, but the rams also received 150 g/day of concentrate supplementation per animal.

A total of 128 bottles were incubated, eight of which contained only rumen fluid and the buffer medium as control (blanks), which were used to determine the production of gas from the rumen content for a later correction of net gas production. The remaining 120 bottles corresponded to twelve repetitions per inoculum (rams and bull) for each treatment (CON, ENZ, LYS, LIP and MET), with nine replicates, corresponding to the post-incubation times of 3, 6, 9, 12, 16, 24, 32, 48 and 72 h.

Pressure readings were taken 3, 6, 9, 12, 16, 24, 32, 48 and 72 h after incubation, using a pressure transducer (model Press Data). The transducer is connected to a three-outlet valve, one outlet being connected to the transducer, another to a 25 mm × 0.7 mm needle and the third free to remove the gas after the reading.

The pressure data (obtained in PSI) were converted to volume of gas produced using the equation found by Guimarães Júnior *et al*. (2008), for the temperature and atmospheric pressure conditions of Planaltina - DF, Brazil:

$$\text{Volume (mL)} = 4.50231 \times \text{pressure (PSI)} + 0.05164 \times \text{pressure}^2 \ (R^2 = 0.996).$$

The kinetics of gas production in each treatment was determined by the equation from the model described by France *et al*. (1993):

$$Y = A\ \{1 - \exp[-b(t - L) - c(\sqrt{t} - \sqrt{L})]\},$$

where Y = cumulative gas production (mL); A = maximum gas production potential (mL); L = colonization time or lag time (h); b (h^{-1}) and c ($h^{-0.5}$) = constant fractional rates; and t = time (h).

In vitro degradability was analyzed in a randomized complete-block design in which each jar constituted a replicate. In statistical analysis, the *in vitro* degradability fractions were compared by the F test at 5% significance and the obtained curves were analyzed by the model identity test (Regazzi, 2003), using R statistical software (R, Development Core Team, 2012).

The gas production trial was laid out in a completely randomized design with a 5 × 2 factorial arrangement, where the factors were represented by the substrates (CON, ENZ, LYS, LIP and MET) and the inocula (sheep and cattle). Cumulative gas production data were subjected to analysis of variance and means were compared by Tukey's test at 5% significance using R statistical software (R Development Core Team, 2012).

III. RESULTS AND DISCUSSION

The results and parameters used to calculate the *in vitro* DM degradability (IVDMD) are shown in Table 2. Fraction a, which represents the fraction of rapid ruminal degradation, was lower ($P<0.05$) in MET than in the CON and LIP treatments. The highest result for fraction b ($P<0.05$), which represents the fraction potentially degradable in the rumen, was found in LYS, followed by LIP, MET and CON. The ENZ treatment obtained the lowest value for this fraction, which not differ from CON. The hourly rate of degradation (c) of fraction b did not differ ($P>0.05$) between the treatments. Each degradation curve estimated from the Orskov & Mcdonald (1979) equation is a model. The model identity test described by Regazzi (2003) allows for a comparison of the parameters and regressions of this model using the F test, which makes it possible to determine whether or not there is similarity in the regression profile. The comparisons between parameters a, b and c of the models was pairwise (Table 2).

Table 2. In vitro dry matter degradability of experimental diets and model identity test of fractions and in vitro degradability curves.

Parameter	Treatment				
	Control	Methionine	Enzyme	Lysine	Lysophospholipid
Fraction a (%)	14.05^{a1}	7.67^{b}	12.66^{ab}	13.33^{ab}	15.96^{a}
Fraction b (%)	45.50^{bc}	48.01^{b}	37.50^{c}	71.14^{a}	56.68^{b}
Fraction c	0.0281^{a}	0.0489^{a}	0.0479^{a}	0.0233^{a}	0.0264^{a}
PD (%)	59.54	55.68	50.16	84.49	72.64
ED (kp=2%)	40.62	41.74	39.12	51.59	48.22
ED (kp=5%)	30.41	31.41	31.01	35.93	35.56
ED (kp=8%)	25.87	25.88	26.71	29.37	30.03
Lag time (h)	3.24	2.69	2.10	2.36	0.03

Comparison	Model-identity test			
	Fraction			Model identity
	a	b	c	
CON × ENZ	ns[2]	ns	ns	ns
CON × LYS	ns	0.022	ns	<0.001
CON × LIP	ns	ns	ns	<0.001
CON × MET	0.022	ns	ns	0.017
ENZ × LYS	ns	0.007	ns	<0.001
ENZ × LIP	ns	0.006	ns	<0.001
ENZ × MET	ns	0.029	ns	0.014
LYS × LIP	ns	ns	ns	ns
LYS × MET	ns	0.011	ns	0.001
LIP × MET	0.004	ns	ns	0.001

[1]Means followed by common letters in the rows do not differ by the F test (P<0.05)

[2]Comparisons between means and models not significant in the F test (P<0.05)

The fact that a fraction or all fractions are similar between treatments does not necessarily imply equal models. Small differences in the values of the fractions between treatments may not be noticeable in statistical tests for comparison of means. However, they can substantially modify the graphic behavior of the model, since the small numerical differences between the fractions in the treatments can add to their effects. Therefore, model identity tests are necessary to demonstrate the differences between treatments, when analyzing the whole set. The comparisons of CON × ENZ and LYS × LIP revealed similar results. Figure 1 shows the visual similarity between the curves drawn from these treatments.

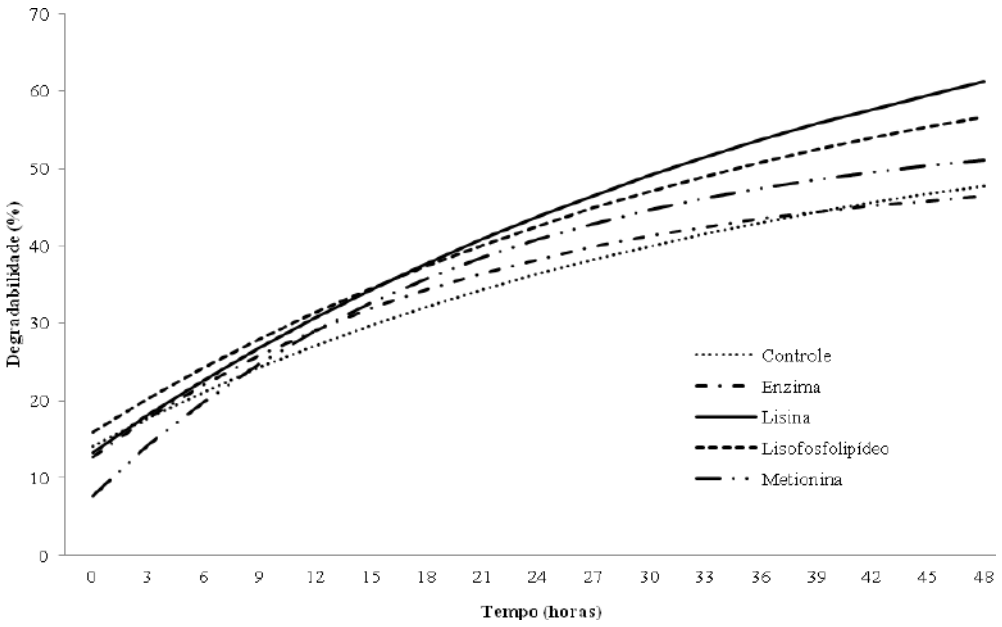

Fig.1: DM degradation curve of the experimental diets according to the adjusted parameters of Orskov & Mcdonald (1979).

The MET and LYS provided showed higher (P<0.05) IVDMD than CON. Obeidat *et al*. (2008) and Acosta *et al*. (2012), however, found no differences in the *in vivo* digestibility of sheep diets enriched with MET, which had already been described by other researchers (Oke *et al*., 1986; Antongiovanni *et al*., 2002). Han *et al*. (1996) also observed no differences in the *in vitro* degradability of lamb diets enriched with LYS and MET analogues, and the same was reported by Sun *et al*. (2007).

Sun *et al*. (2007) observed an increase in the activity of endo-1,4-β-D-glucanase and β-glucosidase after supplementing LYS and MET. These enzymes are responsible for degrading the dietary fiber (Bowman & Firkins, 1993). It is not known how these amino acids affect the activity of these enzymes. Fiber degradability was not evaluated, but the increase observed in the IVDMD of the LYS and MET treatments may be due to greater degradation of the fibrous portion.

There was no difference in IVDMD between ENZ and CON. However, Crosby *et al*. (2006) observed an 8.9% increase in the *in vivo* digestibility of lamb diets enriched with different doses of *Bacillus licheniformis* amylases.

There was an increase in IVDMD with the addition of LIP, in comparison to CON. This result agrees with the descriptions of the Cong *et al*. (2009), who observed an increase in IVDMD using three different surfactants. Hristov *et al*. (2007) also reported increased *in situ* degradability of starch and DM with the addition of a surfactant to the diet.

The parameters estimated through the gas production model developed by France *et al*. (1993) are shown in Table 3 and the cumulative gases production means of the CON, ENZ, LYS, LIP and MET treatments incubated with cattle or sheep inoculum at different times are described in Table 4.

Table 3. Gas production potential (A), constant fractional rates (b and c) and lag time (L) calculated for different substrates in rumen fluid of sheep and cattle.

Treatment	A (mL/g DM)		b (h^{-1})		c ($h^{-0.5}$)		L (h)	
	Sheep	Cattle	Sheep	Cattle	Sheep	Cattle	Sheep	Cattle
CON	212.8	192.0	0.030	0.028	-0.077	-0.080	1.6461	2.0372
ENZ	194.6	258.2	0.029	0.016	-0.074	-0.035	1.6132	1.1655
LYS	217.1	248.7	0.032	0.018	-0.115	-0.055	3.2115	2.2665
LIP	173.7	184.2	0.043	0.032	-0.150	-0.112	3.0947	3.4837
MET	150.7	162.0	0.045	0.044	-0.150	-0.180	2.7931	4.2357

Table 4. Mean cumulative gas production values (mL/g DM) at 24, 48 and 72 h of fermentation in rumen filtrate of cattle and sheep.

Treatment	24 h		48 h		72 h	
	Sheep	Cattle	Sheep	Cattle	Sheep	Cattle
CON	69.21^{aA}	53.96^{bA}	131.06^{aA}	$108,42^{bA}$	$168,87^{aA}$	$144,81^{aA}$
ENZ	61.79^{aAB}	53.77^{bA}	116.60^{aAB}	$106,22^{aA}$	$152,27^{aAB}$	$152,10^{aA}$
LYS	57.86^{aB}	45.59^{bB}	124.77^{aAB}	$102,15^{bA}$	$165,76^{aAB}$	$146,20^{aA}$
LIP	57.09^{aB}	46.89^{bAB}	119.69^{aAB}	$103,63^{bA}$	$147,37^{aAB}$	$139,08^{aA}$
MET	56.00^{aB}	46.23^{bAB}	110.99^{aB}	$106,53^{aA}$	$131,29^{aB}$	$134,34^{aA}$
Mean	60.39^{a}	49.29^{b}	120.62^{a}	$105,39^{b}$	15311^{a}	$143,31^{a}$
CV	12.16		14.43		15.85	
P1*	<0.001		<0.001		0.1125	
P2**	<0.001		0.2577		0.0751	
P3***	0.4128		0.3098		0.5604	

Means followed by distinct lowercase letters in the rows or uppercase letters in the columns differ from each other by Tukey's test (P<0.05). Probability values of analysis of variance for inocula (*), treatments (**) and their interaction (***).

At the incubation times of 24 and 48 h, there were significant differences in gas volumes between the inocula, with a larger amount produced in the sheep inoculum. However, there was no significant difference at 72 h. As rumen fluid donors, the rams received a diet with a higher non-fibrous carbohydrate content than the bull. Thus, it is possible that the microbiota of the rams was more able to digest non-fibrous carbohydrates than that of the bull, which explains the higher initial gas production. Nonetheless, over time, the microbiota present in the cattle rumen fluid may have adapted to the substrate, or the very existing microbiota managed to digest the substrate that had not yet been fermented, resulting in a similar final production in both inocula.

Bueno *et al*. (2005) compared the use of cattle and sheep inoculum in the production of gases from various substrates and found higher values in cattle inoculum (345.9 mL) than in sheep inoculum (323.8 mL) per gram of organic matter, after 96 h of incubation.

By 24 h of fermentation, CON produced more gas than LYS, LIP and MET, but was similar to ENZ in the sheep inoculum. In the cattle inoculum, however, CON and ENZ showed higher production ($P<0.05$) than LIS and similar results to other treatments. After 48 h and 72 h of fermentation, CON produced more gas than MET, but was similar to the other treatments in the sheep inoculum, with no differences occurring between the treatments in cattle inoculum for these times. When only the treatments were analyzed regardless of inoculum source, differences were solely present at 24 h, when CON and ENZ were superior to the other treatments.

Wang et al. (2004) observed no differences in the volume of gas produced from cattle diets enriched with a nonionic surfactant. For the same product, there was a decrease in the cumulative gas production from barley grains (*Hordeum vulgare*) after 36 h of incubation, when added at the dose of 0.10%. In the proportion of 0.05%, there was no difference in relation to control (Lee & Ha, 2003). However, in the same study, no difference in gas production was observed after 96 h of incubation for orchard grass hay (*Dactylis glomerata* L.). Cong et al. (2009), on the other hand, observed an increase in gas production following the addition of three different surfactants.

Gas production curves are illustrated in Figure 2.

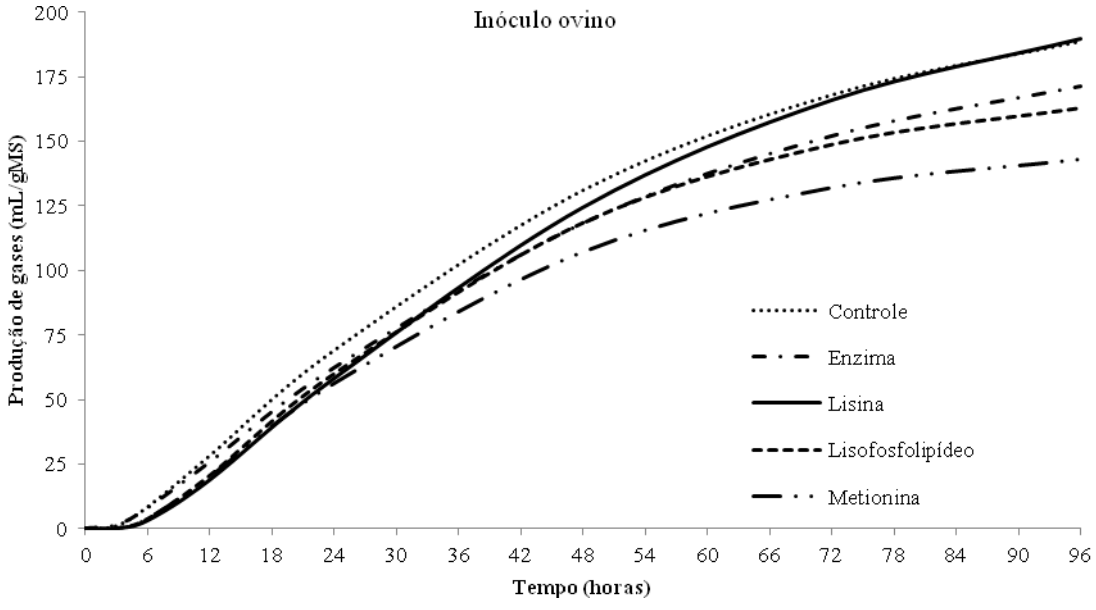

Fig.2: Cumulative gas production during 96 h of fermentation process in cattle or sheep inoculum adjusted to the model of France et al. (1993).

The treatments showed different responses in terms of gas production in each inoculum. However, in both inocula, MET and LIP represented the curves with the lowest gas production values visually.

IV. CONCLUSIONS

The inclusion of lysophospholipid increases the *in vitro* dry matter degradability of high-concentrate diets for finishing lambs, whereas the addition of protected methionine reduces this variable. Gas production is greater in sheep inoculum up to 48 h of fermentation. The addition of amylolytic enzyme increases gas production up to 24 h of fermentation.

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The Challenge of Managing Megaprojects

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***Keywords*—Contingency theory, Megaproject definition, Megaproject management, Project classification, Project management, Project types.**

***Abstract*—*This paper reviews the concepts of project management and megaprojects, emphasizing on how to join these topics and the challenges of managing this kind of project, because the standard methodologies are not specific for megaprojects and, until now, academic researches focus only in the general content of methodologies for megaprojects. So, the objective of this paper is to jointly discuss project management, megaprojects and the challenges of managing this kind of project. First, we review the project management concepts and standards; then we define megaprojects, considering that a narrow definition is not the best alternative and then we present the current discussions about managing megaprojects. As a conclusion, we suggest unfolding the emerging topics for managing megaprojects in specific process, documents, tools and templates, to create a new standard, otherwise project managers will keep unsuccessfully trying to adapt the traditional methodologies to their megaprojects. This work brings a theoretical contribution when reviewing the newest advances in this topic and suggests future researches in the development of a new megaproject methodology.*

I. INTRODUCTION

Project is defined as a temporary endeavor undertaken to create a unique product, service, or result (PMI, 2017). Most of the activities we conduct in our day-to-day life, personally or professionally, can be classified as a project. Some examples of a project would include this paper that I have written, a specific work one has to conclude in his organization to deliver to his customer or a trip with your family in the next summer vacations.

Project management consists in the application of knowledge, skills, tools and techniques to conduct activities to meet project requirements (PMI, 2017). These requirements are set from the project´s customer or even from any stakeholders (anyone with any interest in the project). To properly manage a project, it is necessary to have in hand these tools and techniques and the ability to conduct a group of persons, the team members, into the execution of the project. Of course, before the execution of the project, the team, led by the project manager, needs to plan the whole project.

This is a not a simple activity, as it is possible to imagine. But when we think in megaprojects, the challenge remains even more complex. Flyvbjerg (2014) defines megaprojects as large-scale, complex ventures that typically cost a billion dollars or more, take many years to develop and build, involve multiple public and private stakeholders, are transformational, and impact millions of people. Other authors consider that the economic value is not the most important variable to define a megaproject, like Pollack et al. (2018) that state that a megaproject should be defined by the organizational complexity, ambiguity, ambition, political aspects and risks that are entailed on it. In some industry segments or in some small countries, megaprojects can be well defined by this second definition.

By analyzing the literature on project management and megaprojects, the objective of this paper is to discuss jointly these topics and the challenges of managing this kind of project. This is an important topic because of the volume of global spending in megaprojects annually. Flyvbjerg (2014) estimated it to be USD 6-9 trillion

annually, or 8 percent of total global gross domestic product. If we look in the next following years, the impact is also very high. The McKinsey consultant company estimates that the world needs to spend about USD 57 trillion on infrastructure by 2030 only to enable the predictions of the global GDP growth (Garemo et al., 2018).

II. PROJECT MANAGEMENT

A systematic project management approach consists of methods, toolkits and design models. Thus, project management can be viewed as the sequential application of structured processes that are continuous and repeated and, when used by an organization in a gradual and safe way, permits a business to take steps toward the institutionalization of standardized practices.

Project teams require help to plan and deliver projects, considering the project's entire life cycle, toward both the business and customer satisfaction. In recent years, some standards were created by project management institutes and associations as presented in Table 1.

The most renowned standards of project management are the PMBoK (Project Management Body of Knowledge) and the ICB (International Project Management Association Competence Baseline) (PMI, 2017; IPMA, 2006). Their focus is in the traditional management of projects, despite the European model emphasizes the human aspects of managing a project. The same happens with a not so worldwide well-known standard, the AIPM (Australian Institute of Project Management Professional Competency Standards for Project Management) from Australia (AIPM, 2008). Its structure is very similar to the PMBoK, divided in knowledge areas.

The APM (Association for Project Management) Body of Knowledge, from UK, is the most complete standard, offering not only project related content, but also strategic aspects and project governance content (APM, 2006). But there are also some specific standards, not so comprehensive, used in individual industry segments. The PRINCE2 (Projects in Controlled Environments) is a set of methods for information technology projects developed in the UK from the Office of Government Commerce (OGC, 1996). For construction projects, the Japan Project Management Forum developed the ENAA Model Form-International Contract for Process Plant Construction (ENAA, 1992).

Existing literature (McHugh and Hogan, 2011; Besner and Hobbs, 2013) recognizes the benefits of implementing and using a project management methodology. Besner and Hobbs (2013) analyzed the perceived value and potential contribution of project management practices in their success, starting from the use of different tools and techniques of the same management method. On the other hand, McHugh and Hogan (2011) studied organizations that used their own internally developed methodology. They discovered that, even for these organizations that developed proprietary methodologies, there was a desire within these organizations to implement a universal and internationally recognized project management methodology.

These standardize types of methodology are structured in common process that can be applied to different projects. They suggest tools and templates that must be adapted by each organization that decides to use them. The advantage of using this kind of methodology is that the basis of project management concepts used in the company is the same from other companies and was already tested in other projects. This solution guarantees that best practices will be used within the company. To implement this solution, the first two methodologies, from the six presented in Table 1, are the most indicated. The PMBoK (PMI, 2017) and the ICB (IPMA, 2006) are the most used worldwide in a huge variety of organizations, so their processes have already been tested in lots of projects, making their tools the most stable ones and their suggested best practices, the most applicable ones to different industry segments.

III. MEGAPROJECTS

Defining a megaproject is not a simple task. There is no consensus on a common definition for the characteristics of a project, to classify it as a megaproject (Flyvbjerg, 2014; Misic and Radujkovic, 2015; Li et al., 2018; Pollack et al., 2018). A direct definition, proposed by Flyvbjerg (2014), specify the minimum value of a billion dollars to classify a project as a megaproject. A more structured set of characteristics to define a project as a mega one, includes variables such as complexity, ambiguity, stakeholder's ambition, political aspects and risks, as proposed by Pollack et al. (2018). To include these additional variables besides budget, is a good solution to classify a project as a megaproject. In some specific segments, projects are not so expensive as a construction project, that can achieve a billion dollars budget. But, for sure, they are complex, sometimes involving hundreds and even thousands of team members or more than ten different suppliers, and hard to implement, whit a schedule of several months or even years and with the implementation of a technical solution never used before.

Table 1. Major Associations of Project Management and Their Standards

Institute	Standard	Country of Origin	Methodology Focus	Characteristics	Observations
Project Management Institute (PMI, 2017)	*Project Management Body of Knowledge* (PMBoK)	USA	General management of projects	Set of methods developed for various types of projects, which are therefore generic and structured according to areas of knowledge in a project	These methods are complemented by two additional standards: program and portfolio
International Project Management Association (IPMA, 2006)	ICB—IPMA *Competence Baseline*	European Union	General management of projects	Structured according to skills that must be developed by project participants, divided into: contextual, behavioral and technical	Together with the Australian standard, this method has a much greater degree of depth than other methods related to the human aspects of the project manager
Australian Institute of Project Management (AIPM, 2008)	AIPM—*Professional Competency Standards for Project Management*	Australia	General management of projects	This document, published by the Australian institute of projects, is very similar in structure to the PMBoK and is divided by areas of knowledge	This document focuses more deeply on human skills
Association for Project Management (APM, 2006)	APM *Body of Knowledge*	UK	General management of projects	One of the most complete set of methods, this document provides project-related content, value, office projects and strategic aspects of project management	This is the most comprehensive set of methods
Office of Government Commerce (OGC, 1996)	*Projects in Controlled Environments* (PRINCE2)	UK	Management of information systems projects	Set of methods structured according to project stages and activities to be conducted by the management team	This set of methods is aimed at information technology projects
Japan Project Management Forum (ENAA, 1992)	ENAA *Model Form-International Contract for Process Plant Construction*	Japan	Management of construction projects	The document primarily focuses on the contractual aspects of a project	This set of methods focuses on engineering construction projects

The problem is when these variables are subjective and difficult to define when classifying a project. How one would define if a project scope is sufficient ambiguous or in which sense are the stakeholders enough ambitious to define a project as a megaproject? Trying to answer this question, Li et al. (2018) propose a mixed definition including a budget value variable, like Flyvbjerg (2014), but also additional variables like Pollack et al. (2018). They suggested three groups of variables: the economic value; significance and importance of the project and complexity in terms of technology, organization and environment.

But maybe the more adequate definition of a megaproject comes from Misic and Radujkovic (2015). They advocate that a megaproject should be defined depending on its application area. For them, each industry segment, country, type of project and application area, can have a specific definition to classify a project, as a mega one. In that sense, they present some megaproject´s definition, according to different federal agencies, associations and authors (Table 2).

Table 2. Megaproject Definitions

Author(s)	**Definition**
Flyvbjerg (2014)	Large-scale, complex ventures that typically cost a billion dollars or more, take many years to develop and build, involve multiple public and private stakeholders, are transformational, and impact millions of people.
Misic and Radujkovic (2015)	Definition of a megaproject depending on industry segment, country, type of project and application area.
Li et al. (2018)	Very expensive or very large, where the cost or investment exceeds a determined value in USD or as % of country GDP. Attracts a lot of public attention, carry strong symbolic significance, are closely linked to society, environment, economy and politics. Extremely complex in terms of technology, organization, environment, culture and finance with high degrees of uncertainty, are unique, a one-of-a-kind project.
Pollack et al. (2018)	Should be defined by the organizational complexity, ambiguity, ambition, political aspects and risks that are entailed on it.

Although the increasing literature on project management and megaprojects, with the standards presented (Table 1) and researches conducted (Table 2), which help the advancement in process, tools, techniques and systems; project management success studies, mainly for megaprojects, remains low. Mir and Pinnington (2014) tested the relationship between project management performance and project success for 154 megaprojects in Asia. They created multi-dimensional frameworks to test their hypotheses and suggest that organizations should invest time, money and effort to develop proper project management methods and key performance indicators to manage different types of projects.

This is the same idea suggested by Shenhar (2001), some years ago. He proposed that different types of projects should be managed in different ways. The novelty presented in his paper was to explore the domain of traditional contingency theory in the more modern world of projects. He created a two-dimensional model to classify technical projects into technological uncertainty and system complexity. The benefits of his work were to show for project leadership why and how management should adapt a more project-specific style, offering a collection of insights to improve projects.

As it is possible to verify in Mok et al. (2015), the idea of choosing a specific approach to manage complex and uncertain projects, has been broadly accepted through a large period in the academic research. They analyzed the development of stakeholder management for mega construction projects, reviewing 85 selected articles published from 1997 to 2014, and show the evolution and the increasing of methodologies and process used to manage complex projects.

The discovery from Mok et al. (2015) was already expected, in my opinion. During decades, project managers tried to use the standard process and tools, provided by the general methodologies presented in Table 1, to manage megaprojects and the results obtained show that this is not the best solution. The Standish Group (2018) presents that the rate of megaprojects considered successful (i.e. achieved the planned schedule and cost, and delivered the required scope), was 16% in 1994. This is a very low rate for any kind of project, specially for megaprojects, considering that 84% of these projects, normally projects with a budget higher than a billion dollar, were unsuccessful ones. As the researches were developing new methodologies specific for megaprojects, the managers were using them, and it is also possible to see this initial positive effect on the megaprojects´ results, with a 29% successful rate obtained in 2015 (The Standish Group, 2018).

IV. MANAGING MEGAPROJECTS

One of the main findings in the Flyvbjerg (2014) work was that the conventional way of managing megaprojects has reached a "tension point". Where tradition is challenged, and reform is emerging. Although the successful rate of megaprojects increased a lot in the last 20 years (The Standish Group, 2018), it is still very low, whit more than two in three projects not achieving their goals. Flyvbjerg (2014) is right when he says that it is time to change this game. It is not possible anymore to keep using the traditional tools to manage megaprojects and at the end obtain these unsatisfactory results. According to him it is necessary to build a “new methodology” in order to reach the goals set for this kind of project. The author presents data and examples showing that most megaprojects incurs in over budget and over time when managed using the current methodologies.

Shenhar (2001) was the first one to propose a contingency approach to project management. In his work he suggested to start differentiating the methodologies to manage the projects. Flyvbjerg (2014) agrees with him, although for an even more specific type of project, a megaproject. Both conducted their researches studying some projects and then generalizing their findings. Shenhar (2001) goes beyond, proposing a model for analyzing projects, but again, both authors do not solve the “problem”. They just suggest that it is necessary to use specific methodologies to specific types of projects. For example, in a crisis project, that must be conducted with much urgency, like the care for Hurricane Katrina victims, it is necessary to start the project very soon with a very short time for planning. All the documentation will come further. In a opposite way, in a very complex, risky, long and expensive project, like the construction of the International Space Station (ISS), the methods and tools, will be very carefully followed, before the implementation of project starts.

More recently, Svejvig and Andersen (2015), presented the results of their research in a very provocative way, once they say that it is not only necessary to adapt the standard methodologies to different types of projects. They suggested that is necessary to completely rethink project management to succeed in this “brave new world” we live nowadays, according to them. They studied 74 other papers published in the last 30 years to create a critical look at what is happening in the project management research. They suggest 6 topics that are emerging ones and will dominate project management research in the following years: contextualization, social and political aspects, rethinking practice, complexity and uncertainty, actuality of projects and broader conceptualization. It is possible to see that, at least 4 of them are aligned with what was proposed by Shenhar (2001) and Flyvbjerg (2014).

A broader conceptualization was recently studied by Bisenthal et al. (2018). They suggest more characteristics that justify a different approach to manage megaprojects:

- Reach: the megaproject effects go beyond national borders due to its impacts;

- Duration: the benefits obtained from a megaproject, due to the long duration of them, could also be included in their completion and evaluation;

- Cost: once the costs of megaprojects are high, independently of the defined value, it is necessary large amounts of money to implement them and sometimes loans from international funding agencies, that impose some restrictions on the way in which the project is managed;

- Risks and uncertainties: megaprojects often use new technologies and process that require careful risk analysis and treatment;

- Controversy: these projects are subjected to public and media scrutiny, so success criteria are often fuzzy and misrepresented;

- Legal and regulatory issues: due to its complexity, legal claims and litigation very often occurs, and multiple governance regimes are necessary over the duration of the project;

- Value involved: social, economic and ecological value are high in megaprojects, because of the intense labor force used and impact caused.

The success of using specific approaches to manage megaprojects was studied by Shenhar and Holzmann (2017). The authors applied contingency theory specifically to megaprojects. They studied 500 megaprojects conducted in the past and already concluded, searching for successful projects to compound a final sample to be studied in detail. For this final sample, 14 projects considered successful ones were selected and analyzed in detail searching for characteristics that distinguish them from unsuccessful ones. They propose three major elements: clear strategic vision, total alignment and adapting to complexity. I agree with them, adaptation to complexity is necessary as was possible to see in the prior sections of this paper, but, moreover, to stablish a clear vision for a megaproject is indispensable, once this kind of project consists in a long effort. And without a total alignment between the megaproject and the organizations that are involved with them, it is even not possible, to start a project like this.

V. CONCLUSION

This paper reviewed the concepts of project management and megaprojects, emphasizing on how to create a specific methodology to manage this kind of project, because the standard methodologies are not specific for megaprojects.

Managing complex, uncertain and megaprojects are not a simple task. Independently of what kind of megaproject will be managed (Flyvbjerg, 2014; Misic and Radujkovic, 2015; Li et al., 2018; Pollack et al., 2018), it is necessary to create specific process, tools and techniques (Shenhar, 2001; Mok et al., 2015; Padalkar and Gopinath, 2016), as reviewed in this paper.

Once the traditional standards (ENAA, 1992; OGC, 1996; APM, 2006; IPMA, 2006; AIPM, 2008; PMI, 2017) were created to manage any kind or project, most of them are standard ones, i.e., they are not specific developed to complex or big projects. Organizations and project managers must create new methodologies in order to manage properly their megaprojects (Flyvbjerg, 2014; Svejvig and Andersen, 2015), otherwise their projects goals will not be achieved.

There seems to be an agreement on using specific process to manage complex projects, but what are the content of these methods? Some topics are already being presented (Bisenthal et al., 2018), but it is necessary to detail and specify the tools. The literature review shows that common topics, such as, adaptation to complexity, careful risk analysis and treatment, funding, corporate alignment and strategic vision, are already been discussed in researches and inside the organizations. But the problem remains unsolved. Project managers need specific tools, process and methods to manage their megaprojects. It is necessary to unfold these topics in several detailed documents for each part of a project, with the ultimate goal of creating specific methodologies for megaprojects. Future research should go in this direction.

Otherwise, project managers will remain trying to use the traditional methods to manage their megaprojects, and the results will not be achieved as would be expected, besides the fact that some results are beginning to be revealed (Shenhar and Holzmann, 2017). This is the challenge of managing megaprojects.

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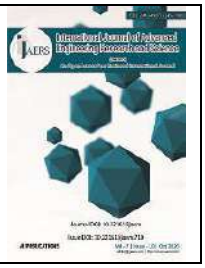

The Repercussion of the Brazilian Forest Code in the Small Property of Family Agriculture

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***Abstract*—** *This article has as main objective to analyze the repercussion of the Current Brazilian Forest Code on Small Family Farming. It is an explored activity through the personal work of the family farmer and rural family entrepreneur, influencing the country's economy. In this context, this work seeks to discuss the changes at Nº. 12,651/2012 law, brought to the small rural producer, showing the APPs, the Legal Reserve areas and the Registration with the CAR. The research methodology was developed through critical bibliographic analysis of legislation, periodicals, doctrines, and books. As a result, it was demonstrated that the forestry legislation recognized the importance of small family farmers, granting different treatment. It is noticed that the Brazilian Forest Code Legislation was instituted to apply the reality experienced by small producers in land use, which must make development compatible with the preservation of biodiversity.*

I. INTRODUCTION

Family farming has received numerous definitions over the years, but in general it can be characterized as subsistence agriculture, of small production, being initially insignificant for the development of the country (GUANZIROLI; CARDIM, 2000).

During the 1990s, according to Esquerdo Souza and Bergamasso (2014), the segment was rediscovered and recognized for its social and productive category, and public policies were created in its favor, valuing the importance of these small productions for the country's growth. it should also be noted that prior to this period, public policies were aimed only at medium and large properties.

When it comes to Brazil, today 70% of the food that arrives at the table of Brazilians originates from the work of family farmers, being produced in 25% of all the land used by agriculture (RBA, 2019).

Given the economic characteristic of family farming, the reflex that the new Forest Code may have in this segment of agriculture has been much discussed, considering the countless changes in relation to the old Code, Law nº 12.651 / 2012 and it is questioned how are the small rural producers with the reformulation of the law given by provisional measure 867, of December 26, 2018 (BRASIL, Law nº 12.651 / 2012).

Considering the history of Forest Codes in Brazil, Césaro and Ferreira (2018, p.65) point out that:

> With each new edition, advances were contemplated. In the current code, the mandatory national electronic registration of all rural properties, demarcating legally protected areas is an important and decisive advance.

In this context, the present work, through bibliographic exploratory research, seeks to analyze the repercussions that the changes in the Current Forest Code can have on family farming and to investigate the legislative treatment that supports this farmer, as well as to study the reflexes of the forest code in relation to rural environmental registry and two complexities.

II. HISTORY OF FAMILY FARMING AND THE BRAZILIAN FOREST CODE

In Brazil, the first indication of a family characteristic in agriculture occurred in the Northeast, around the 16th century marked by its colonial origins of the economy, influenced by the lifestyle of the peasants and the functioning of their family production units (WANDERLEY, 2011).

According to Vinciguera (2014) for a long time, family farming was seen as a marginal segment of little importance, given that in the first moment agriculture in Brazil is especially focused on the cultivation of coffee, sugar cane and soybeans, products considered at that time as the focus of the benefit of public policy, being the country man seen as a person of little intelligence and unable to make effective decisions.

In the governmental sphere, Savoldi and Cunha (2010) emphasize that family farming was included as a priority in the second half of the 90s, more specifically when the National Plan for Strengthening Family Agriculture was launched in August 1995, such a plan it was initially just a credit line for funding, which a little further, through the workers' claims through CONTAG (National Confederation of Agricultural Workers), culminated in the creation of PRONAF (National Program for Family Agriculture Workers), in 1996.

In 1934, with Decree No. 23.793 / 34, the first Brazilian Forest Code came into force, at that time landowners were concerned only with the agricultural and livestock production of the property and the government focused on the production of wood. and firewood, therefore, there was still no concern with the sustainability of the environment, there was no thought of the importance of biodiversity, there was still a belief that natural resources were endless (CÉSARO, FERREIRA, 2018).

Still talking about the subject, Césaro and Ferreira (2018) point out that the great milestone of the Forest Code of 1934 was the promotion of the conservation of natural resources, a position determined in their art. 23 that landowners keep 25% of their property areas covered by original forest, also known as “fourth part”, according to the authors, although this conservation initiative aimed at a first moment for economic development, such as the production of firewood and coal, was a big step in forest conservation.

A little further on, Césaro and Ferreira (2018) point out that in 1965 the second Forest Code was edited by means of Federal Law No. 4,771 / 65, which allowed the squatters to deforest up to 50% of the lots, and in case the colonist did not carry out deforestation , the Union could retake the property, which meant that in other regions of the country, due to the absence of punishment, the deforestation took on alarming proportions, bringing an idea of legal irregularity before the Forest Code.

In 2012, the Brazilian Forest Code was sanctioned through Law No. 12,651 of May 25, 2012, which provides for the protection of native vegetation, the result of a very controversial legislative process, accompanied by society, the scientific community and the press, where prevailing the interests of a particular agricultural sector. Still on the Forest Code, Césaro and Ferreira (2018) explain that, this new Law deals, among others, with the suppression of vegetation for alternative use of the soil, both in the public and private domain, determining the land owners to register the property in the CAR, in addition to providing for several measures related to the preservation of the environment and administrative sanctions, suspending fines that were applied until 07/22/2008 related to the irregular suppression of vegetation in the areas of legal reserve, permanent preservation and restricted use, as they require specific regulations.

2.1. CHARACTERIZATIONS OF SMALL FARMERS AND FAMILY FARMING

At the beginning of colonization, Schallenberger and Colognese (1993) report that small farms concentrated on the development of diversified agricultural production, basically focused on subsistence, trading only surpluses, this phase predominated from the 1950s to the 1960s. the family unit was considered to be self-sufficient, using the markets only to buy an item that was not produced in its rurais property.

This system of traditional agricultural cultivation predominated for a short period of time, because when there was the colonization process, there was also the transition from traditional to modern agriculture, in the early 1970s, the small family agricultural producer was forced to abandon the subsistence productive system: rice, beans, potatoes, cassava for crops that aimed at commercialization, such as wheat and soy (ZAAR, 1999).

In order to corroborate with the aforementioned authors, Stoffel et al (2014) points out that this happened at the moment when the progressive cultivation of soy and wheat was installed, with the incentive of mechanization of the lands, motivated by government aid, which financed the clearing of forests and the acquisition of machinery, thus consolidating a new form of agricultural production, basically focused on products that introduced greater integration and subordination of agrarian activities, agribusiness and state policies.

Over the years family farming has undergone several changes in its form of production, characterizing family ownership primarily in art. 4th of the Land Statute, Law No. 4.504 / 1964, in verbis:

> [...] II - Family Property - The rural property which, directly and personally exploited by the farmer and his family, absorbs their entire workforce, guaranteeing their subsistence, social and economic progress, with a maximum area fixed for each region and type of exploitation, and eventually work with the help of third parties (BRASIL, 1964).

A little later in 1993, with the publication of Law No. 8,629 / 1993 that regulates the provisions related to agrarian reform, the legislator conceptualizes the term “small property”, however it refers to it, only in terms of the size of its area, without any mention of family property, then the opportunity in agrarian legislation to resolve this issue is lost (JUNGSTED, 2019).

In 2006, Potrich and Grzybovski (2017) highlighted the definition of small family farms through the publication of Law 11.326 / 2006 that defines them as establishments characterized as having rural land not exceeding four fiscal modules, using family labor, small-scale production and income, mostly from activities produced in their own establishment, and as such, the small rural property can be understood as family farming, contrary to the concept of agriculture employers, which are basically characterized by large properties, large-scale production and the use of salaried or wheeled labor.

Thus, it is possible to identify according to Jungsted (2019) that the family property has its delimitation based on a medicated unit called 'rural module', while the small rural property is delimited by the unit of measure called 'fiscal module'.

Mendes' explanation (2020) about these modules should be highlighted, the similarity between them is due to the fact that both mention area units, which are expressed in hectares units, however, the rural module is a unit established by a rural property, where each one can have its dimension in hectares based on its shape, dimension, location in the municipality and the economic use that occurs in a given municipality by this property.

Finally, still mentioning the legislation pertinent to the concepts in question, it is worth mentioning art. 3, of Law nº 12.651 / 2012, current Forest Code, which defined it, in verbis:

> [...] V - Small family property or rural possession: That which is exploited through the personal work of the family farmer and rural family entrepreneur, including settlements and agrarian reform projects, and which meets the provisions of Article 3 of Law 11.326, of July 24, 2006 (BRASIL, 2012).

Therefore, according to Jungsted (2019) it is possible to find the small rural property without it being used exclusively by the family, however, it is understood that the family property is entirely linked to the small rural property, that is, not all small rural properties it is a family property, however, every family property is a small rural property.

2.2. FAMILY AGRICULTURE AS A SOURCE OF LIVELIHOOD AND ENVIRONMENTAL SUSTAINABILITY

Family farming can be considered as a source of livelihood and an income and employment-generating practice for rural populations. In this sense, the expansion

of policies that strengthen this activity in rural areas, becomes essential for the formation of a sustainable local development (ALMEIDA, 2016).

According to studies by Ehlers (2008), the notion of sustainability in family farming has the main objective of reconciling food security with the obligation to conserve natural resources, which demands, in addition to previously acquired knowledge, conventional agronomic knowledge integrated with systemic knowledge. , thus integrating several components of an agroecosystem.

To have a sustainable practice in family agricultural production, it is necessary, above all, the appropriate use of technologies, where they serve a local community in its various factors such as: use of fertilizers, soil preparation, resources for the appropriate harvest and aggregation of value to products, resulting in positive economic results, and, therefore, sustainable social results, where the sustainability of family farmers will depend solely on the interaction between all dimensions, social, environmental, economic, spatial and institutional (STOFELL, 2014)

Family farming is one in which the family, while owning the means of production, takes over work in the productive establishment. It is important to insist that this family character is not a mere superficial and descriptive detail, that is, the fact that a productive structure associates family-production-work has fundamental consequences for the way it acts economically and socially (SANTOS, 2014).

In Brazil, Law 11.326 / 06 of July 24, 2006 establishes the National Policy for Family Farming and Rural Family Enterprises, as follows, in verbis:

> Article 3 - For the purposes of this law, a family farmer and a rural family entrepreneur are those who practice activities in the rural environment, simultaneously meeting the following requirements:
>
> I - Do not hold, for any reason, an area greater than 4 fiscal modules;
>
> II - Use predominantly family labor in the economic activities of your establishment or enterprise;
>
> III - Have a minimum percentage of family income originating from economic activities in your establishment or enterprise, as defined by the executive branch; (Law 12.512, of 2011);
>
> IV - Run your establishment or enterprise with your family (BRASIL, Law nº 11.326 / 2006).

According to Noda (2006) family farming is also characterized with an emphasis on agricultural production for self-consumption, where production is aimed at maintaining the biological and social reproduction of the family farmer. In addition, the legally established area for the practice of family farming in Brazil is a maximum of four fiscal modules (MF), which according to the Brazilian Agricultural Research Corporation (Embrapa) is an agrarian measurement unit which represents the minimum area necessary for rural properties to be considered economically viable (LANDAU, 2012).

According to Vinciguera's conception (2014, p.8);

> family farming means the cultivation of land by a family, where the producer takes the products for his own consumption and for possible commercialization, the farmers being managers and workers of the land themselves. Cultivation is carried out by small rural producers, with labor in most cases the family, eventually complemented by wage labor.

Taking as a reference the data from the last Agricultural Census of 2017, it appears that there was a significant growth of family farming in the context of Brazilian agricultural production, compared to the Census carried out in 2006, in the 2017 Census, 3,897,408 establishments met the criteria of the Law and were characterized as family farming, representing 77% of the total establishments visited, occupying an area of 81 million hectares, that is, 23% of the total area of Brazilian rural establishments. As for the production value, it is possible to identify according to the census data that family farming is responsible for 23% of the total production value of the establishments (IBGE, 2017).

III. THE REFLECTIONS OF THE FOREST CODE IN THE LEGAL RESERVE AND PERMANENT PRESERVATION AREAS IN THE SMALL FAMILY FARMING PROPERTY

According to Law No. 12,651 / 2012, entitled Brazilian Forest Code, the owners and owners of rural properties must use their land respecting the limitations that general legislation and especially the Forest Code establish, of these limitations four are especially important and deserve due mention, they are: the APPs; the legal reserve (RL); areas of restricted use; and also, the prior

authorization of the competent body for the suppression of vegetation for alternative use of the soil (SILVA, MARQUES AND SAMBUICHI, 2016).

The legal reserve area is located inside the rural property, where the land owner has the obligation to maintain an area with native vegetation coverage, respecting a required percentage that varies depending on the biome in which the rural property is located, 80% of which when it is located in forest areas, 35% in cerrado areas and up to 20% in areas of general fields and in other regions of the country (BRASIL, 2012).

According to Law nº 12.651 / 2012 Brazilian Forest Code, the creation of legal reserve areas in family farming has the main objective of controlling the rampant deforestation of fields, promoting the more rational use of rural properties, conserving natural resources and biodiversity (MACHADO, 2010).

About this, Padovezi, et al (2018) comment that as to the location of the legal reserve, it is determined by the rural owner himself, however, it depends on the approval of the competent environmental agency, when approved it must be registered in the CAR and cannot be its location subsequently modified, except in cases of public utility or allocation in areas with better environmental function.

For Antunes (2015) the current Brazilian Forest Code is explicit in the characterization of the RL, since it is necessary for the sustainable use of natural resources, flora and fauna, and the person responsible for the area can enjoy it, as long as it guarantees its preservation.

They are delimited in art. 4 of the current Code, which thus provides, in verbis:

> Art. 4 - It is considered a Permanent Preservation Area, in rural or urban areas, for the purposes of this law:
>
> [...] the marginal strips of any natural watercourse (riverside riparian forest); around the springs and the perennial water eyes; around lakes and natural lagoons; around artificial water reservoirs; on slopes or parts of these with a slope greater than 45 °, on the tops of hills, hills, mountains and mountains, etc. (BRAZIL, 2012)

The Forest Code provides in its articles 4 to 9 the legal protection over APPs and lists several categories for each of them, defines the parameters of the protection range in which the vegetation must be preserved, and as a general rule, is that it cannot there should be economic exploitation of forest resources in these areas, with only access for people and animals to obtain water and to carry out activities with low environmental impact (BRASIL, 2012).

Therefore, according to the Forest Code, it is foreseen that the vegetation located in APP is maintained by the owner of the area, owner or occupier in any capacity, individual or legal entity, of public or private law, with emphasis on the fact that vegetation suppression has occurred. located in these areas, the person responsible for it promotes the restoration of vegetation, except for the authorized uses provided for in this law.

It is noted that in case of unauthorized suppression of vegetation carried out after July 22, 2008, it is forbidden to grant new suppression authorizations until the obligations provided for in Law 12.651 / 12 are not met.

As for the minimum lengths and widths of APPs, these are described in art. 4 of the Forest Code in force, however, each state and each municipality that has its own forest code can determine, according to their local particularities, different areas that must be investigated, thus, anyone responsible for a rural property that has the objective of to use these protection areas, before starting the deforestation process, you need to pay attention to the requirements of these rules and make them comply, and you must first of all request the necessary licenses to deforest at the competent environmental agencies (CÉSARO; FERREIRA, 2018) .

It should also be noted in art. 4th § 5 of the aforementioned Law, the permission for the planting of short-term seasonal and seasonal crops in areas of permanent preservation by small property or family rural possession, which thus provides, in verbis:

> § 5 - It is admitted, for the small family property or rural possession, referred to in item V of art. 3 of this Law, the planting of temporary and seasonal crops of short cycle ebb in the strip of land that is exposed in the period of ebb of rivers or lakes, provided that it does not imply suppression of new areas of native vegetation, water quality is preserved and the soil and the wild fauna is protected (BRASIL, 2012).

This time, they point out that APPs play a role in protecting water resources, which are mainly the stabilization of slopes and slopes, the maintenance of river morphology, protection against flooding, regulation of water temperature, the retention of sediments and nutrients and soil protection due to impacts caused by rains.

Corroborating with these authors, Chiavari and Lopes (2016) state that permanent preservation areas are necessary in order to preserve environmental services considered essential, such as water supply, geological stability and soil protection.

APPs form vegetation of essential importance for the maintenance of the environment, and predatory exploitation is not even susceptible to private properties, and their preservation is in the public and private interest, with both the owner of the rural property and the public authority the duty to protection and conservation, directly or indirectly, not allowing the degradation of springs, river banks and mountain slopes (CÉSARO; FERREIRA, 2018).

This time, APPs and RLs, according to Machado (2010) are distinct legal figures, equally created by Environmental Law, both limiting the full exploitation of rural property, both aimed at nature conservation, differing in the fact that the former cannot to be the object of exploitation, as it can occur in the case of the legal reserve, allowing the law for sustainable forest management, being an extremely important step in the conservation of ecosystems and of strict relevance to the quality of life on earth.

3.1. THE SPECIAL IMPACT OF THE FOREST CODE ON SMALL FAMILY FARMS

With regard to rural property management instruments, the most important innovation brought by the Forest Code was the creation of the CAR (Cadastro Ambiental Rural) at the national level, it is a mandatory electronic public record for all rural properties and aims to purpose to integrate the environmental information of rural properties and possessions, composing a database in order to control, monitor and combat deforestation of forests and other forms of native vegetation in Brazil (CÉSARO; FERREIRA, 2018).

Regarding the enrollment in CAR, the current Forest Code, in its art. 29 º thus provides, in verbis:

> [...] § 1 The registration of the CAR rural property must be made, preferably, at the municipal or state environmental agency, which, under the terms of the regulation, will require from the rural owner or possessor:
>
> I - identification of the rural owner or owner;
>
> I - proof of ownership or possession;
>
> III - identification of the property by means of a plan and descriptive memorial, containing the indication of the geographical coordinates with at least one mooring point on the perimeter of the property, informing the location of the remaining native vegetation, the Permanent Preservation Areas, the Use Areas Restricted, the consolidated areas and, if any, also the location of the Legal Reserve (BRASIL, 2012).

Registration with the CAR takes place through some data collection requirements, such as identification of the owner or rural owner, proof of ownership or possession and identification of the property through georeferencing, informing the location of APPs, areas of restricted use, reservation legal, consolidated areas, areas of remnants of native vegetation, such information will compose an electronic database that should point out environmental irregularities in the areas that must be protected, which can be remedied in accordance with the current Law (SILVA; MARQUES; SAMBUICHE, 2016).

Registration in the CAR is mandatory for the exercise of various rights such as obtaining authorization for the suppression of native vegetation, the calculation of APP in the areas of legal reserve, the maintenance of activities and consolidated areas, in addition to being mandatory for the concession of rural credit by all financial institutions as of 2017, as provided for in Article 78 - A of that Law. (BRASIL, 2012).

It is also important to mention, according to Césaro and Ferreira (2018) the PRA - Environmental Regularization Program that aims to adapt rural properties to the terms of the Forest Code, promoting the environmental regularization of areas consolidated in APP and legal reserve that were occupied with activities agrosilvipastoris, before July 22, 2008, based on Art. 59 of the aforementioned Law, determining that the adhesion to the program should be made within one year from its implementation by the state and extended for another year since the rural property be enrolled in the CAR.

In order to better understand the repercussion of the current code in force in the properties of the small rural producer, it is necessary to understand according to Césaro and Ferreira (2018) that the size of the rural area determines how many fiscal modules exist in each property, being the fiscal module a parameter for classifying the property as to the size of the area.

In this sense, the same authors mention that:

> Rural properties, depending on the size of the area, are classified by INCRA in Smallholdings, with an area of less than 1 (one) fiscal module; Small

> Property, area between 1 (one) and 4 (four) fiscal modules; Medium Property, area greater than 4 (four) and up to 15 (fifteen) fiscal modules and Large Property, area greater than 15 (fifteen) fiscal modules (CÉSARO; FERREIRA, 2018, p.83)

As previously stated, the registration of the property in the CAR is the first obligation on the part of the rural owners and owners, however, with respect to small rural producers, or owners of properties with up to four fiscal modules, the first difference in the process of environmental regulation is in the rules for the registration of the CAR, because for these smaller rural properties, the New Forest Code established a simpler process, in which only the presentation of a sketch for the identification of the rural property will be mandatory, indicating the perimeter, the APPs and the remnants of native vegetation that form the legal reserve, as provided for in art. 8 of the referred Law (SILVA; MARQUES; SAMBUICHE, 2016).

It is considered that if the occupation occurred after July 22, 2008, the regularization of these areas will be done without any advantage, following the general rules of the Forest Code, however, if the occupation with agroforestry activities took place before July 22 As of 2008, the regularization of these areas should follow special rules, even more flexible than those provided for larger properties, requiring adhesion to the PRA and the signing of the term of commitment (SILVA; MARQUES; SAMBUICHE, 2016).

Also according to Silva, Marques and Sambuiche (2016) the great advantage in regularizing areas consolidated in APP before July 22, 2008 for smaller properties is linked to the parameters of recomposition of APP vegetation, since in this case, the marginal strips protection varies according to the size of the rural property, and in consolidated areas of relief there is no need to compose the native vegetation of the APP.

It appears that these activities are carried out with practices that conserve soil and water, and as for the methods of recomposing vegetation in small rural properties, there are rules considered more beneficial, it can be done naturally or by intercropping of woody species. perennial or long-cycle native species with regional occurrences with exotic species, which may occupy a maximum of 50% of the total area, unlike the larger real estate areas, where the restoration of APP must be done with 100% of native species.

Finally, still citing studies by Silva, Marques and Sambuiche (2016), the biggest advantage granted by the Forest Code to small producers concerns the legal reserve, in rural properties with up to four fiscal modules, the occupation of the legal reserve area with activity rural area consolidated before July 22, 2008, there is no obligation neither to recover nor to offset the legal reserve, as provided for in art. 67 of the aforementioned Law, and yet, as an example of another advantage, the owners or possessors may issue the CRA (Environmental Reserve Quota) under the native vegetation that makes up the legal reserve while for properties larger than four fiscal modules, the CRA it can only be issued under native vegetation that exceeds the legal reserve. Observing then, that the advantages granted by the Forest Code in force to property owners are less rigid and with more simplified steps.

IV. CONCLUSION

The importance of small rural properties to Brazil is undoubtedly, the number of beneficiaries and the contribution to income generation is the differential for fixing man in the countryside, becoming essential for the economy, whether in grain production or in agriculture.

Research has shown that small family farms are essential as a source of family livelihood and are compatible with sustainable rural development.

The property is classified as a small rural property, according to Art. 4 of Law nº 11.326 / 06, it is considered a family farmer and a rural family entrepreneur: “one who practices activities in the rural environment, simultaneously meeting the requirements of not holding, in any case, area greater than 4 (four) fiscal modules.

Of the changes brought about by the current forestry legislation, it is important to highlight the changes regarding APPs, the areas of legal reserve and the requirement to register with the CAR, which proved to be of great relevance for agribusiness in general, specifically with regard to family farming, being able to reconcile the economic interests of small rural producers with protecting the environment through sustainability.

It should be noted that the main changes that the Code brings, the creation of the Environmental Regularization Program - PRA, with a view to reducing the legalization of producers in disagreement with the law, and new criteria for calculating the Permanent Preservation Areas. (APPs) and Legal Reserve (RL).

It is pointed out that Law 12.651 / 2012 presents innovations that allow an increase in the area available for economic activities, or, from another perspective, reduce the territorial requirements for environmental regularization and favor production activities.

The current Brazilian Forest Code was approved based on the prevailing argument that it was necessary to 'adapt' the environmental standard to the Brazilian reality, since 90% of rural landowners were irregular under the legislation of the time, in this case the Forest Code of 1965. The compliance with this Law is extremely important for the conservation of Brazilian biodiversity.

It is concluded that the Forest Code innovated by giving special treatment to small family properties, including releasing smallholders from constituting a legal reserve and permanent preservation area. Thus, the forestry legislation regularized the situation of thousands of smallholders and strengthened production and income generation.

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Diagnosis of the Knowledge of Students and Professors About Environmental Education - Case Study.

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***Keywords*— Education, Environment, Federal Institution.**

***Abstract*—** *The objective of this work was to investigate the treatment of the theme Environmental education in a transversal way with the students of the 1st periods of the courses of Buildings and Integrated Sanitation of the IFPE (Federal Institute of Education, Science and Technology of Pernambuco) - Campus Recife, under the perspective of awareness of these students, with mathematics as an important aid tool. The survey took place in July and August 2020, where questionnaires were applied through Google Forms to 80 students. In a second step, another form was sent to the teaching segment, in a total of 50 questionnaires. The questions addressed in the questionnaires to students led to points such as the perception of the existence of environmental problems, also seeking to analyze the degree of understanding of students in relation to mathematics as a support to environmental education. Subsequently, tabulation, statistical treatment and analysis of the data obtained through descriptive statistics were performed. The results revealed that a significant portion of the students came to understand that the environmental issue is not only a matter of nature, but also of society. Although, it should be noted that some of them can better understand what an environmental problem is than fully understand what the environment is. As for the professors, they demonstrated to relate to the current reality of the planet, however, a portion of this segment suggests that the structure of work to approach the theme is not so adequate.*

I. INTRODUCTION

When it comes to environmental education, discussions involving topics such as legislation, administration and geography are common. In this context, it makes sense to approach these themes. However, the discussion of this theme, like any other, would not be possible without the aid of mathematics, since it is inserted in all aspects that involve the need to quantify or qualify a result.

Environmental education is present in all schools. In Brazil, the National Environmental Education Policy (PNEA) - Law No. 9,795, of April 27, 1999, defines that environmental education must be present in a continuous, articulated and interdisciplinary way in all modalities of formal and non-formal education [1]. However, some research on environmental education practices in public

schools in the country portrayed the difficulties of professors to insert it in the school context [2].

Agenda 21, in its chapter 36, highlights environmental education as a process that seeks to develop a population that is aware and concerned with the environment and its related problems. A population that has knowledge, attitudes, skills, commitments, and motivations to work individually and collectively, seeking solutions to existing problems and preserving those that still resist and deserve more attention [3].

Also, according to [3], Environmental Education is an educational process, the purpose of which is to develop pedagogical instruments that expand educational practice so that man lives in harmony with the environment.

Based on this, the pedagogical work with Mathematical Modeling is an important instrument for the application of mathematics, in the environmental context, to solve real problems, since it uses the generation and need of data collection, aiming at the simplification of reality situations. Actions aimed at experimentation, visualization, interpretation, and forecasting, if the commitment to explore new things, has the consequence of producing knowledge, because when working with practical projects, we favor the construction of environments in which students are encouraged to do analogies and perform simulations, leading to the design of models that can be useful in representing different situations [4].

In this context, environmental education, and mathematics, in the context of modeling, becomes a strong ally, because through mathematics we can quantify environmental problems, obtaining a clearer view of the phenomena that are occurring in the environment, creating an opportunity to act in the sense to improve or modify some aspects related to the quality of the studied environment [5].

Prospecting (for an aspect of mathematics teaching) the degree of awareness and workability of the theme Environmental Education in the classroom at a federal public institution was the objective of this work.

II. METHODOLOGY

- Place of Study

The surveys were carried out in July and August 2020, at the Federal Institute of Science and Technology Education of Pernambuco IFPE - Campus Recife, but specifically at the Academic Department of Infrastructure and Civil Construction - DAIC (Block F). Campus Recife is in the Cidade Universitária neighborhood, in the city of Recife, Pernambuco, Brazil.

Currently Campus Recife has 7,856 students with active enrollments, distributed in courses of the most diverse modalities of classroom teaching: postgraduate, specialization, bachelor's, and technologist, subsequent, integrated and PROEJA (Youth and Adult Education Program) (IFPE, 2020 - data extracted from the Q-academic registration platform - IFPE's academic and institutional system).

- **The Questionnaire:**

To develop the research, questionnaires were adapted by the author and applied. There were questionnaires in electronic format, delivered via email for access through a link, generated through the Google Forms tool.

80 (eighty) questionnaires were applied to the student public - corresponding to the total number of students in the 1st period of both courses mentioned above. Of this amount applied, 75 (seventy-five) questionnaires were answered. 50 (fifty) questionnaires were applied to the teaching public, obtaining 44 (forty-four) responses as feedback. They are professors who teach classes to both courses (Sanitation and Buildings), of the most diverse curricular components, under the pedagogical perspective of what is proposed by the various Course Plans of the Institution.

The questions addressed in the questionnaires to students, led to points such as the perception of the existence of problems related to the environment, also seeking to see the degree of perception of these students in relation to mathematics as a tool and support to environmental education. To do so, evaluate and outline a general profile of this public to the topic discussed.

Likewise, the questionnaire to the teaching public granted and sought to evaluate the theme from an interdisciplinary perspective. In other words, how far professors (after a general outline) have advanced in the classroom about environmental education, based on the pluralism of ideas and pedagogical concepts from different sciences.

Thus, the procedure for carrying out this part of the work was then divided into two parts: first, an email was sent to the email address of each student and each professor, where the intention of this work was exposed, in addition to the links (form Google Forms) of the questionnaire - specific to each class. In the second moment, the tabulation and the due analysis of the data obtained were performed - through descriptive statistics. Thus, allowing the profile of both audiences evaluated.

The research result provides quantitative descriptions of the object of study and addresses associations between

the issues (the theme) and characteristics (social and cultural) of the audiences evaluated.

III. RESULTS AND DISCUSSION

- Students

A preliminary analysis of the data obtained (1st integrated period of the Sanitation and Buildings courses; N = 75 - number of questionnaires answered) made it possible to understand that a higher percentage, despite a not so significant difference, of the interviewees claim to be aware of definitions and issues related to the environment and environmental education. This suggests that these students have, despite starting high school, a relative critical sense about the topic. The observed results, in general, corroborate with [6], who signals that the environment started to be understood by the students, in its totality, under a globalizing perspective, without dissociating nature and society.

On the questions 'do you understand what the environment is' and 'can you understand what environmental problems are?', when compared, it is noticed that the interviewees tend to better identify an environmental problem, than to properly conceptualize what the environment is.

When asked about what they consider to be an environmental problem, given the options provided, almost 90% say that 'Sewage disposal in rivers and canals' is an environmental problem. 81.33% consider 'Emission of gases' as a bad environmental issue, followed by 80% consider 'Urban waste' and 50.67% 'flooding' (Figure 1).

Fig.1: Data obtained on "What do you consider an environmental problem?" - questionnaire sent to students in the 1st period - 2020 (courses on Sanitation and Buildings) - IFPE. Source: The authors (2020).

It is important to note that for none of the options mentioned in the question, unanimity (100%) was reached as an answer, which makes it possible to understand that a relative percentage, however significant, does not have full knowledge about what constitutes an environmental problem. The National Environmental Education Policy (PNEA) defines that environmental education must be present in the formal and non-formal educational process, having as objectives actions that will improve the quality of life on Earth.

However, when asked if there are environmental problems where they live, the percentage of positive responses is absolutely significant: 90.67% 'Yes. Exists': 6.67% answered that they do not know and 2.67% answered that it does not exist.

The practice of environmental education becomes increasingly necessary, especially in the school environment, as stated by [7]. Therefore, sensitizing children and adolescents, in the stage of cognitive training, is a promising strategy for achieving new results.

When asked who is primarily responsible for the emergence of environmental problems, approximately 75% claim that the Industrial sector is the protagonist, the Government takes second place with 62.67% of the respondents' opinion, and Society and Agriculture follow tied with 46.67% (Figure 2). It is curious to note that, when asked about who is responsible for solving these same issues, the interviewees thought that the Society was first (70.67%), subsequently the Government with 62.67%, followed by Industry and Agriculture, 30.67% and 24% respectively (Figure 3).

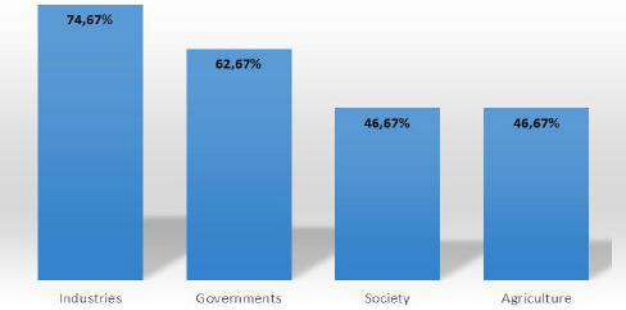

Fig.2: Data obtained: "Who are responsible for the emergence of environmental problems?" - questionnaire sent to students in the 1st period - 2020 (courses on Sanitation and Buildings) - IFPE. Source: The authors (2020).

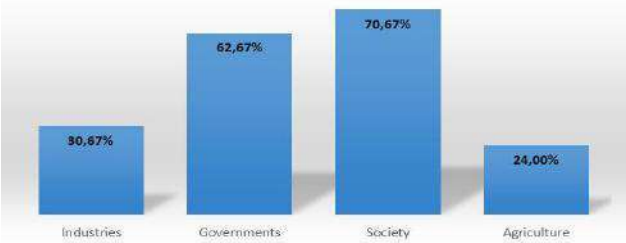

Fig.3: Data obtained: "Who are responsible for solving

these environmental problems?" - questionnaire sent to students in the 1st period - 2020 (courses on Sanitation and Buildings) - IFPE. Source: The authors (2020).

For Environmental Education to be considered, it is necessary to insert it into the educational universe. Thus, when understanding it as education, which is also understood as political action and, therefore, an activity that is not neutral and that reproduce conceptual differences related to Environmental Education with different philosophical-political and pedagogical references, determined almost always by society organization [8].

It is true that the environment is revealed as a privileged field for the educational process. Mathematics being understood as an instrument to understand and modify the reality experienced, as stated by [9].

In this context, the last two questions asked to students contextualize their perspicacity, by associating mathematics as a useful and efficient tool to reduce expenses involving water and electricity. Thus, seeking to mitigate impacts on the environment. Figure 4 shows the percentages obtained as responses.

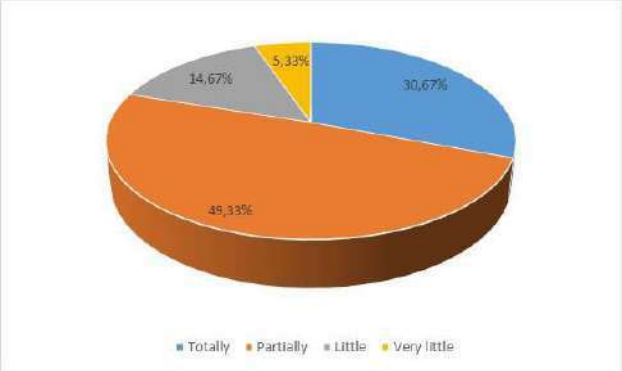

Fig.4: Data obtained: "Does mathematics contribute to solving environmental problems in your home?" - questionnaire sent to students in the 1st period - 2020 (courses on Sanitation and Buildings) - IFPE. Source: The authors (2020).

[10] states that when quantifying an environmental problem using mathematical instruments it is possible to visualize more clearly the phenomenon that is occurring in the environment, in addition to creating an opportunity to act with the intention of improving some aspects.

However, this instrument should not be used in isolation, but as part of the continuous educational process (interdisciplinarity), which results in transformative practices, considering that the classroom must be an idealized space where one can reflect and build understandings / concepts new and stimulating [11].

Often, school spaces, as well as didactic materials, do not contemplate (in their entirety) the student's reality, that is, they do not offer opportunities that make him perceive the environment in which they are inserted. The absence of these opportunities can make it difficult for these people to perceive and understand the environmental problems that exist and are experienced by each person in their communities. Therefore, school spaces (in an interdisciplinary and continuous way) must provide means for students to become aware, and acquire critical sense, through environmental perception, allowing them to understand the natural environment, and enabling them to change realities.

- PROFESSORS

According to [12], the Tbilisi Intergovernmental Conference on Environmental Education (1977) proposed as one of the basic principles of Environmental Education: applying an interdisciplinary approach, taking advantage of the specific content of each discipline, so that a global and balanced perspective is acquired. Due to the nature of the environment, given its multiple interactions, the issue of Environmental Education could not be dealt with in a single discipline. An important contribution in this aspect is contemplated in the National Curriculum Parameters through the transversality of the themes, whose environment is one of them.

With the intention of exploring what the evaluated teaching public thinks about the theme discussed above, the first statement of applied research dealt with the pluralism of pedagogical ideas and concepts, where the interviewees had to position themselves whether they agree or disagree, being for both positions (totally or partially). Among the professors evaluated, the theme of Environmental Education should be treated from an interdisciplinary perspective. Despite expressive unanimity, 15% say they partially agree. What may still be associated with little discussion and little incentive, on the part of the Institution's pedagogical management, for the professors to approach the theme in the classroom in a holistic way, exploring all possible teaching possibilities.

When asked if they have already had opportunities to participate in any event (activities, projects, etc.) related to the environmental theme (Figure 5), almost 50% claim to have participated less than 10 (ten) times; 22.73% claim to have participated more than 10 (ten) times; soon after, 18.18% said they had never participated in any event on this theme, and 13.64% participated only 1 (one) time.

Education needs to be practiced interdisciplinarily, however, it is known that the school system as it stands

does not favor working together. The school, the Institution are compartmentalized. According to [12], "universities are divided into departments, knowledge is divided into disciplines, and so on. We share everything and lose track of the whole". In all areas of education, the interrelationship between different subjects favors enrichment when addressing the theme.

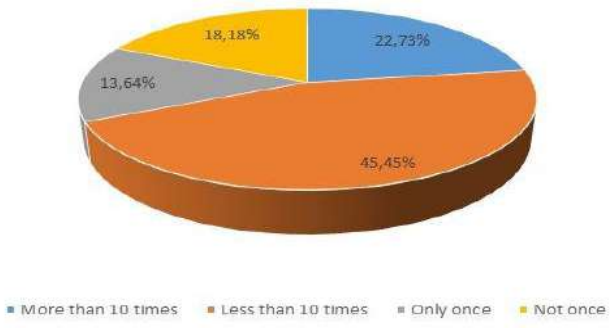

Fig.5: Data obtained: "Have you had the opportunity to participate in any activity and / or project related to the Environment theme?" - questionnaire sent to professors related to the Sanitation and Buildings courses - IFPE. Source: The authors (2020).

[13] warns that it is necessary for the school to be prepared to incorporate the environmental theme in a coherent way, without falling into the trappings of fads, as the development of activities related to environmental issues is a requirement for the school to fulfill its function Social.

In this regard, the work also sought to understand in which activities the professors participated most, related to the environmental theme. The survey provided four options for professors to identify themselves, making it possible for the interviewee to select all the themes (if any) proposed in the question. Activities related to Sustainability had the highest percentage (72.97%), among the others: Recycling (54.05%), Environmental Preservation (48.65%) and Conscious Consumption (40.54%).

The National Environmental Education Policy, established in Law 9795/99, bases environmental education as an essential and permanent component of national education, and must be present (in an articulated way) at all levels and modalities of the educational process, in a formal and non-formal, which should be developed as an integrated, continuous educational practice involving all professors [14].

[14] in the proposition of Law 9795/99, the environmental dimension must be included in professor training curricula, at all levels and in all disciplines, and in postgraduate courses, extension courses and in areas focused on the methodological aspect environmental education, when necessary, the creation of specific discipline is allowed. It also adds that active professors should receive complementary training in their areas of activity, with the purpose of adequately meeting the principles and objectives of the National Environmental Education Policy (PNEA).

In 2012, the National Curricular Guidelines for Environmental Education (DCNEA) were established to reaffirm the relevance and mandatory nature of Environmental Education in basic and higher education, in addition to highlighting its interdisciplinary approach (BRASIL, 1999).

According to [15], environmental educators do not say the same thing, much less have the same objectives in dealing with the environmental issue, as they are based on different worldviews. Therefore, as stated by [16] there is no consensus between the fundamentals of Environmental Education, as it is constituted from multiple worldviews.

The proposal of the National Curriculum Parameters (PCN) is to incorporate, through conventional disciplines, the transversal themes to establish a relationship with reality and allow the possibility of pedagogical work that involves political-social engagement with knowledge and training aimed at citizenship [17].

[18] states that the basic text in offers more concrete elements for application to different areas of knowledge, does not point out possibilities on how to work on the theme, does not demonstrate the interfaces of Environmental Education with the disciplines, does not present concrete situations of action, does not it indicate and nor guides educational and cultural activities that imply effective changes in the environment.

Faced with this discussion, the research sought to discover which tools are used by professors to deal with the theme in the classroom. Data obtained according to Figure 6.

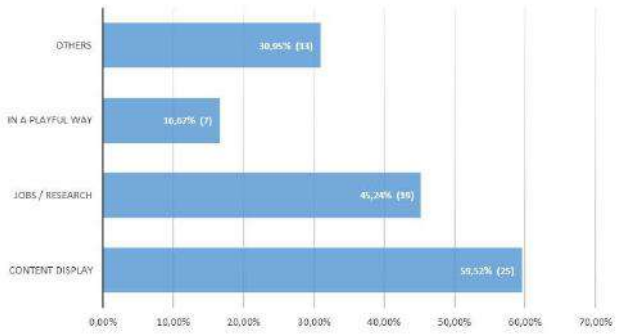

Fig.6: Data obtained: "Dear professor, if the topic is addressed in the classroom, in what way (s) do you expose

it?" - questionnaire sent to professors related to the Sanitation and Buildings courses - IFPE. Source: The authors (2020).

In the school context, the challenge is also to find ways that awaken in the student public the desire to conserve and protect the environment, as well as participate in relationships that can benefit the recovery of degraded environments and the protection of natural resources. One way is to use innovative methodologies in the teaching-learning process.

Currently, the process of knowledge development involves the transition from concrete to abstract and back to concrete, forming a cycle. Mediation in this process is carried out by abstractions, where thought moves away from concreteness as a necessary condition to approach it, to act on it [19].

Therefore, it is important to develop practices to promote concrete awareness of the environment from an early age. The school has a fundamental role in the development of quality Environmental Education, recognizing the environment as a heritage of all.

Programs such as Eco-92, Agenda Rio + 20, and now Agenda 2030 are promoted by the United Nations (UN), and promote (on a global scale) debates and shared social governance actions for sustainable development. In this perspective, in the teaching-learning process, each being must be aware of their rights and duties.

Educators must be involved in the construction of knowledge, being essential for the formation of citizenship since Environmental Education is a pedagogical practice. Since this practice is not carried out in isolation, as stated by [6], but in the relations of the school environment, in the interaction between the different actors, conducted with zeal and excellence.

Based on the principle that the school should contribute to the formation of citizens who are sensitive and aware of the environmental cause, teaching should be organized in a way that creates opportunities and allows the student (the student public) to use knowledge actively about the environment, through participation in activities within the school and in its communities.

IV. CONCLUSION

The research developed aimed to investigate, and to counter - when necessary, the degree of involvement of the teaching and student audiences, both related to the 1st integrated periods of the Building and Sanitation courses (entry 2020.1) - Campus Recife - IFPE, with issues related to the Education theme Environmental versus Mathematical Modeling. As well as it highlighted and sought to understand important factors (mainly political and sociocultural) that define profiles of both audiences interviewed.

It can be said that the educational process is always under construction, gradually overcoming errors and adding efforts to assume a more effective attitude, with regard to the teaching-learning dichotomy. In view of the data obtained as responses to the applied questionnaires, the critical perspective on Environmental Education, with regard to the student audience, is positively reasonable. What is consistent to affirm that the school (preferably in an interdisciplinary way) has an important role to be fulfilled: to enable these students to have a full, holistic, and solid understanding of all aspects of this theme.

In this way, the formation of critical, conscious and reflective subjects (citizens) on the environment theme, will certainly provide possible changes to the current development paradigm that has aggravated the environmental problem.

Regarding the teaching public, it appears that they are (in general) sensitive to the theme. Positioning themselves willing to work on the theme of Environmental Education in an interdisciplinary way, although they recognize that there are obstacles that seriously hamper the cross-sectional discussion on the subject. Perhaps the result of a possible mismatch between theories, methodologies, pedagogies and applicability.

It was also found that one of the great challenges for the insertion of Environmental Education in schools is precisely the lack of a greater incentive, and constant training for this teaching public, about environmental issues. It should be noted that schools, in general, have not adapted (sufficiently) to develop interdisciplinary projects as suggested by law 9795/99 - the National Environmental Education Plan (PNEA).

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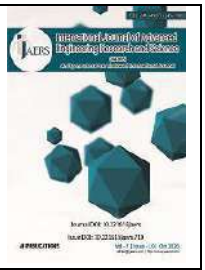

Systematization of nursing assistance to a newborn with congenital malformation – Experience report

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Abstract**—** *Objective: to report the experience of applying nursing care systematization to a Newborn with congenital malformation. 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. The Nursing Care Systematization was applied to a Newborn with indication for cesarean delivery due to premature amniorrexis and polydramnium and presenting congenital malformation mainly in the face region and who was admitted to the Neonatal Intensive Care Unit in a teaching hospital reference in maternal*

***Keywords*— Nursing, Nursing Process, Congenital Abnormalities.**

and child health in the City of Belem-PA/ Brazil. To build this report, if needed-five times: at first, there was a knowledge of the pregnancy story acts l of the mother, the second time, created a care plan, not the third time, were applied the Nursing Diagnostics of the North American Nursing Diagnosis Association International (NANDA-I), in the fourth moment, the Expected Results were demonstrated, finally, in the fifth, the pertinent nursing prescriptions were scored. Results: Patient followed in critical condition, monitored, sedated and under the care of a multidisciplinary team in palliative care because his clinical picture with anomalies incompatible with life after the end of the stage, it was reported that the infant died. Conclusion: The Systematization of Nursing Assistance made it possible to plan the creation of a care plan geared specifically to meet the user's demands, through the listed nursing problems, providing quality in the development of care and user satisfaction.

I. INTRODUCTION

The nursing process is a scientific method that is designed to take care of in the best way of human being, based on a care individualized and systematized that provides user observation altogether. In this scenario, use the systematization of nursing care as an essential nursing action to strengthen health care (MARINELLI, SILVA, SILVA, 2015).

Good nursing care is provided by the use of SAE; this tool helps organization of services by providing quality in the care management and work organization process to be developed by the nursing team (SILVA, GARANHANI, PERES, 2015).

Thus, nurse faces a great challenge when structuring and implementing their care practice. Perform nursing actions in perspective of maintaining, restoring and promoting quality of life, is influenced by the organization of activities and services to be developed, besides being weakened by a line of fragmented care by a multidisciplinary team heterogeneous with a predominance of curative and medication practices. (SOARES, 2015).

Furthermore, the cost of care for children with malformation and who need special attention to their needs is a process that requires competence and skill on the part of health professionals, especially nurses, as it requires humanized and resolute assistance that guarantees quality and satisfaction. (VEIGA, NUNES & ANDRADE, 2017).

Congenital anomalies are caused by morphological defects that are present at birth and occur by a number of errors in morphogenesis, is characterized by malformations, ruptures, deformations and syndromes. Given

these circumstances, it is essential that nursing care is carried out with quality and provided according to the needs of each individual, regardless of their health-illness condition. (MELO, PACHECO, 2013).

In Brazil, congenital malformations are the second leading cause of neonatal death, with a rate of approximately 22.8% of deaths. Thus, this research is justified given the need to encourage health practices, by all professionals, especially nursing, in humanized care for newborns with malformation. (FONTOURA *et al*. 2018).

The objective of this study is to report the application of the experience of systematization of nursing assistance (SAE) to a Newborn with bad training congenital.

II. METHODS

This is a descriptive study, with a qualitative approach, an experience report type. The study was carried out through the monitoring and daily volume of a newborn with congenital malformation. The sample selection followed the nonprobabilistic criterion, where the participant was included in the study for convenience. SAE was applied to a newborn with an indication for cesarean delivery due to premature amniorrhexis and polydramnium and presenting congenital malformation mainly in the face region and who was admitted to the neonatal Intensive Care Unit (NICU) in a teaching hospital that is a reference in health maternal and child in the City of Belem-PA / Brazil.

Applied to the SAE clinical nurse the Obstetric Center, along with students from the 9th period of the course Bachelor Nursing a Higher Education Institution who were experiencing supervised in that hospital. The consultation took place on 07/23/2020, shortly after the indication of cesarean delivery of the child's mother.

In order to construct the present report, five specific moments were needed, namely: in the first moment, there

was a knowledge of the history of gestation of the pregnant woman by the academics, presented by the nurse in the hospital's ward sector. The interns had the opportunity to carry out the client's admission to the infirmary and get to know her background in depth and, then, plan and systematize the nursing care to the client.

Then, in the second moment given the indication of transfer to the Surgical Center, where the delivery took place in a cesarean section, the students were able, together with the whole team and mainly with the help of the nurse, to build a care plan that was carried out by providing transoperative care to better serve the mother and child binomial.

In the third moment, the Nursing Diagnostics of the North American Nursing Diagnosis Association International (NANDA-I) were applied. In the fourth moment, the expected results were designed according to the demand of each problem found during the expenses of nursing care. Finally, in the fifth moment, persistent nursing interventions and prescriptions were scored.

III. RESULTS

It is reported that all available and possible nursing care was carried out, with a view to providing students with learning and showing interest, respect and commitment to the Systematization of Nursing Care for the newborn. The user's SAE is then reported: newborn, born on 7/25/2020, cesarean delivery with cephalic presentation, 39 weeks, weighing 2,888 grams and APGAR 9/9 at birth, 39-week, height of 49 centimeters, head circumference of 33 centimeters, thoracic of 30 centimeters and abdominal of 31 centimeters. He was admitted to the NICU due to the diagnostic impression that, in addition to the congenital malformation, he had neonatal seizure and the Infection Related to Late Health Care by Klebsiella pneumoniae bacteria found by blood culture and Pressure Injury in the Occipital region. Waiting for the Karyotype result to determine the malformation.

First evolution of Nursing:

Lactente Serious infant with congenital malformation, Ramsay 6. On physical examination: clean and intact scalp, with pressure injury in the occipital region. Clean and integrated nostrils and ear. Absence from the eye. Asymmetrical face, pale oral mucosa, cleft palate. Intubated in mechanical ventilation. Ventilatory mode: Invasive mechanical ventilation: Inspiratory pressure:18, Positive and expiratory pressure: 0.6 centimeters/h2O, Inspiratory oxygen fraction: 50% progressive respiratory fraction: 35 repetitions per minute, Partial Respiratory rate, Peripheral Oxygen saturation: 91%. Symmetrical chest. Lung auscultation: vesicular murmurs present and snoring. Cardiac Ausculta: 2 – stroke normophonetic heart sound with improved murmur, heart rate: 114 beats per minute. Temperature: 37.4 Celsius, satisfactory peripheral perfusion. Receiving infusions for left axillary phlebotomy: human albumin, Lasix, caloric intake 8.6 milliliters/hour. Makes use of ciprofloxacin, phenobarbital. Clean and well fixed dressing Central venous access. Flaccid and normotensive abdomen. Receiving enteral diet by orogastric infusion pump of 15 milliliters in 3/3 hours, clean and jaundiced skin. Lower limbs with edema. Spontaneous diaper elimination functions. Follow the care of the team.

Second evolution of Nursing:

Severe labile infant, intubated in support of Invasive mechanical ventilation, maintaining ventilatory parameters. Hipoactive, hyporeactive, pale, acyanotic, letified perfusion, kept in heated isolette, protective nest, continuous parameterization of vital signs. Tolerating an orogastric tube diet, with a volume of 14 milliliters. Flaccid and normotensive abdomen. Receives caloric intake for functioning left axillary phlebotomy. Using oxacillin and piperacillin. Occlusive dressing at the former CLD site. Change dressing in the occipital region installed CGF hydrocolloid plate, next change on 07/16 or before saturation. Intensify air change in decubitus.

IV. DISCUSSION

Were applied for each nursing problem found A Nursing Diagnosis, calling Standard Affected and the Basic Human the newborn need, as well as its SAE with results Expected and Nursing Interventions. There is, then, the following Assistance Plan.

1st EP: Orotracheal intubation. NHB: Oxygenation. DE: Aspiration risk, related to mechanical ventilation. RE: it is expected to avoid accumulation of secretions in the airways. IE: Monitor level of consciousness, cough reflex, nausea and ability to swallow. Keep vacuum available. Perform aspiration once every shift or when necessary, using aseptic measures.

2nd EP: Invasive Devices. NHB: Skin integrity Mucosa. DE: Risk of infection. Related to the presence of Invasive devices. Results Expected: It is expected that newborn does not develop Infections will predict levels. Nursing interventions: Assess condition at the catheter incision site every 6

hours. Monitor signs and symptoms of infection (edema, hyperemia, heat, flushing, hyperthermia). Hand

wash with alcoholic gel before and after each procedure. Perform disinfection with 70% alcohol in intravenous devices (equipment, burette), before administering medications. Apply the fever scale and when administering medications.

3rd PE: Orogastrica probe. NHB: Nutrition. A: Standard ineffective infant feeding, associated with the m l congenital malformation and characterized by inability to coordinate sucking. Results Expected: It is expected to maintain the appropriate Nutritional parameters. Nursing Interventions: Monitor and evaluate the presence of intestinal noises every four hours or as needed. Monitor the hydro electrolytic condition every six hours; monitor the change in height and weight every 48 hours; monitor the presence of edema or dehydration.

4th EP: Pressure Injury. NHB: Security / protection. DE: Impaired skin integrity, characterized by Pressure Injury, related to the long stay in bed. Results Expected: Expected adequate wound healing in at fourteen days and prevent infection. Nursing interventions: Perform adequate dressing; Observe signs and symptoms related to infection; perform decubitus changes every three hours and use a pyramidal mattress while in bed.

5th EP: Jaundice. NHB: Nutrition. DE: Neonatal hyperbilirru binemia characterized by related abnormal blood profile Bacterial infection. RE: expected to ensure the safety of the infant IMP therapy l emended in order to prevent possible complications. Nursing interventions: Perform phototherapy on the newborn. Check the light intensity daily. Monitor vital signs according to the protocol or whenever necessary. Change the newborn's position every four hours or according to the institution's protocol. Monitor serum bilirubin levels according to the institution's protocol or at the request of the responsible professional.

6th EP: Neurological damage. NHB: Nutrition. Results Expected: Ineffective infant feeding pattern characterized Inability to coordinate sucking, swallowing and breathing R related to congenital malformation. Nursing interventions: Raise the decubitus position by 30º; observe tolerance to the offered diet.

The patient remained in critical condition, monitored, sedated and under the care of the multidisciplinary team in palliative care, as his clinical condition with anomalies were incompatible with life, after the end of the internship, he was informed that the infant died.

V. CONCLUSION

The Nursing Care Systematization made it possible to plan and create a care plan aimed specifically at meeting the user's demands, through the listed nursing problems, providing quality in the development of care and user satisfaction.

This study raises reflections on the importance of SAE in the care of pediatric patients who live with congenital malformation, since these anomalies require differentiated care, with specific care, often at the hospital level, in which nursing care it's essential.

For this to happen, it is necessary to exercise theoretical bases that support nursing actions in their practice, supported by nursing theories, humanization, excellence and indissociation between the theory and practice of care, which have as their starting point the Nursing Process to elaborate the SAE giving quality to the assistance.

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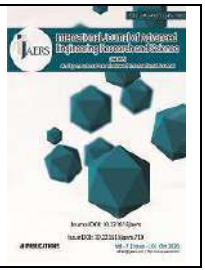

Study of the Relationship between Sports Efficiency Index and the Classification Performance of the Clubs of the Brazilian Championship Series A

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***Abstract*—** *The performance of soccer clubs in Brazil has shown a significant evolution in the last decade. Considering the competitiveness of the market, there is a need to act as companies using sustainable management models. In fact, the purpose of sports institutions is to obtain titles and good results that allow them to generate greater revenues and make expenses and investments in search of perpetuity and ascension of objectives. In this sense, this survey compared the Sports Efficiency Indexes with the soccer clubs' Classification Performance, in the classification tables of the Brazilian Championship in the years 2017 and 2018. In order to meet the objective, data wrapping analysis (DEA) and Kendall's correlation coefficient were applied for evaluate investment performance. The results showed that in the period analyzed there was significant parity ration in part of the results found, since many clubs reached a position in the corresponding tournament with the ranking of sports efficiency. Then, it concluded that the better is the sporting efficiency team, the better its ranking in the championship. Searching for an efficient allocation of resources, the research seeks to contribute attesting to the need for a detailed examination of expenses and investments in the perspective of better results.*

I. INTRODUCTION

Considered one of the most popular sports on the planet, soccer attracts a crowd of fans, especially in Brazil, especially in the dispute for the title of the Brazilian championship (Roboredo, Aizemberg & Meza, 2015). Such popularity, in the last 20 years, has become the clubs not seen as sports organizations, becoming large corporations in view of the exorbitant revenues obtained, revenues coming mainly from sponsors, television stations, negotiation of players and tickets, among others (Ribeiro & Lima, 2012).

Currently, the literature recognizes the importance of combining financial results with the sports factor, these two elements being part of the objectives of financial and administrative management of clubs (Barros, Assaf & Sá-Earp, 2010).

A soccer club aims to achieve sporting success by winning and winning titles, but like any other entity in other sectors of the economy, to remain in operation it needs financial balance.

Due to the increase of interest in the financial situation of the clubs and their management (especially sponsors, investors, fans and government), and due to the

society's demand for more transparency in management, in 2003, Law n. 10.672/03, made it mandatory for sports entities to disclose the financial statements in newspapers with wide circulation. This made soccer, which was a sport managed partly in an amateur way, need to professionalize management (Leoncini, 2001). However, after the implementation of the legal requirement, the level of quality and the low standardization of the statements are factors that make it difficult to conduct studies, especially comparative (Dantas & Boente, 2012).

Soccer clubs seek satisfactory financial results, capable of self-maintenance and survival. Better results occur from a result of sporting success, such as championship achievements (Haas, 2003). In this scenario, the level of efficiency of the clubs, can and should be measured through performance from both perspectives (Espitia-Escuer & García-Cebrián, 2010), both in the financial search and in the sports field. In this sense, it also considered the evidence of non-financial performance indicators, the focus of the study by Benin, Diehl and Marquezan (2019) that indicate a positive relationship between the level of disclosure and the size of soccer clubs.

On the studies of investment efficiency, Dantas, Machado and Macedo (2015) complement that such practices have become one of the major goals of soccer management, taking into account the concern of clubs in reconciling spending with performance, both in economic-financial and sports achievements.

The good management of available resources, conscious of obtaining good results on the field, is believed to be the recipe of an efficient team, therefore it is questionable: in observing the results of the indicators of sports efficiency of the clubs participating in the Brazilian Championship, can be said to be the same reflected in the sports performance of teams throughout the competition?

Based on the above, this work aims to compare the rates of sports efficiency obtained through the Data Envelopment Analysis (DEA) technique, capable of evaluating the performance of a company, and perform a comparative analysis with the final positions of the teams in the classification tables of the Brazilian Championship in the years 2017 and 2018.

The choice for the Brazilian Championship is justified because it is one of the most profitable championships in the world, according to a study conducted by BDO (2018). Adding the 25 clubs, being 20 members of Series A of the Championship played in 2017 to another 5 members of Series B of the same year, it reaches an amount of R$ 5,243,000,000.00 (five billion two hundred and forty-three million reais), with an increase of 60% in the last 5 years. As for the subject, Guzmán (2006) already testified, indicating that there are few studies in the field of sports efficiency analysis, due to the difficulty in accessing the demonstrations, and even the lack of some.

II. LITERATURE REVIEW

Soccer hasn't been seen by the market only as an activity in which groups of fans had fun watching the teams play ball and aiming for victories. The passion of the fans has always moved the sport to high levels, with the consolidation of capitalism, and since the 1980's with the media and the evolution of the media, soccer has seen profound possibilities within an economic vision. (Perruci, 2006).

Seeking to increase profits and revenues, soccer clubs have sought several ways to raise financial resources through external means, such as marketing actions with players and brand exploitation. It is known that the purpose of clubs is to achieve good results and consequently titles, but their management in the search for the maximization of good results, must effectively manage the available resources, in order to achieve satisfactory financial and sports results, aiming at the perpetuity of the business. (Pereira, Corrar, & Lima 2004).

Barajas, Fernández-Jardón and Crolley (2005) point out that in the sports environment, unlike other sectors, performance is directly connected to the invoicing, but with a refined control of expenses and costs, profit must be achieved. However, in the sports field there is still no policy that balances costs in an elucidated way.

As Espitia-Escuer and García-Cebrian (2010) state, profits maintain the survival of a club, increasing as consequence of the increase in income, which comes from sales of tickets to the stadiums, sponsors and broadcasting rights. These, magnitudes directly proportional to the performance of the clubs in the championships they compete in the season.

However, these are not only the forms of income obtained by the big clubs there is also the stock market. Dantas, Silva, Steppan, & Oliveira (2009), point out there are, approximately, 38 worldwide clubs have their shares traded on stock exchanges in several countries. In Brazil, any club has open capital in the stock market due to the club-company model has not adopted in the country. Moreover, Dawson and Dobson (2002) point as the basic theory for the study of the efficiency of the sports sector the Theory of Human Capital (Becker, 1962). According to the theory, a combination of factors generates human capital, coming from a collective and individuals, which

encompasses a set of skills, technical knowledge, and personal knowledge of the individual (Dawson & Dobson, 2002; Abeysekera & Guthrie, 2004; Unger, Rauch, Frese, & Rosenbusch 2011). About this, Unger et al. (2011) state that there are a number of positive relationships between the firm's success and human capital, as these help the firm to raise other resources, such as physical and financial capital, accumulating new skills and knowledge.

As Baroncelli and Lago (2006) approached, soccer clubs seeking to simultaneously achieve good sports results and good financial management under the perspective of Sustainable Management, should excel by establishing a "Virtuous Cycle", described in Figure 1:

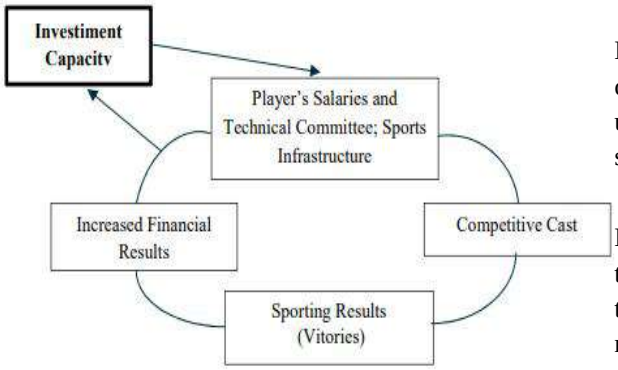

Fig.1: Virtuous cycle between sporting and financial results

Source: Adapted from Baroncelli & Lago (2006).

According to Garcia-Sanchéz (2007), the issues are discussed, based on central economic visions, mainly in relation to efficiency and effectiveness, which in the soccer economic industry, must be taken into account the fact that it is the passion of the fans for the club, driven by the good results obtained on the field, which foster this industry.

In this sense, the Index of Efficiency under the perspective outcome of the outputs of a management process, leads us to examine the possibility of reaching titles with lower spending or even more efficient allocations, while recognizing the importance of components or inputs for the calculation of the index that is based on expenditures and investments. The main components are mentioned below:

a. Cost of Social and Sports Activities - Salaries, charges and benefits to employees; Expenses with games and competitions; Right of image; Expenses with negotiations of athletes; Amortizations and retirements of rights over players; Transfer of economic rights; and Professional Services.

b. Administrative and Commercial Expenses - Salaries, charges and benefits to employees; Miscellaneous agreements (labor and tax enforcement); Advisory, consulting and participation; and Provision for contingencies.

Following Gúzman and Morrow (2007), some operational research techniques, focused on efficiency measurement, in several sectors of the economy were incorporated the performance research. As far as the sports sector is concerned, there are two objectives to be maximized: the financial result and the sports result, so most of the relevant work that was carried out on input-output analysis was concentrated on production processes.

In the last two decades, studies have relied on the Data Envolvement Analysis (DEA) method, a method capable of measuring the efficiency of decision-making units (DMU), as a technique for measuring financial and sports efficiency.

Many studies originated in the Premier League, England's first soccer division, and one of the most traditional leagues in the world. Soon after, it extended to the other major European leagues, all using the DEA as a method. However, the studies in Brazil began in the last 10 years, noting a tendency of some authors to explore the measurement field of sports and financial efficiency. Chart 1 presents the main researches that used the DEA to study the efficiency of soccer clubs, inspiring this study.

Chart 1 - Studies conducted with the DEA method.

Authors	Sample
Haas (2003)	Premier League (Inglaterra) – 2000/01
Haas, Kocher e Sutter (2004)	Bundesliga (Alemanha) – 1999/00
Guzmán (2006)	La Liga (Espanha) – 2001/02 e 2002/03
Jardin (2009)	League 1 (França) – 2004 a 2007
Barros, Assaf e Sá-Earp (2010)	Brazil – 20 clubs – 2006 e 2007
Hamidi et al. (2011)	Premier Football League (Irã) – 2009/10
Dantas e Boente (2011)	20 largest in the world (Forbes) – 2008/09
Dantas e Boente (2012)	Brazil – 14 clubs – 2006 a 2009
Nascimento et al.	Brazil – 13 clubs – 2006 a 2011

(2015)	
Dantas, Machado e Macedo (2015)	Brazil – 36 clubs – 2010 a 2012
Freitas, Farias e Flach (2017)	Brazil – 25 clubs – 2014
Salles et al. (2018)	European Football – 2015/2016

Source: Research data.

The results obtained vary according to the inputs and outputs used with the DEA method in each survey. Haas, Kocher and Sutter (2004), using as input, the wages of the players and the coach, as output, the points earned the total revenues and the average use of the stadium, did not obtain a correlation of results between the efficiency index and the placement of clubs in the German championship in the 1999/00 season. Guzmán (2006), using the Spanish league as a base, observed through the DEA that Spain's professional soccer clubs in financial performance, based on a goal to obtain revenue, few approached the efficiency frontier. While Jardin (2009) noted that in the French championship from 2004 to 2007, the best teams on the table, which had the most championship titles and consequently the highest revenues, were not efficient. Having as the first source of inefficiency of Ligue 1, the excessive investment as the main problem, in the period analyzed.

Barros, Assaf and Sá-Earp (2010), analyzed the Brazilian soccer championship in order to estimate the efficiency index with the DEA. The performance of the clubs derived from the DEA, showed that Brazilian clubs operate with a high degree of inefficiency. Always taking into account the inputs and outputs used in the research. To

Dantas and Boente (2012), through a DEA (BCC) model, seeking to analyze the efficiency of the expenditures of the main Brazilian soccer clubs in obtaining revenues, as well as whether these expenditures were important in obtaining titles in the period analyzed. Among the clubs in the sample, Internacional proved efficient in both aspects analyzed (financial and sports). Nascimento et al. (2015) through data obtained from the 13 highest revenues of Brazilian soccer clubs, in the period 2006 to 2011, using the Data Envolvement Analysis (DEA), aiming at financial efficiency, noted that Figueirense was the most efficient club in the sample, even not having won any title in the period analyzed.

Freitas, Farias and Flach (2017) analyzed the efficiency of 25 Brazilian soccer clubs in revenue generation, and the reasons that lead the clubs to obtain them. Using as input the total assets and operating costs, and as output the operating revenue, using a sample of the years 2012, 2013 and 2014. The authors found that Gremio, Palmeiras and Vasco were not efficient in any period analyzed.

DATA ENVOLVEMENT ANALYSIS (DEA)

Data Envelopment Analysis (DEA) is a non-parametric mathematical method introduced by Charnes, Cooper and Rhodes (1978), and extended by Banker, Charnes and Cooper (1984), used to measure the efficiency of certain Decision Making Units (DMU's), in various sectors of the economy, such as business companies, government agencies, hospitals, universities, among others.

The DEA is a generalization of a work introduced by Farrell (1957), where it measures the efficiency of DMU's (Decision Making Units), which seek to obtain the best result (output/output), using the same inputs (input/input). It can be considered as a quantitative, non-parametric and empirical method, which aims to measure the level of relative efficiency, using the DMU in the estimation of the best production boundaries (Guzmán, 2006).

According to Jamasb and Pollitt (2002), the DEA may be oriented to output e input oriented, having two possibilities, Variable Returns to Scale (VRS) or as a Constant Returns to Scale (CRS). The choice of where the sample will be directed, i.e., whether it will be directed to the input, or to the output, is required. According to Macedo e Almeida (2009, p. 33) when directing the input one seeks to "maximize product quantities, that is, to maximize a linear combination of several company products". The output orientation, on the other hand, seeks to minimize the amount of inputs for production (Macedo, 2004).

The CRS or CCR model (Charnes, Cooper and Rhodes) applied when an input increase, consequently makes a proportional increase in the output. The VRS or BCC model (Banker, Charnes and Cooper) is applied when not necessarily an increase in input, makes a proportional addition to the output (Dawson, Dobson & Gerrard, 2000).

Finally, following the objectives of the research, it is necessary to distinguish the concepts of efficiency and effectiveness, we have the vision of Peña (2008) that states that efficiency, is the best way within the process, to unite the inputs to generate the maximum output (product) in the end. With the ability to minimize, in a correct way, the ratio of inputs and product, being the effectiveness linked to the achievement of a goal, understanding the capacity to achieve it, having previously desired it. (Mello et al., 2005).

III. METHODOLOGY

The research was characterized in relation to the objective as descriptive, that according to Raupp and Beuren (2003) this type of research aims to describe the characteristics of a population and to identify relationships between variables.

As far as procedures are concerned, the research was defined as documentary, since financial statements of Brazilian soccer clubs were collected and included in the study. Gil (2009), argues that the purpose of this type of research, is to analyze the documents collected regarding the object of study, building and confirming hypotheses. As for the approach and treatment of data, this research is characterized as quantitative, using quantitative methods for data collection and analysis (Raupp & Beuren, 2006), in the case of this research, DEA and Kendall correlation.

Every year 20 clubs dispute the A and B Series of the Brasileirão, corresponding to the first and second divisions, respectively. The last 4 clubs in the Series A table, after the end of the championship, are relegated to the second division. In the B Series, the top 4 guarantee a place in the first division of the championship, obtaining the relegated clubs' place, for the dispute of the A Series next year.

Thus, the sample studied uses the financial statements of the 24 clubs that competed in the Brazilian Soccer Championship - Series A, in the years 2017 and 2018, for the collection of revenues and operating expenses. All the statements were taken from the official websites of the clubs to collect the necessary data. The survey covered the statements of the respective years as result of the sports institutions in the sample having had enough time to adjust, approve and correct their accounts and thus reflect more faithfully their results.

During the data collection, it was found that there is no uniformity in the availability of the financial statements on the clubs' websites. The statements can be found in several tabs, such as "The Club", "Transparency", "Assets". As the research did not address the issue of transparency of the statements disclosed, only the lack of homogeneity in the availability of information should be taken into account, since future research may face the difficulty of access to the statements.

Thus, as already explained, the objective of the study was to establish a comparison between the Efficiency Index of the Clubs participating in the Brazilian Cape League and the respective Classification Performances disclosed by the Brazilian Football Confederation - CBF, in the years 2017 and 2018. The efficiency indexes were obtained using the Data Envelopment Analysis (DEA) method.

The study also highlighted the importance of a Sustainable Management based on the Efficiency Index and mainly on the management of the main components, in order to achieve more perennial results.

Barros, Del Corral and Prieto-Rodriguez (2009), affirm that a characteristic in the studies conducted on the efficiency of sports entities present in the literature, does not take into account the issue of heterogeneity of the data analyzed, assuming that clubs use the same methodology. This research considered the heterogeneity of the data collected, i.e., the existence of clubs with different sizes, in this scenario the BCC model is the most propitious. (Dantas & Boente, 2012).

Typically, there are two models that was considered classic: the CCR and the BCC (MELLO et al., 2005). The CCR model, originally presented by Charnes et al. (1978), builds a linear surface in parts, not parametric, involving the data. It works with constant returns of scale, that is, any variation in inputs produces proportional variation in outputs. This model is also known as the CRS - Constant Returns to Scale model.

The BCC model, due to Banker et al. (1984), considers variable returns to scale, that is, it replaces the proportionality axiom between inputs and outputs with the convexity axiom. Therefore, this model is also known as VRS - Variable Returns to Scale. Mello et al. (2005) points out that by forcing the boundary to be convex, the BCC model allows DMUs that operate with low input values to have increasing returns to scale and those that operate with high values to have decreasing returns. Mathematically, convexity of the boundary is equivalent to an additional constraint on the data envelope, which is now the one indicated for input and output orientation.

Specifically, the BCC-VRS model is the most appropriate and used in the article. The use is justified due to the size of the clubs, so the measurement of efficiency is made according to the scale of each DMU under evaluation. These conditions are formalized by the following nomenclature: Eo is the efficiency of the DMUo in analysis, vi and uj are the weights of inputs i (i=1,...,r) and products j (j=1,...,s); xij and yjk are the inputs i and outputs j of the DMUk, with k=1,...,n; xio and yjo denote the inputs and outputs of the DMUo.

However, the model used in this article is output oriented, in this sense it received some modifications. Specifically, the modification is pointed out as follows: $\boldsymbol{h}_o = \boldsymbol{E}^1 o$ making the model so

constructed:

Orientation: *inputs*

$$MaxE_o = \sum_{j=1}^{s} u_j y_{jo} + u_*\ Bound:$$

$$\sum_{i=1}^{r} v_i x_{io} = 1$$

$$-\sum_{i=1}^{r} v_i x_{ik} + \sum_{j=1}^{s} u_j y_{jk} + u_* \leq 0, \forall k$$

$$v_i, u_j \geq 0, u_* \in \mathbb{R}$$

Orientation: *outputs*

$$Minh_o = \sum_{i=1}^{r} v_i x_{io}$$

Bound:

$$\sum_{j=1}^{s} u_j y_{jo} = 1$$

$$\sum_{j=1}^{s} u_j y_{jk} - \sum_{i=1}^{r} v_i x_{ik} \leq 0; \forall k$$

$$v_i, u_j \geq 0$$

The analysis of the data was made by the Data Involvement Analysis (DEA), the DEA method used will be the BCC (or VRS) - Scale Variable Return, for being entities of different sizes, and also, following the guidance of Guzmán (2006), who concludes that the BCC model is the most appropriate for measuring the efficiency of soccer clubs. The model will be output oriented, seeking to minimize the amount of inputs needed (Macedo, 2004).

In the calculation of sports efficiency, the methodology was adopted like Dantas and Boente (2012), which consists of the input being the division between expenses and revenues, multiplying them by 100, to be used as a percentage, due to the output of sports efficiency being the use of points.

These revenues are largely composed of quotas arising from TV broadcasting rights, athlete negotiations, advertising, sponsorship, box office, among others. According to the amount available, a large part of its resources is invested in the soccer department, mainly in the purchase of players' wages (Dantas & Boente, 2012).

The coach's planning and the quality of the players will have a vital effect on the results. Moreover, the quality of the coach and players depends on the available budget and hiring. (GonzálezGómez & Picazo-Tadeo, 2010).

The output of the efficiency is the percentage referring to the use of points of the club within the championship, which consists of the ratio between the amount of points earned and the number of points played (points won / 38 games x 3 points)

The performance of the sports efficiency calculation was treated in the software SIAD v3 ® - Integrated Decision Support System. The program aims to calculate all the results of the AED models (efficiency, weights, targets, benchmarks and gaps), developed by Meza et al (2003).

In order to meet the objective of this research, it is necessary to identify if there is a correlation between the ranking of the most efficient clubs based on the Data Envolvement Analysis (DEA), with the classification table at the end of the Brazilian Championship in 2017 and 2018, using the Kendall correlation, proper for ordering.

IV. DESCRIPTION OF THE DATA

As determined in the methodology, the research makes use of some variables, which will be applied for the input and output. In the input will be the Gross Operating Revenues and the Operating Expenses derived from the professional soccer activity, taken directly from the result of each club's fiscal year, in the financial statements. According to Tables 1 and 2.

Table 1: Gross Operating Revenue 2017 and 2018

Clubs	2017	Clubs	2018
Flamengo	R$ 599.764.000,00	Palmeiras	R$ 601.987.000,00
Palmeiras	R$ 448.783.000,00	Flamengo	R$ 490.445.000,00
São Paulo	R$ 423.716.000,00	Corinthians	R$ 438.053.000,00
Corinthians	R$ 358.105.000,00	Grêmio	R$ 384.211.000,00
Grêmio	R$ 322.581.000,00	São Paulo	R$ 369.430.000,00
Atlético-MG	R$ 291.250.129,00	Cruzeiro	R$ 363.247.150,00
Cruzeiro	R$ 283.382.276,00	Internacional	R$ 293.265.830,00
Santos	R$ 258.770.000,00	Fluminense	R$ 280.562.000,00
Fluminense	R$ 212.156.000,00	Vasco	R$ 246.782.000,00
Botafogo	R$	Atlético-	R$

	208.206.000,00	MG	237.755.607,00
Vasco	R$ 183.616.000,00	Santos	R$ 191.034.000,00
Atlético-PR	R$ 130.667.064,00	Botafogo	R$ 155.524.000,00
Coritiba	R$ 119.098.299,00	Atlético-PR	R$ 150.533.609,00
Bahia	R$ 104.897.356,00	Bahia	R$ 136.107.034,00
Chapecoense	R$ 99.801.712,00	Vitória	R$ 86.645.000,00
Vitória	R$ 88.071.107,00	Sport	R$ 79.203.316,00
Sport	R$ 71.510.847,00	Chapecoense	R$ 75.129.780,00
Ponte Preta	R$ 61.770.035,00	Ceará	R$ 64.787.134,00
Avaí	R$ 59.289.801,00	América-MG	R$ 61.179.666,00
Atlético-GO	R$ 44.964.008,00	Paraná	R$ 48.774.000,00
Total	R$ 4.370.401.651,00	Total	R$ 4.754.658.144,00

Exchange rate and parity US $ / R $ = 3.3074 / 1.0000, Dec. 2017; and US $ / R $ = 3.8742 / 1.0000, Dec. 2018. Data: Quotations and Bulletins - Central Bank of Brazil.

Source: Research data.

The clubs with the highest revenues in the years studied were Flamengo in 2017, followed by Palmeiras, with a difference of over one hundred million reais. In 2018, Palmeiras had the largest revenue, followed by Flamengo. Showing the strength of the clubs in the southeast region in front of national soccer. Table 2 shows the gross operating expenses of each club

Table 2: Gross Operating Expenses 2017 and 2018

Clubs	**2017**	**Clubs**	**2018**
São Paulo	R$ 354.760.000,00	Palmeiras	R$ 516.966.000,00
Flamengo	R$ 351.687.000,00	Corinthians	R$ 377.659.000,00
Palmeiras	R$ 339.875.000,00	Flamengo	R$ 350.979.000,00
Corinthians	R$ 277.973.000,00	Cruzeiro	R$ 324.187.736,00
Grêmio	R$ 250.171.000,00	São Paulo	R$ 310.187.000,00
Cruzeiro	R$ 244.675.109,00	Grêmio	R$ 259.919.000,00
Atlético-MG	R$ 239.969.344,00	Fluminense	R$ 235.193.000,00
Fluminense	R$ 237.965.000,00	Internacional	R$ 214.344.899,00
Santos	R$ 197.947.000,00	Atlético-MG	R$ 205.143.129,00
Vasco	R$ 145.227.000,00	Santos	R$ 173.824.000,00
Botafogo	R$ 108.011.000,00	Vasco	R$ 136.192.000,00
Atlético-PR	R$ 106.383.968,00	Atlético-PR	R$ 119.921.854,00
Vitória	R$ 87.013.615,00	Botafogo	R$ 111.944.000,00
Bahia	R$ 86.593.056,00	Chapecoense	R$ 97.104.585,00
Chapecoense	R$ 85.031.415,00	Bahia	R$ 94.644.907,00
Ponte Preta	R$ 65.473.609,00	Sport	R$ 70.264.157,00
Sport	R$ 62.592.868,00	Vitória	R$ 67.798.000,00
Coritiba	R$ 62.304.312,00	América-MG	R$ 57.620.182,00
Avaí	R$ 35.028.181,00	Ceará	R$ 48.722.531,00
Atlético-GO	R$ 24.634.041,00	Paraná	R$ 41.627.000,00
Total	R$ 3.363.317.535,00	Total	R$ 3.814.243.998,00

Exchange rate and parity US $ / R $ = 3.3074 / 1.0000, Dec. 2017; and US $ / R $ = 3.8742 / 1.0000, Dec. 2018.

Data: Quotations and Bulletins - Central Bank of Brazil. Source: Research data.

According to the operating expenses spent by the sample clubs shown in Table 2, in the year 2017 São Paulo was the club that spent the most in the year, followed by Flamengo. In 2018, Palmeiras was the club with the highest expenditure, when the team became Series A champion of the Brazilian Championship. Followed by Corinthians, with a difference of more than one hundred million reais, but not reflected in the position of the club in the championship, which was only 13th. Jardin (2009) in his research found that teams with more revenue were less efficient.

According to Dantas and Boente (2012), the most reliable output used in measuring financial efficiency, shows the use of points of the clubs in the championship. As this number is a percentage, it is necessary that the DEA input be a variable treated in percentage as well. In this way, expenses were divided for revenues, multiplied by 100, so that it was in a way, as an expense index. The results are showed in Table 3.

Table 3: Expense to income ratio

Clubs	2017	Clubs	2018
Botafogo	52%	Vasco	55%
Coritiba	52%	Grêmio	68%
Atlético-GO	55%	Bahia	70%
Avaí	59%	Botafogo	72%
Flamengo	59%	Flamengo	72%
Palmeiras	76%	Internacional	73%
Santos	76%	Ceará	75%
Corinthians	78%	Vitória	78%
Grêmio	78%	Atlético-PR	80%
Vasco	79%	Fluminense	84%
Atlético-PR	81%	São Paulo	84%
Atlético-MG	82%	Paraná	85%
Bahia	83%	Atlético-MG	86%
São Paulo	84%	Corinthians	86%
Chapecoense	85%	Palmeiras	86%
Cruzeiro	86%	Cruzeiro	89%
Sport	88%	Sport	89%
Vitória	99%	Santos	91%
Ponte Preta	106%	América-MG	94%
Fluminense	112%	Chapecoense	129%
Average	79%	Average	82%

Source: Research data.

The lower the percentage, the better the revenue collection in relation to the expenses for the period, or even lower was the own expense for the maintenance of operations in the period. If this number is greater than 100, it means that expenses exceeded revenues. (Dantas & Boente, 2011).

The output will be the use of the points earned by the clubs at the end of the championship, in the respective years of analysis, as described in table 4.

Table 4: Use of points disputed in Series A - Brazilian Championship 2017 and 2018

Clubs	2017	Clubs	2018
Corinthians	63%	Palmeiras	70%
Palmeiras	55%	Flamengo	63%
Santos	55%	Internacional	61%
Gremio	54%	Gremio	58%
Cruzeiro	50%	São Paulo	55%
Flamengo	49%	Atlético-PR	52%
Vasco	49%	Atlético-MG	50%
Atlético-MG	47%	Cruzeiro	46%
Chapecoense	47%	Botafogo	45%
Botafogo	46%	Santos	44%
Atlético-PR	45%	Bahia	42%
Bahia	44%	Fluminense	39%
São Paulo	44%	Ceará	39%
Fluminense	41%	Chapecoense	39%
Sport	39%	Corinthians	39%
Avaí	38%	Vasco	38%
Coritiba	38%	Sport	37%
Vitória	38%	América-MG	35%
Ponte Preta	34%	Vitória	32%
Atlético GO	32%	Paraná	20%
Average	45%	Average	45%

Source: Research data.

In the year 2017, the club with the best use of the championship was Corinthians, reflecting on the Series A title, showing above average results. The worst performance was with Atletico-GO, which in the edition ranked 20th, the last place in the competition, being relegated to Series B. In 2018, Palmeiras took the best advantage, just as in 2017, the club with the best advantage became Series A champion. Similarly at the bottom of the table, where the Parana won only 20% of the competition, was relegated to the B Series in last place.

According to the methodology explained above, it is necessary to disclose the ranking at the end of the 38 rounds of the Brazilian Soccer Championship - Series A - 2017 and 2018, for the correlation with the ranking of the most and least efficient clubs in the analysis. Table 5 presents the ranking table, released by the Brazilian Football Confederation (CBF).

Table 5: Brazilian Championship Classification - Series A - 2017 and 2018.

2017		2018	
1°	Corinthians	1°	Palmeiras
2°	Palmeiras	2°	Flamengo
3°	Santos	3°	Internacional
4°	Grêmio	4°	Grêmio
5°	Cruzeiro	5°	São Paulo
6°	Flamengo	6°	Atlético-MG
7°	Vasco	7°	Atlético-PR
8°	Chapecoense	8°	Cruzeiro
9°	Atlético-MG	9°	Botafogo
10°	Botafogo	10°	Santos
11°	Atlético-PR	11°	Bahia
12°	Bahia	12°	Fluminense
13°	São Paulo	13°	Corinthians
14°	Fluminense	14°	Chapecoense
15°	Sport	15°	Ceará
16°	Vitória	16°	Vasco
17°	Coritiba	17°	Sport
18°	Avaí	18°	América-MG
19°	Ponte Preta	19°	Vitória
20°	Atlético-GO	20°	Paraná Clube

Source: CBF 2020 (https://www.cbf.com.br/futebol-brasileiro/competicoes/campeonato-brasileiro-seriea, reco vered in 20, April, 2020).

The following shows the sporting efficiency of the clubs.

SPORTING EFFICIENCY

Table 6 shows the results of the clubs' sporting efficiency obtained by the DEA-BCC model, output orientation.

Table 6: Result of sports efficiency, output orientation

Clubs	2017	Clubs	2018
Corinthians	1	Palmeiras	1
Botafogo	1	Flamengo	1
Flamengo	0,97	Vasco	1
Santos	0,89	Grêmio	1
Palmeiras	0,89	Internacional	0,96
Grêmio	0,86	São Paulo	0,80
Coritiba	0,83	Atlético-PR	0,78
Cruzeiro	0,79	Atlético-MG	0,71
Vasco	0,78	Botafogo	0,71
Avaí	0,75	Bahia	0,69
Chapecoense	0,75	Cruzeiro	0,66
Atlético-MG	0,75	Santos	0,63
Atlético-PR	0,71	Ceará	0,60
Bahia	0,70	Fluminense	0,57
São Paulo	0,70	Corinthians	0,56
Atlético-GO	0,67	Chapecoense	0,56
Fluminense	0,65	Sport	0,53
Sport	0,62	América-MG	0,50
Vitória	0,60	Vitória	0,48
Ponte Preta	0,54	Paraná	0,29
Average	0,77	Average	0,70

Source: Research data.

According to table 6, the most efficient clubs in 2017 were Corinthians and Botafogo, the first was the Brazilian champion of the edition, obtaining the highest score with 63%. Botafogo, on the other hand, obtained a use of only 56%, but in relation to the index of

expenses/revenues, was the club in the year with the lowest index, showing that it obtained a good surplus in the exercise, consequently, obtaining the maximum level of efficiency.

In the year 2018, 4 clubs in the sample proved to be efficient, they were Palmeiras, Flamengo, Vasco and Grêmio. The first one, won the championship title, obtaining the best use. The second was the vice-champion, and still had a moderate expense index. Vasco and Gremio, as in the case of Botafogo in the previous year, did not obtain the best performance of the points, however, in face of the verification of lower rates of expenses in relation to the revenue in the year, they classified themselves as efficient.

According to the results of the Freitas, Farias and Flach (2017) survey, using a sample of the years 2012, 2013 and 2014, they found that Grêmio, Palmeiras and Vasco did not show efficiency in any period analyzed by the authors. This is a different result from the present survey, what it was identified that the previously mentioned clubs, Vasco, Grêmio and Palmeiras, were efficient in the period analyzed, 2017 and 2018.

Table 7 highlights information to check if there is a correlation between the ranking of the most efficient clubs from the Data Envolvement Analysis (DEA), with the ranking table at the end of the Brazilian Championship in the years 2017 and 2018.

Table 7: Efficiency vs. Series-A Rating Correlation

2017 Series-A		DEA-BCC		2018 Series-A		DEA-BCC	
1°	Corinthians	1°	Corinthians	1°	Palmeiras	1°	Palmeiras
2°	Palmeiras	2°	Botafogo	2°	Flamengo	2°	Flamengo
3°	Santos	3°	Flamengo	3°	Internacional	3°	Vasco
4°	Grêmio	4°	Santos	4°	Grêmio	4°	Grêmio
5°	Cruzeiro	5°	Palmeiras	5°	São Paulo	5°	Internacional
6°	Flamengo	6°	Grêmio	6°	Atlético-MG	6°	São Paulo
7°	Vasco	7°	Coritiba	7°	Atlético-PR	7°	Atlético-PR
8°	Chapecoense	8°	Cruzeiro	8°	Cruzeiro	8°	Atlético-MG
9°	Atlético-MG	9°	Vasco	9°	Botafogo	9°	Botafogo
10°	Botafogo	10°	Avaí	10°	Santos	10°	Bahia
11°	Atlético-PR	11°	Chapecoense	11°	Bahia	11°	Cruzeiro
12°	Bahia	12°	Atlético-MG	12°	Fluminense	12°	Santos
13°	São Paulo	13°	Atlético-PR	13°	Corinthians	13°	Ceará
14°	Fluminense	14°	Bahia	14°	Chapecoense	14°	Fluminense
15°	Sport	15°	São Paulo	15°	Ceará	15°	Corinthians
16°	Vitória	16°	Atlético-GO	16°	Vasco	16°	Chapecoense
17°	Coritiba	17°	Fluminense	17°	Sport	17°	Sport
18°	Avaí	18°	Sport	18°	América-MG	18°	América-MG
19°	Ponte Preta	19°	Vitória	19°	Vitória	19°	Vitória
20°	Atlético-GO	20°	Ponte Preta	20°	Paraná	20°	Paraná

Source: Research data.

Analyzing the top of the chart, it can be seen that in fact the champions of the 2017 and 2018 editions obtained the maximum efficiency index, in the respective title year, followed by the clubs that obtained the best indexes, in correlation with the classification table of the year corresponding to the analysis of the statements. With the exception of Botafogo in 2017 and Vasco in 2018, that became efficient due to the lower rates of the sample, in the relation between expenses/revenues, with 52% and 55%, respectively.

At the bottom of the table, in the year 2017, two of the four clubs that were among the last placed in the ranking also obtained the lowest efficiency rates. However, in the year 2018, the four clubs that obtained the lowest rates of the sample in relation to efficiency, also remained in the last places in the ranking.

The two rankings formed between the final classification of the Series A teams and the DEA analysis resulted in Kendall's Ordinal Correlation Coefficients,

given by $x = 0.636^{**}$e $x = 0.779^{**}$, both showing statistical significance at the 95% level. As they are positive, it is inferred that the greater the sports efficiency of the team, the better its ranking in the Brazilian championship. Regarding sports efficiency, Benin, Diehl and Marquezan (2019) stand out, who found that sports performance is positively related to the size of the clubs, which seems natural, because the same authors point out that large clubs compete in major competitions frequently and their technical skills are high.

V. CONCLUSION

This research sought to compare the Sports Efficiency Indexes with the soccer clubs' Classification Performance, in the Brazilian Championship's classification tables in the years 2017 and 2018. Throughout the article, the sports efficiency of the clubs was determined using the DEA method, extracting the data from their financial statements to verify their relationship with the final position of the teams in the Brazilian Soccer Championship - Series A, in the period studied.

Among the clubs analyzed in 2017, the champion of the edition, Corinthians, obtained the maximum index of efficiency, but followed by Botafogo that proved efficient in the analysis, due to its low rate of expenditures, but with only 46% of points. Of the clubs that qualified among the first, a great part presented the best Sporting Efficiency Indexes. However, Coritiba being in the seventh position of efficiency, being lowered with its seventeenth position in the table, possibly reinforcing the idea of the need for a more accurate evaluation about the allocation of resources in alignment with the results.

The year 2018 presented an evolution in the ordinal correlation coefficient. Among the clubs verified, four obtained maximum efficiency: Palmeiras, Flamengo, Vasco and Gremio. According to the previous year, one of them was the champion, Palmeiras. Flamengo was second and Gremio equaled the indicators, staying in fourth position. In the last four places, parity among the results was attested, being the teams with less efficiency, all relegated in their respective orders. However, Vasco, with the highest efficiency index was almost relegated, reaching the 5th worst ranking, presenting, in this case, a misalignment between the results, reinforcing that despite the significant influence of the achievement of sports efficiency, the strategic allocation of resources by the main components of the index should have substantial weight on the clubs' ranking positions.

It was concluded, based on the results of the ordinal correlation coefficients of Kendall that presents a relevant level of statistical significance in the order of 95%, that the greater the sporting efficiency of the team, the better its ranking in the championship. However, it was verified that there is no perfect alignment between the Sporting Efficiency Index and the Clubs' Classification Performance, that is, part of them did not obtain a position in the efficiency ranking exactly equal to their real positions in the tournament, attesting the possible presence of other factors that may also contribute to the classification results.

Thus, believing in the importance of the theme, it is suggested for future studies the analysis of the impacts that the Brazilian clubs will suffer in their indicators of sportive efficiency in face of the period of paralysis of their activities by the pandemic of the new coronavirus (Covid-19) and also, in the improvement of a Sustainable Management, the development of a study on what the nature of expenses and investments the main clubs have systematically allocated resources for the achievement of sportive efficiency.

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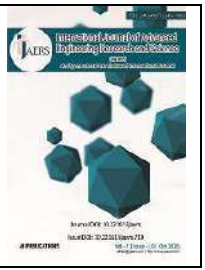

A Framework Approach for Risk Assessment and Management of CO_2 Geological Storage

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***Abstract*—*The aim of this article is to analyze the particular contributions provided by the Risk Assessment and Management framework to the CO_2 geological storage process on the offshore oil and gas sector. The CO_2 geological storage, inherent to Carbon Capture and Storage (CCS) activities, is characterized as an effective mitigation option to reduce the levels of this gas in the environment. The risk assessment allows the identification of the most significant risks and impacts, respecting the facilities characteristics, the geological conditions of the basin and the associated natural processes, assisting to propose measures that reduce the probability or the magnitude of their occurrence. Then, this analysis requires an understanding of the stages of the frameworks for Risk Assessment of CO_2 storage streams in geological formations of the main international organizations, based on studies of the literature reviewed for these purposes. In fact, the risk management procedures are necessary to maximize the intended isolation and to minimize the effects of possible CO_2 leakage. Finally, the results demonstrate a consistent relationship between the Risk Assessment and Management tool and its frameworks specificities for this activity.*

I. INTRODUCTION

Emerging Carbon Capture and Storage (CCS) technologies are primarily aimed at achieving an environmental benefit by removing large amounts of CO_2 from the atmosphere and contributing to the reduction of problems associated with climate change (Bui et al., 2018; EA, 2011). The CO_2 geological storage, inherent to this technology, is used worldwide with the potential for further expansion, as it can be considered a transition technology for reducing greenhouse gas emissions (Singh et al., 2011, 2012). Because it is an innovative method and due to the operational complexities of the project, potential risks to health, safety and the environment can occur (Abu-Khader, 2005) (Koornneef et al., 2011). In this way, understanding the risks associated with this technology becomes of fundamental importance (J. Blackford et al., 2009).

The international literature is largely focused on work associated with the International Energy Agency Greenhouse Gas R&D (Research & Development) Programme (IEA GHG) (IEA GHG, 2007; Yanagi et al., 2019). The IEA GHG has established a Risk Assessment Network from which much of the available literature has been produced (Beck & Aiken, 2009). A large portion of the work completed to date has been in the commercial sector, which inhibits the availability of detail and means that often what is available has not been peer reviewed. Much of the work under the heading of risk assessment focuses on understanding specific aspects of the sequestration and storage process that may produce a

perceived risk (i.e., ultimately reducing the risk) and not on the actual risk assessment procedure itself (M. Gerstenberger et al., 2009; M. C. Gerstenberger et al., 2013).

Regarding risk assessment, it consists of several elements such as leakage probability, assessing the strength of potential environmental impact (Jerry Blackford et al., 2020), and quantifying the potential ecological, economic (Deng et al., 2017), and social impacts (J. Blackford et al., 2009). Its purpose is to identify risks scenarios and their respective consequences (Tanaka et al., 2013), assessing the potential effects on the environment and proposing measures to reduce them (OSPAR, 2007). Therefore, for an appropriate understanding of the CO_2 geological storage risk assessment, it is also important to know the regulations of the leading organizations relevant to this activity, such as European Union, Canadian Standards Association, World Resources Institute and Ministry of Environmental Protection of China, and the details of its framework (Larkin et al., 2019; Qi Li & Liu, 2015).

Thus, this study also seeks to assist the specific Risk Assessment and Management framework for CO_2 storage activities, based on experiences of risk assessment studies practiced in countries with tradition in these activities. Besides, there have been quite significant developments in research into potential environmental effects of leakage from CO_2 storage since the IPCC report in 2005 (J. Blackford et al., 2009; Jones et al., 2015; Kim et al., 2016; Paulley et al., 2013). In addition, a discussion related to the Risk Assessment and the potential risks of CO_2 storage in a geological reservoir also becomes relevant. Finally, the application of this information and approaches can assist in the Framework for Risk Assessment and Management for CO_2 geological storage activities of the offshore oil and gas sector, during the implantation and operation process of storage systems and its final abandonment.

II. METHODOLOGY

The scope of this research is associated to the risk assessment and management of CO_2 geological storage focusing on experiences correlated to the offshore oil and gas industry.

The method used is a bibliographic research of scientific articles and the main international reports (technical reports and guidance documents) recognized as reference on CO_2 storage were carried out, within the scope of CCS technology. To ensure identification of all relevant literature, relevant studies (articles and reports) encountered when reviewing other studies were also included. This research is based in a qualitative study and the following documents provide a range of data on CO_2 storage risk assessment and management submitted to interpretative analysis.

The basic references, standards and recommendations of countries with tradition in these activities, applicable to the risk assessment of offshore installations were used, considering the life cycle of a project (planning, implementation, operation and decommissioning). In addition, the existing legal, technical and scientific requirements were considered, in order to add environmental safety to the activities, as well as contribute to the identification of potential environmental impacts.

III. RISK ASSESSMENT OF CO_2 GEOLOGICAL STORAGE

A definition of risk assessment in the context of CCS was defined as the means of identifying, estimating or calculating and evaluating potential risks of storage to human health and safety, the environment and assets (Beck & Aiken, 2009). Risk assessment, which is 'problem orientated', was identified as part of a larger risk management framework, which focuses more on monitoring and remediation and is 'solution orientated'. The consensus was reached that for risk assessment and communication of results, emphasis should be placed on 'solutions' ahead of 'problems' (Beck & Aiken, 2009).

Furthermore, as the CO_2 risk assessment community is still relatively new, there currently is no consensus on the appropriate methodologies for risk. Largely, the focus of the community has been guided by the lack of understanding of the reservoir behavior and the effect on the risk assessment that this implies (Ashworth et al., 2015; L'Orange Seigo et al., 2014). This makes it difficult to constrain the risks involved and makes developing a holistic probabilistic risk assessment methodology a challenge; for some events, even defining a probability of occurrence may be beyond current ability without the input of new knowledge (M. Gerstenberger et al., 2009; M. C. Gerstenberger et al., 2013).

Also, there is still no standard for risk assessment tools for this technology (M. Gerstenberger et al., 2009; M. C. Gerstenberger et al., 2013), despite the fact that new methods and tools have been developed for quantitative and qualitative risk assessment (R. Pawar et al., 2013, 2014). For example, there are researches on development of a risk assessment tool for geological storage that covers geological strata, marine environments, ground surface, ambient air and injection site and its vicinity (Tanaka et al., 2013). These methods have been integrated effectively with monitoring and mitigation techniques and deployed in the field for small-scale field tests as well as large-scale

commercial projects (R. Pawar et al., 2013, 2014). Thereby, existing projects use a variety of tools, from the simplest to the sophisticated and probabilistic ones. As a single assessment standard should not be standardized in all cases, an organized set of risk assessment possibilities and tools is recommended to lead to the best possible risk estimate (M. Gerstenberger et al., 2009; M. C. Gerstenberger et al., 2013).

The potential risks of CO_2 storage in a geological reservoir can be divided into five categories, according to their main causative actions: CO_2 leakage, CH_4 leakage, seismicity, ground movement, and disposal of brine (Qi Li & Liu, 2015). The typical failure scenarios for CO_2 storage activities are leakage along a well, wellhead failure or wellbores (abandoned and in use); caprock failure, fracture or permeability; leakage with along a spill point and leakage through existing or induced faults and fractures (Chae & Lee, 2015; Koornneef et al., 2011, 2012). Clearly, the hot spot of risk research is CO_2 leakage; because there is a need to guarantee, to the extent possible, that the injected CO_2 stays safely underground (Qi Li & Liu, 2015). The analysis of CO_2 injection and potential leakage scenarios is usually associated with large underground reservoirs (Chae & Lee, 2015; Koornneef et al., 2011)

According to the European Union (EC, 2008, 2011), the storage phase has similar risks to chemical and power generation industries and was considered in Council Directive 96/61/EC. In this case, several authors discuss Risk Assessment criteria (M. C. Gerstenberger et al., 2013; He et al., 2011; Larkin et al., 2019; Qi Li & Liu, 2015; Widdicombe et al., 2013), especially related to CO2 leakages highlight to the role that risk assessments play in addressing uncertainties, which requires consideration of economic, technical, political, and social dimensions of CCS projects.

IV. FRAMEWORK FOR RISK ASSESSMENT AND MANAGEMENT OF CO_2 STORAGE STREAMS IN GEOLOGICAL FORMATIONS (FRAM)

In fact, a risk assessment can assist the process of identifying the main risks of CO_2 geological storage (Q. Li et al., 2017; Qi Li & Liu, 2015) for later identification of the potential environmental impacts inherent to this activity. Understanding its framework is significant for this purpose. The IEA GHG R&D Programme (IEA GHG, 2007) developed a risk assessment workflow diagram for the deployment of a commercial-scale storage program (Qi Li & Liu, 2015; R. Pawar et al., 2013, 2014). Previously, a Framework for Risk Assessment and Management of CO_2 storage streams in geological formations (FRAM) has been developed (OSPAR, 2007). This framework makes use of relevant developments within the framework of the London Convention/London Protocol, including developments relating to the draft Risk Assessment and Management Framework for CO_2 Sequestration in Sub-Seabed Geological Formations and developments relating to a specific London Protocol waste assessment guideline.

The risk assessment associated with CO_2 geological storage often proceed based on the ISO Standards (Q. Li et al., 2017; Qi Li & Liu, 2015) or a "self developed" workflow, according to main organizations relevant to this activity, as can be seen summarized in Table 1, that describes the risk assessment stages. According to ISO 2009:31000, risk assessment is an integral part of risk management, and it is the overall process of risk identification, risk analysis, and risk evaluation. The organizations listed, succinctly, do not have a standardized framework with each other. However, they have the hazard and/or risk identification/characterization scenarios in common in their framework, which can assist in the application of Environmental Risk Assessments for CO_2 geological storage projects.

Table.1: Stages of a framework for Risk Assessment of CO_2 storage streams in geological formations for the main international organizations.

Risk Assessment Stages	Description	Organizations' CO_2 Storage studies
1. Context and Problem Formulation	Critical scoping step defining the boundaries of the assessment, including the scenarios and pathways to be considered	(IEA GHG 2007; OSPAR 2007)
2. Risk Source Assessment	Site selection and characterization (collection and evaluations of data concerning the site)	(EC, 2008, 2011; IEA GHG, 2007; OSPAR, 2007)
	Risk identification	(CSA Group, 2012; EC, 2008, 2011; IEA GHG, 2007; ISO ABNT, 2009; Qi Li & Liu, 2015; MEP China, 2015)

Risk Assessment Stages	Description	Organizations' CO_2 Storage studies
	Vulnerability assessment	(IEA GHG, 2007; OSPAR, 2007)
	Hazard identification: focus on the main potential pathways for CO_2 leakage	(Forbes et al., 2008)
3. Exposure Assessment	Detailed site characterization; simulation of storage complex and movement of the CO_2 stream; security, sensitivity and hazard characterization	(EC, 2011; IEA GHG, 2007; OSPAR, 2007)
4. Effect Assessment	Response of receptors within the (marine) environment resulting from potential exposure to the CO_2 stream if leakage of injected or displaced fluids were to occur.	(EC, 2011; Forbes et al., 2008; IEA GHG, 2007; OSPAR, 2007)
5. Risk Characterization	Integrates the exposure and effects data (3 e 4) to provide an estimate of the likelihood of adverse impacts (qualitative/semi-quantitative/quantitative)	(IEA GHG, 2007; OSPAR, 2007)
6. Risk Management	Risk analysis: including risk estimation, process designed to determine the nature and level of risk, providing the basis for risk evaluation and decisions about risk treatment	(ISO ABNT, 2009; Qi Li & Liu, 2015; MEP China, 2015)
	Design preventive measures based on prediction (derived from the risk assessment process). Englobes: Risk evaluation: process of comparing risk analysis results with criteria to determine whether the risk and its magnitude are acceptable or tolerable	(EC, 2008, 2011; Forbes et al., 2008; IEA GHG, 2007; ISO ABNT, 2009; Qi Li & Liu, 2015; MEP China, 2015; OSPAR, 2007)
	Risk treatment	(IEA GHG, 2007; OSPAR, 2007)
	Monitoring and verification	(EC, 2008, 2011; Forbes et al., 2008; IEA GHG, 2007; OSPAR, 2007)
	Mitigation and remediation planning	(Forbes et al., 2008; OSPAR, 2007)
7. Communication and Consultation	Defined at this article as a seventh stage, once it is a fundamental process that should permeates all stages	(Forbes et al., 2008; IEA GHG, 2007; OSPAR, 2007)

The life cycle of a CO_2 storage project consists of the following phases: planning; construction; operation; site-closure; and post-closure (Flemström et al., 2004; Manuilova et al., 2009; OSPAR, 2007). The planning, including design, construction and operation should lead to an inherently safe storage site. Each phase of the project requires all, or a selection of, the stages of the FRAM to be implemented.

The risk characterization for the storage of CO_2 streams in geological formations should be based on site-specific considerations of the potential exposure pathways, the probabilities of leakage, and potential effects on the marine environment, human health, and other legitimate uses of the maritime area (OSPAR, 2007). Thorough, a site characterization is therefore critical for defining the nature, temporal and spatial scales of potential impacts. Risk assessment plays an important role in all stages of site characterization and selection from the initial pre-screening to permitting and implementation (Beck & Aiken, 2009).

The framework of (OSPAR, 2007), similar to the (IEA GHG, 2007), describes an iterative process that should be used for continual improvement of the management of the project during the project lifecycle and improving the assessment and management of other similar projects. A simple conservative deterministic assessment is sufficient if the adverse consequences are insignificant, but if they are likely not to be, then, for precaution, the assessment

should include probabilistic approaches to achieve acceptable results (OSPAR, 2007).

V. CONCLUSION

Considering the regulatory-based risk assessment and risk management frameworks, the storage site selection and characterization is often identified as the most effective approach to reduce risk; and the risk assessment for human health is specified less often than environmental effects (Larkin et al., 2019). In terms of risk management, the primary mandatory requirement is limited to monitoring, with an interactive approach recommended to monitor and re-assess risk. Other considerations such as uncertainty, stakeholder communication and consultation and the goal of transparency are not elaborated in the regulatory context, while some non-regulatory guidance is focused specially on these activities (Larkin et al., 2019).

While storage of CO_2 streams in geological formations aims to isolate CO_2 from the biosphere (including the atmosphere) permanently, risk management procedures are necessary to maximize the intended isolation and to minimize the effects of possible leaks of CO_2, incidental associated substances and substances mobilized by the CO_2 stream (OSPAR, 2007). Permanent containment of CO_2 streams is the ultimate objective of risk management. It should however, demonstrate how an event of leakage would be managed in order to prevent it leading to significant adverse consequences for the marine environment, human health and other legitimate uses of the maritime area (Kim et al., 2016; OSPAR, 2007; Paulley et al., 2013; R. Pawar et al., 2014). In fact, considerable progress has been made to effectively integrate communication strategies with risk management approaches to increase stakeholder confidence in the effectiveness of deployed risk management approaches to manage risks (R. J. Pawar et al., 2015).

In addition, it is relevant to discuss, in future studies, the main sensitive or indicative variables of CO_2 leakage, which can be identified through a Framework for Risk Assessment and Management to be considered in geological CO_2 storage projects. Finally, the applicability of this information can additionally assist in the environmental risk assessment for Carbon capture and Storage (CCS) activities in the offshore Oil & Gas sector, during the implementation and operation of storage systems and its final abandonment.

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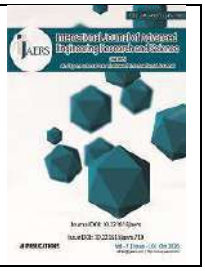

Human Sexuality in the Life of Adults and the Elderlys: Report of a Field Study in Porto Velho,Rondônia, Brazil.

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***Keywords*—Adult. Elderly, Human Development, History of sexuality, Human Sexuality.**

***Abstract*—** *This work aims to know the representations of sexuality in adults and the elderlys in the development of sexuality in the genital phase, in order to understand the expression of the sexuality of these individuals from the perspective of Freudian theory, the methodology used was constituted through the practice of observation, application of interviews and analysis of data obtained in conjunction with bibliographic references, the public served was men and women between 25 and 70 years old, in a total of 10 people. The results obtained were the verification of the scarcity of works aimed at the adult phase of human development, and numerous references about the social representations of sexuality in the elderly, showing the sexual repressions suffered by them by society, which we could also see In the interviewees' discourse, such as: prejudices, guilt, changes, needs, wants, fears, etc. Our intention to know the representations of the sexuality of this public and the possible changes in sexual practice was limited, mainly due to the scarcity with regard to scientific articles aimed at adult and elderly life from the perspective of the Freudian genital phase, due also to little knowledge that the public had on the subject of sexuality, it became evident that there is confusion between sexuality and sex itself, impairing the evaluation of responses, and also due to the number of participants who joined the survey, even so, this points to the importance to open research on this topic.*

I. INTRODUCTION

Sexuality is still an object of great taboo by society, sexuality in the genital phase that includes adults and the elderly, is even more problematic. Currently, the speeches that are on the topic of sexuality, do not yet cover all its meaning. From a psychoanalytic perspective, sexuality at this age is experienced with characteristics that can only be acquired at a certain age.Queiroz*et al*(2015), reports such experiences well, particularly those that refer to the elderly.

From this perspective, Queiroz*et al*(2015) there is also an increase in this population, and, consequently, an increase in the views that aim to properly think about old age. Social representations are present at all ages, as well as the social representation of the sexuality of adults and the elderly, and the concept of sexuality that has changed over the years.

We consider this topic of extreme importance, since even though studies are done on the subject, it does not contemplate the dynamics of these people in their entirety, and, we think a contribution in this sense is necessary. We seek to verify, under the eyes of these everyday actors, their practices and beliefs, and feelings about their own sexuality. The research method chosen was an open and closed interview, in which we sought to collect relevant information on the subject, and having the interview as a working method, the freedom with which issues can be treated was considered a priority.

The results found reveal discrepancies in some aspects, such as the distinction of answers in relation to what could be more important about their sexualities, and we were able to verify, even, what is meant by sexuality in a more open interview, which gives rise to a discussion wider.

II. DEVELOPMENT

2.1 - Brief historical constitution of sexuality

The history of human sexuality, being a complex and vast subject, will be treated here in a pragmatic way, with the sole intention of contextualizing the socio-historical roots that are engendered in the view of contemporary relations on sexuality. We will make an outline of this history, punctuating the ancient civilizations that gave rise to Western sexual practices, from antiquity to the contemporary of the 19th century, trying to point out the importance of culture, beliefs, myths and customs in the formation of human mentality and behavior regarding sexuality.

According to Guedes*et al* (2007) In Babylon, capital of ancient Mesopotamia considered the cradle of cultural sex, there was a culture devoted to worship that devoted sensual love through sexual practice, for the Babylonians such practices were attributed the value of a rite transition from nature to culture. There are records that certify that they had their own sanctuaries and liturgies, in which sacred prostitutions, heterosexual sexual intercourse, sexual practices between women, or between men of the same sex occurred without apparent moral condemnation, and to the priestesses of the goddess Aphrodite (women cultural sex workers) were separated from their fate of wives and mothers, and given *status*were respected because they were servants of the goddess of fertility. For these people, love was a natural activity that was culturally practiced by individuals in this society and orgasm brought them closer to the presence of the goddess.

This city only became known to the Western people through the Bible, from the historical accounts of the Old Testament in which it was indicated as an example of a sinful city, called the "prostituted city", condemned due to sex outside of marriage and as a representation of the sacred and the worship of the Greek gods. In ancient Greece, a patriarchal society, based on monogamous marriage, although the adult Greek man was socially permitted to have sex with both his wife and his concubines.It remains for the wife to fulfill the role of fidelity. Sacred prostitution or cultural sex also existed in this formation of society, but with a marginal character, being reserved for specific locations.

During this period, studies report that sexual practices, the Greek man was also protected the right to have relations with people of the same sex, some scholars delegate to this practice "Greek homosexuality", contested by others who defend as "Greek pederasty", which according to Greek etymology, it means "love for the child (parents)", which consisted of a pedagogical and loving relationship between an adult and a teenager including sexual initiation. What was decisive in this type of sexual attitude was the relationship of activity or passivity in the sexual act. In Greek pederasty the boy (eromenes) occupies the passive position and the adult man (erastes) the active position, with love as the intention to make him a sexually active man and not sex itself the wisest adult man guided the young man in customs, postures,*et al* , 2007).

It is worth mentioning that the Greeks did not accept sexual relations between adult men as well as between women. Among men, they were socially condemned, since a citizen should be sexually active, just as he was politically active. If this behavior were to become public, it would result in the loss of their political rights. And women were only meant for procreation during marriage. Therefore, pederasty was considered a normal and superior

relationship in relation to other forms of love, valued as having an integrative civil function, which taught the individual how to assume his responsibilities as a citizen.

Sexual practices that in other cultures, times and civilizations and laws, would be classified as vulnerable rape and pedophilia. In Brazil today, for example, in the strictly legal sphere, pedophilia is commonly regarded as the sexual abuse of children and adolescents, giving rise to numerous crimes provided for in both the ECA and the Brazilian Penal Code, Law No. 12,015 of August 2009, in which says "The law will severely punish the abuse, violence and sexual exploitation of children and adolescents" and Art. 217-A of the Penal Code; rape of vulnerable (LIMA; FRANCE, 2014).

In ancient Rome, bisexual behavior still existed in adulthood, but with certain changes, because it is an intense hatred of the passive relationship, the passive subject should necessarily be a slave, regardless of his age. Through logic, “you get pleasure when you are free and you give pleasure when you serve”. Roman marriage was considered a private and informal act, being easy to perform and separate. There were two reasons for marrying, in this society, money and the legitimate existence of descendants. The rupture of this union could come from both sides (GUEDES *et al*, 2007). From the republican period to imperial Rome, two different morals constituted the monogamous relationship. The first moral recommended marriage, the wife could also be "borrowed" between two masters, and in the case of adultery by the wife, the husband was ridiculed by society for having failed to "take care" of the wife, as she was considered as an irresponsible being. The second moral also indicated to the man the fidelity, other times attributed only to the woman, and that he should only make love (sex) for the purpose of procreation, respecting his wife, and this should be valued, that is, a relationship based on the feeling.

During the Roman Empire Christianity was born, based on the teachings of Jesus Christ who would be the Messiah, considered by his followers as the one sent by God to the world to liberate and save his faithful. Its birth occurred during the reign of Otávio Augusto, first Roman emperor, in a period with strong Jewish influences, Jewish society, which in turn, had a great social motivation for the repression of the pleasurable manifestations of sexuality.

The Jews needed to assert themselves as a people, since the other peoples of the time were all polytheists, with highly sexed and erotic gods, as we saw in Babylonian society, and these would have originated from the sexual union between gods almost always brothers, the which characterized an incestuous act, which would justify the worship of an asexual God (Yahweh), without having had a sexual act for his birth, without having the weight of the cult of “sacred sexuality”.

Some Jewish values were maintained, all Christian priests were encouraged to maintain an regulated active sex life through monogamous and heterosexual marriage, for example. But, over time, in the early centuries of the Christian era, theological treatises praised female virginity and devalued marriage. And they also wrote instructions about sexual desires directed to some servants of God according to the authors:

Between the 4th and 6th centuries, monastic literature appeared, aimed at men who lived isolated in monasteries and constantly fought against their desire. These writings addressed the lone combat of fornication and provided the monks with techniques for observing the "flesh" to combat it (DANTAS, 2010, p.701).

In order to attract more believers, the Church gave up its defense strategy for marriage, treating it as a stopgap for those who were unable to dedicate themselves to abstinence, not as an act that would purify their bodies, but as a way of reducing filth. . Marriage, which was an aristocratic practice and restricted to the domestic space, suffered interference from the Church in the 12th century, building rules and precepts about marriage, inducing Christians to follow their matrimonial model, whose main precepts were marital indissolubility and monogamy , this ideal of marriage was imposed and if not fulfilled, the faithful would be under the threat of excommunication. The nuptial ceremony previously performed on the breasts of families was transferred to the Church, which guaranteed the priest to celebrate it, as explained by Dantas (2010, p.703-704)

The sacramentalization of marriage ensured the consolidation of the Church's political power, but not before facing aristocratic opposition, as aristocrats were in the habit of repudiating their women and forming new marriages. Forcing the Church not to expressly prohibit the dissolution of the marriage bond.Gradually the Christian model of marriage, monogamous and unaltered, prevailed.

This relation to the control of the church over the conduct of the faithful towards marriage, there was a method used to have control over the couple's sexual acts, legal-theological codes were elaborated that discriminated between permitted and prohibited acts. It was stated that sex was for reproduction purposes only, and everything else was lewd, stipulated that there should be no sexual relations with a sign of respect for holy days, among other prohibitions. As Dantas describes, (2010, p.706) “[...] sexual intercourse was prohibited on holy days, religious celebrations, Sundays, periods of menstruation, pregnancy, breastfeeding and the forty days after delivery.

Theologians, therefore, considerably restricted the time devoted to sexual practice".

After a while, the church realized through the confessions of the faithful that despite attempts to control the intimacy of couples, it was unable to absolutely monitor something so restricted, so According to Dantas (2010 *apud*VAINFAS, 1986, p.707), "From the 16th century onwards, there was greater flexibility among theologians in relation to the conjugal act for that reason, they made the strategies adopted and the penalties applied minimally flexible". And so, we come to contextualization through the ages, the formation of aspects of human sexuality from a historical perspective.

2.2- Brief history of social representations of sexuality in adults

Sexuality, according to Vitiello and Conceição (1993), can be understood from a broad and comprehensive focus, manifesting itself in all stages of life in each and every human being and despite what spreads culturally and popularly, has in genius only one of its aspects, perhaps even the least important.

Dall'Agnol (2003) alerts us to the connotations that certain subjects have over the years and how some remain in the same pattern, while others undergo significant processes of change. There is still, according to the author, a complexity when defining words related to the theme of sexuality in the adult phase of human development, this fact is directly related to the multiplicity of aspects that it covers, as well as the breadth and meaning.

Within the psychological frameworks, as Dall'Agnol (2003) states, we can attribute a contemporary meaning to sexuality derived directly from Freud's psychoanalytic findings, which broke with the fields of perversions and repressions adopted by the biomedical and psychological view of the time. On the other hand, Foucault in postmodernity says that sexuality is the result of different factors, proposing a broader concept, among them: speeches by the sages, the rules and imperatives of the powers they establish and the meaning and value, conduct, duties, pleasures you know or aspire to.

We understand social representations, as Vieira *et al* (2016) guides us, as a system of values, ideas and practices that have a dual function: to establish an order that allows people to orient themselves in their material and social world and to control it; and also to make communication possible between members of a community, providing them with a code to name and classify, unambiguously, the various aspects of their world and their individual and social history.

Therefore, sexuality cannot be reduced to the sexual act, but it can be understood as a way of being that is incorporated into a body through its practices. Within a broader context, Vitiello and Conceição (1993), one can consider the influence of sexuality that permeates all human manifestations, from birth to death. In this way, we can think of sexuality within a biopsychosocial dimension, where the subject receives a strong influence from social life in the construction of meaning. Marola, Sanches and Cardoso (2011) reinforce "[...] the meaning of sexuality as a symbolic and historical process when stating that the constitution of a subject's identity is manifested in the way he experiences the issues of intimate treatment, considering the moral and ethical issues of the social group in which it is inserted "(p. 96).

In view of this, these meanings were constructed and undergo continuous re-signification processes where the historical context assigns new meanings. The movements of the 1970s, for example, caused numerous changes in sexual practices and sexuality, demystifying reproduction and presenting an approach to the body and health promotion for women. In this sense, we can think of several other movements, advances or changes in paradigms that modified social representations at a given historical moment.

Vitiello and Conceição (1993) affirm that the adult phase is or should be the most significant period of human sexuality, since the subject is sufficiently mature and safe to establish solid affective bonds and, in the majority, to enjoy properly and pleasantly, if your sexuality. This maturation that we are talking about can be represented at different times and this will depend on each person and their experiences at each stage of human development, however, it is more frequently reached during the young-adult phase, up to 30 years old, or at the end of it.

Unfortunately, at the cost of a distorted sex education and the most diverse social prejudices (among which machismo is evident), this is not always the case. It is not uncommon for people to have a distorted notion of sexuality, failing to see it as something positive, as something good and beautiful, as a gift. (VITIELLO; CONCEIÇÃO, 1993, p. 55).

We observed that throughout history, quite distorted concepts of sexuality have been created, where men and women have assigned themselves supreme and mandatory goals, such as orgasm, considered the climax or real meaning of sexuality, therefore.

In this sense, it is the "obligation" of the man to give orgasms to the woman, as if orgasms were present that the male omnipotence can distribute at his pleasure. The woman, in turn, to consider herself "truly a woman", must

have orgasms (preferably multiple), without which she considers herself a failure. (VITIELLO; CONCEIÇÃO, 1993, p. 55).

Paiva (2008, *apud*Weeks 2000), on the other hand, seeks to understand and provides us with a broader view of the attitudes towards the body and sexuality, apprehending the power relations that shape what is defined as normal and abnormal. Sex would be the descriptive term for basic, external anatomical differences, which biologically differentiate men and women, gender is the social differentiation between men and women and sexuality is a general description for a series of beliefs, behaviors, relationships and socially constructed identities and historically modeled, without being reduced to sexual practice.

III. METHODOLOGY

The present work was developed from a theoretical and practical activity of the Human Sexuality discipline. It is a *survey* study. The work methodology consisted of an analysis of published bibliographic references with the keywords: human sexuality in adults and the elderly; elaboration of a brief interview script (see appendix) aimed at adults and elderly people aged 25 to 70 years from the theoretical framework analyzed; selection of a questionnaire obtained in the digital research platforms and modified aiming at the objectives of the present work (see annex); observation of adults and the elderly and application of data collection in a local square in the city of Porto Velho-RO, on a night of cultural event; analysis of results based on the theoretical and written framework of the report.

IV. RESULTS

The interview script was applied to four participants and the questionnaire obtained on the digital platform was applied to six other participants, totaling 10 participants at the end.

Table 1- Categorization of the response of the interviewed adults and elderly, RO, Brazil, Nov. 2017.

PARTICIPANT	AGE	SEX	ANSWERS
I	53	M	Respect Loyalty Health Protection
II	31	F	Loyalty Freedom Open Dialogue
III	50	F	Respect Self esteem Loyalty
IV	50	M	Health Protection Self esteem Freedom
V	64	F	Respect Love Health Protection
VI	66	F	Respect Pleasure Information

Source: Authors, 2017.

Question 1 - What does sexuality mean to you?	
PARTICIPANT	**ANSWERS**
I	Everything and more. Without that, we can't walk, right?
II	I think we need sex. You see, we get a little disturbed when we run out. Even more if it is with a person that we love.
III	Relief in female orgasm. It is a feminine need.
IV	For me, it has to represent love, togetherness.

Question 2 - Is the importance you attach to sexuality today different from what you used to in the past?	
PARTICIPANT	**ANSWERS**
I	I think experience counts. Child, youth, adult ... Changes in the best sense, of learning.
II	Yes. Note: the participant preferred not to give more information about this question.
III	Do not.
IV	For sure. Nowadays, people think that sex is a joke.

Question 3 - What do you think of sexual practice in elderly people?	
PARTICIPANT	**ANSWERS**
I	Wonderful. There is a great prejudice regarding sex in old age, but it seems that the thing is more acute (told the example of a neighbor with whom she talked about sexuality). I helped her in some way and she helped me too. When I was a child it was different. There is the will, but not that they do not want, it is knowing how to get there.
II	Normal, if you feel good and want to do ...
III	Very good!
IV	Everything is different between four walls.

Question 4 - Do you consider that there are repressions to sexuality in old age? What are these repressions?	
PARTICIPANT	**ANSWERS**
I	The main repression is by society, which condemns. It is to think that life is over ... that you are old, that you are dead.
II	Yes. My 76-year-old father, I think that since he doesn't do it anymore, he's kind of disconnected from things.
III	Yes. I can't tell you, but there are.
IV	There is a prejudice, because nowadays people ...

Question 5 - Do you think sex is seen differently than it was seen in the past? What differences do you think exist?	
PARTICIPANT	**ANSWERS**
I	Yes. In the past things were more camouflaged, today they say “everyone is lost”, I don't think it's lost, things are more visible. It has always existed, (give the example of a neighbor who had two husbands), but under seven keys (told the example of a nuns' school where there were cases of homosexuality). It has always existed and today things flow much more. In modernity everyone knows everything.
II	In the past I had more love for each other.
III	No.
IV	*Note: the interviewee received a call and had to leave immediately.*

IV. DATA ANALYSIS AND DISCUSSION

The field data were obtained through observations, application of a structured questionnaire and semi-structured interview with adults and the elderly in a cultural environment in the city of Porto Velho-RO, in November 2017. The bibliographic survey was fundamental for the creation interview and modification of the questionnaire obtained on digital platforms according to the delimitations carried out in groups.

The bibliographic survey allowed us to analyze the main characteristics about the sexuality of adults and the elderly and the main axes to be verified in practical contact in the field. Thus, we observed the scarcity of works aimed at the adult stage of human development and, on the other hand, the findings showed us the numerous references on the social representations of sexuality in the elderly, showing the sexual repressions that involve the elderly being in society.

The fieldwork was carried out in a cultural event involving dances and typical foods from other regions and brought together several people, including children, youth, adults and the elderly, in the central area of the city. Observation, application of questionnaires and interviews totaled about 3 hours. Some environmental factors hindered the application of the instruments, such as the loud sound and the continuous flow of people, however, the environment allowed significant observations about the personal and group manifestations. The present group consisted mostly of adult and elderly couples, between 25 and 70 years old.

The interview script was based on questions in order to know the representations of sexuality in adults and the elderly and the possible changes in sexual practice, as well as sexuality at different times in life, in addition to the factors for such changes. These questions help us to understand different factors that preponderated sexuality in the lives of human beings, such as: prejudices, guilt, changes, needs, wants, fears, etc.

The questionnaire contributed to the verification of the main factors that lead us to understand the significance and

representativeness that adults and the elderly place in what they consider sexuality and proved to be easy to apply in view of environmental variables. Concomitant data contribute to an analysis, albeit limited due to the number of participants, which is important for understanding sexuality from a broader perspective and allows us to expand the existing theoretical discussion.

5.1- Sexuality and sexual relations

According to Foucault (1998, *apud*LEAL 2003) the term sexuality appears in the beginning of the 19th century, and even before its emergence, there were studies on sexual practices and behaviors, on related themes, which started at least in the 17th century. Leal (2003), says that sexuality only became a value, regardless of which parts of the body or acts are considered sexual, starting from Foucault in the 20th century. The author states that what we have as sexuality in the contemporary world, are sets of phenomena that are related to sexual life, sexual act, sexual desires and fantasies, sexual behaviors or parts of the body that are considered sexual.

Queiróz*et a* (2015) states that the production of pleasure is closely related to sexuality, but there is a confusion, since sexuality is recognized only through the sexual act, as if this were the only way to talk about sexuality. From a psychoanalytical point of view, sexuality would then be directed to pleasure and its consequences, as well as to the erotic aspect and the sexual relationship itself.

There is an implicit need to better understand sexuality in its entirety, and Vieira *et a* (2016), provides explanations that differentiate these terms, that is, between sex, sexual intercourse and sexuality. In the article, it is mentioned that there is a document prepared by WHO (World Health Organization), in which a distinction is made between sex, which are the biological characteristics that define who is a man and who is a woman.

Sexuality is seen as “a central aspect of the human being from the beginning to the end of life, and surrounds sex, gender identity and role, sexual orientation, eroticism, pleasure, intimacy and reproduction” (KRUG *et al* , 2002 *apud* VIEIRA *et al*, 2016, p.21)

A study by Uchôa*et a* (2016) in which it was found that the majority of the elderly do not know or cannot, distinguish between sex and sexuality, thinking these, as the sexual act and reproduction, and not as a source of pleasure, a way of expressing and experience pleasure. It was also verified, that the campaigns that are related to sexuality, are not thought for the elderly public, and, therefore, the lack of information is also prominent in this sense.

This stems from the taboo that sexuality in old age faces, whereas sexuality in adulthood is called the "maturity phase", there is a reductionist perception that provides the basis for these two phases of life, and the psychosocial, emotional aspects, physicists, are constantly involved in these phases.

Hogan (1985, *apud*ROZENDO; ALVES, 2015), places sexuality as something that must be understood as inherent to every individual, considered unique to each person and manifesting at any time in life. It would then be a mixture of symbolic and physical feelings, such as acceptance, tenderness, pleasure and respect, for example. Rozendo and Alves (2015) found from a survey conducted with the elderly, that many of them seek sexual fulfillment precisely in the elderly, and that they are happy with their sexual life, considering it satisfactory, even though it is a taboo for society as one all.

What was verified in this research, corroborates with what Hogan (1985) *apud*Rozendo and Alves (2015), affirm about sexuality, about a fusion of physical and symbolic feelings, so that, it is explicit in the speech of most of the participants of the specific questionnaire, which thinks respect and loyalty as a preponderant factor in the relationship.

With regard to disease prevention campaigns, it is noted in the interview that another important factor is that of health protection, and this research elucidates many aspects that have connection with observable behaviors in the place where the interviews were conducted.

5.2- Sexuality within a transgenerational perspective

Sexuality is seen from different perspectives over generations and Vieir*et al.* (2016) argue that specific characteristics of each stage of the development of human sexuality be considered and the influence of socio-historical factors, including political, economic, ideological and biopsychosocial aspects on human development and behavior.

With regard to marriage, Carvalho and Paiva (2010) point to Western cultural changes from the Middle Ages to the present. According to the authors, marriage was established as a sacrament by the Catholic Church and had procreation as its sole purpose. In the transition period between the Renaissance and the Modern Age, in the 18th century, marriage started to be seen from a perspective where love was prioritized, compatibility between spouses and sexual practice became more accepted. Subsequently, in the period of the Industrial Revolution, there is an approximation of emotional family ties and we begin to discuss marriage as a choice involving love and not necessarily an obligation, considering the satisfaction of

both spouses. In the 20th century, from the development of Psychoanalysis, sexuality has become a major issue, pointing out its importance in the development of human beings, the existence of oedipal relationships and the categorization of the stages of development. In the process, getting married and staying married became choices, diverging in some points from the religious perspective.

Bauman (2004, *apud* CARVALHO; PAIVA, 2010) presents that the current society is in an individualization process and that it increasingly seeks disposable, soluble relationships, of uncertain duration, believing that it is always possible to find for yourself a better partner, of so that the greater the detachment, the better, which masks a real desire of human beings to relate. Carvalho and Paiva (2010) explain that a large part of this change in perspective is related to feminist movements, the change in the role of women, the development of the contraceptive pill and the emergence of divorce.

Through a field study, the authors analyzed that contrary to what many women today seem, whether young or older, they present contradictions between a "revolutionary" discourse and in the unconscious conservative ideas about the role of women and the the role of man in society, as well as ideals about married life and motherhood, resulting from values rooted in family and social inheritances. At the end of the study, they found that older women consider that nowadays people see sexuality as just fun, revealing that in their opinion women should be submissive and focus on motherhood and the home.

The perspective on sexuality has changed a lot over the generations. In the 21st century, discussions are more open than they were in the past and space was opened to address, besides the theme of sex and sexual practice, other aspects of sexuality, such as gender identity, sexual orientation, libido, among many possible issues of approach. However, it appears that despite the greater openness for discussion, it is still taboo in Western society to discuss such matters.

V. FINAL CONSIDERATIONS

As discussed in the course of the present work, human sexuality has its roots in ancient civilizations, these being the ones that gave rise to Western sexual practices. Understanding the influence of culture, beliefs, myths and customs in the formation of human mentality and behavior regarding sexuality are of great relevance, and can thus be thought from the biopsychosocial perspective.

We also saw that sexuality is not limited to the sexual act, as it can be understood as a way of being that is incorporated into a body through its practices, that is, it is basically the way we experience being a man and being a woman.

Each stage of the development of human sexuality has its prevalent characteristics, in adulthood it is considered that the individual is mature and safe to establish solid affective bonds, thus enjoying, adequately, their sexuality. In the case of the elderly, there is a prevalence of the qualitative in relationships, in the manifestations of affections, such as tenderness, companionship, understanding, among others, not discarding, in any way, the continuity of sexual activity in this phase, despite the reprehensible social representations that these experience within society.

Finally, combined with the bibliographic contributions and the field research carried out, it was possible to understand the breadth related to the theme of human sexuality, especially with regard to the phase of old age. We emphasize that our intention to know the representations of the sexuality of this public and the possible changes in sexual practice was limited, mainly due to the scarcity with regard to scientific articles aimed at adult and elderly life from the perspective of the Freudian genital phase, due also to the little knowledge that the public had on the subject of sexuality, it became evident that there is confusion between sexuality and sex itself, impairing the evaluation of responses, and also due to the low number of participants who joined the survey.

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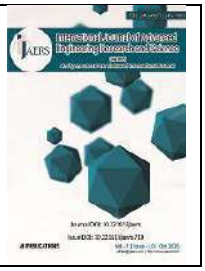

Accessibility of hearing-impaired people at IFPB through an educational resource in LIBRAS for the practice of handball sportive

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***Keywords*—libras, handball, physical education, inclusion, glossary.**

***Abstract*—*Despite advancements in recent years concerning the universalization of access to Basic Education, when dealing specifically with students with a disability, one notes that the effective inclusion of such students is still a great challenge. The inclusion of deaf students in physical education classes, for example, is a growing trend, yet there is still a glimpse of a sensitive gap in the promotion of equal and qualified inclusion due to the difficulties and problems that constantly appear in the process of teaching and learning. The methodology adopted in this research is based on a qualitative approach, configured in terms of basic research with an exploratory objective. Data collection procedures were carried out via bibliographic and patent research. We identified a total of 164 records on the subject (11 references, 16 rare periodicals and 137 general works). However, none of these records are related to sports or to the theme of the project in question (glossary in Libras of technical gestures for handball teaching). In the patent bases, no occurrence was identified for a product similar to the one proposed to be researched. The creation of a technical manual in Libras with technical gestures of handball would minimize these language barriers between physical education teachers and deaf students. As previously explained, the main objective of this research was to analyze the relevance of using educational resources in Libras for technical gestures, equipment and specific terms of handball as a tool to assist in teaching this sport to the student community with hearing-impairment.*

I. INTRODUCTION

Inclusive education is a social process that has been developing around the world and gaining relevance in academic studies in these recent decades (EIRAS, 2019). Despite the advances achieved in recent years concerning the universalization of access to Basic Education, when dealing specifically with students with some disability, one notes that the effective inclusion of this student is still a great challenge. The infrastructural demands adequate to their needs - which vary a lot according to the disablement - and, equally, the scarce investments in formation and training of professionals are obstacles for these disabled students to be properly included in the school space.

According to data published by IBGE (2012), referring to the 2010 Demographic Census, visual impairment was present in 3.4% of the Brazilian population; motor impairment in 2.3%; hearing-impairment in 1.1%; and mental/intellectual impairment in 1.4%. When we consider people with some difficulty in these skills, we found that 18.8% of the population had difficulty in seeing; 7.0% had difficulty in moving; and 5.1% had difficulty in hearing.

The inclusion of deaf students in physical education classes, for example, is a growing trend, yet there is still a glimpse of a sensitive lacuna in the promotion of equal and qualified inclusion due to the difficulties and problems that constantly appear in the process of teaching and learning. According to Melero (2007), school and social inclusion implies a profound change in the content and styles of teaching by most educators. Physical education and sports practice, as an integral part of the basic school curriculum, could not be absent from this process of pedagogical inclusion, and should be considered within the curriculum as a curricular component and not as complementary activities.

The use of new proposals and theoretical-methodological approaches that stimulate creativity, body expression and freedom of movement, as stated by Zuccheti (2011), will provide students with experiences that foster cooperation, sociability and psychomotor development. Specifically dealing with deaf people, Greguol (2010), when arguing that despite the hearing-impairment does not seem to show great commitment to the general development of the individual, the impact of hearing loss can cause serious damage and aggravation if the individual does not have appropriate stimulus.

Therefore, this study sought to analyze the importance of the use of instruments in Libras for technical gestures, equipment and terms specific to the Handball mode, as a tool that presents technical information and enables deaf students to teach a simple, synthetic, illustrative and didactic approach to this mode. Moreover, in addition to the objective importance to the deaf community school, this educational resource has the purpose of serving as a source of knowledge for the training of teachers who work in this sport in physical education classes.

II. THEORETICAL REFERENCE

1. Brazilian Sign Language In Handball Practice

The deaf student usually has no restrictions on their participation in the Physical Education classes, as long the teacher detaches the deafness from the speech experience and the disability. Motor skills activities, including sports, can be performed ordinarily, as hearing loss is related to a sensorial aspect, which allows the free exercise of physical activities of one's preference trough adjustments, that may be effective for their participation (FERREIRA, 2011).

The acquisition of Libras (Brazilian Sign Language), by the Physical Education teachers, has been an allied in overcoming communication barriers and contributing to the development of motor skills levels, perceptives, cognitives and sociocultural, given that the classes in this discipline have distinct characteristics, permitting greater freedom, turning students more spontaneous, creative and leading to a constant exchange of social relationships. Santana and Bergamo (2005), when discussing about the crossroads of social and theoretical struggles of deaf culture and identity, point out that,

> By adopting language as the defining factor of a social identity, even taking into account relationships and conflicts related to the different positions occupied by social groups, its instrumental character is emphasized. Thus, its nature, or its social significance, is credited to the social interactions to which it is connected. (SANTANA and BERGAMO, 2005, p. 568)

This nature of language as a social signifier and foundational point of a deaf culture has been clearly observed. Even so, there is still much to advance. Regarding mainly the methods and practices of teaching in regular schools, we identified that are still insufficient in terms of training and understanding the needs of deaf students when they are inserted in regular classes, spaces of the education system attended by students with and without disabilities.

With the emergence of the International Handball Federation (IHF) in mid-1946, the spread of this sport has become even greater and is gradually improving. Since then, its practice has become democratic in the country and, as Greco (2012) remarks, it is a common sport practice in Physical Education classes, presenting different forms of expression, that is, different levels of performance - school sport (from, to and at school), rehabilitation, health, leisure-recreation, performance, high level of performance and professional sport. Handball is one of the most practiced sports in schools in Brazil. It is played on the beach, in a wheelchair, in the third age, in the master; therefore, it is a sport in which all those who practice it find a group that has their interests and vocations.

Despite this advance, the inclusion of deaf students in this sport is still limited, since most of the information used in the sport dynamics is verbal or visual. In visual terms, the deaf student usually has no difficulties, but when it is only information transmitted orally, it is impossible to understand the information transmitted. Due to the dynamics of sport, the sender is sometimes not aligned or in the same field of view of the deaf student.

Therefore, the creation of signals in Libras in this sports practice can establish your body scheme, your image and unrestricted access to the sports world with bio-

psychosocial benefits so that they can recognize themselves as subjects integrated in these activities in the school environment. The motivation and challenge lies in structuring methodologies, resources and materials that consider rhythms, forms, different stimuli to learn and enable to think in an inclusive and participatory education for all in return for the hegemonic proposals of teaching and evaluation.

The teaching of sports when approached in the practical context presents an enormous variety of specific gestures in its execution and, to insert someone in a group is to give him/her conditions so that he/she can participate actively in the ideas and activities of the same. The need to develop a specific vocabulary for the sport handball that is taught at the IFPB Campus Campina Grande, has become part of the teaching and learning process, once there is a significant share of deaf students with difficulties in understanding the basic principles of sports, as well as to properly instrumentalize the teachers.

We observed the possibility of creating a glossary in Libras with technical gestures, equipment and terms specific to the sport for different sports, thus facilitating the teaching of these modalities both for deaf students, as well as teachers, technicians and other individuals in this context. There are several reports in the literature of advances in projects of translators and other applications for deaf (MELERO, 2007; OLIVEIRA et al, 2017; EIRAS, 2019).

III. MATERIALS AND METHODS

Due to the initial hypothesis of the absence of signs in Libras in the specified context, the present project was developed with the objective of analyzing the existence and pertinence of the use of educational resources in Libras for technical gestures, equipment and specific terms of the Handball modality as an aid tool for the teaching of this sports practice with the student community with hearing-impairment.

The methodology adopted in this research is based on the premises of a qualitative approach, being configured in a basic research of exploratory objective. With data collection procedures carried out via bibliographic and patent research. Initially, a literature review was conducted, consisting mainly of books and scientific articles, which grounded the reflections presented in the theoretical framework. Then, a data collection was made, in this study identified by search of precedence, in documents taken from academic databases that referred to "Signage in Libras", whose focus of exploration was concentrated on the innovative character of the product and not on statistical data.

Based on this demand, we chose to perform a search for anteriority to verify the existence or not of such tool or anything resembling with similar functionality. This type of search is configured in a research activity on technological information that attests to / proves the existence or not of a product, a process or improvement that is akin to the object being questioned. This research must be wide-ranging and must cover both the bibliographic research and the search in patent databases.

The research was carried out between the months of October and November 2019 and was in the site of the National Library (copyright records), in the National Institute of Industrial Property - NIIP, Patentinspiration and Google Patents (patents) and in the periodicals Capes, Scielo and Google Scholar (academic works). They were used as keywords: deaf, language, Libras and sports (in Portuguese at NIIP, Capes, Scielo and Google Scholar) and deaf, language and sport (in English at Patentinspiration).

IV. RESULTS AND DISCUSSION

The National Library's website has searched for copyright records of books, booklets, manuals and dictionaries entitled "Brazilian Sign Language". A total of 164 records on the subject were found (11 references, 16 rare periodicals and 137 general works). However, none of these records are related to sports or to the theme of the project in question (glossary in Libras of technical gestures for handball teaching). In the patent bases, no occurrence was identified for a product similar to the one proposed to be researched.

This time, we identified the absence of these educational tools and therefore verified the need to provide these tools, not only to the IFPB Campus Campina Grande, but to the teaching network as a whole, for the implementation of the teaching-learning process of deaf students in sports practices. The project of an instrument that can help in the translation of gestures related to Handball for Libras that describes, for example, positions, materials, technical gestures, rules and marking the courtis presented in Chart 1.

Therefore, after this study, we will develop a specific signage for handball that meets the demand. To this end, we conducted a survey of terms to be created to represent the dynamics of the game and its translation to Libras.

V. FINAL CONSIDERATIONS

Language barriers are still a major obstacle to the inclusion of deaf students in the practical context of physical education classes when sports are approached, as in the case of handball. It is necessary that educational institutions insert inclusive education in their institutional programs of teacher training (curricular and continued). By providing content that enables both future and current teachers to work with students with special needs.

The creation of a technical manual in Libras with technical gestures of handball would minimize these language barriers between physical education teachers and deaf students. As already exposed, the main objective of this research was to analyze the relevance of using educational resources in Libras for technical gestures, equipment and specific terms of handball as a tool to assist in teaching this sport with the student community with hearing-impairment.

The manual presents itself as a possibility of an instructional tool, mainly in practical classes, since in the dynamics of a handball game, it is not possible for the interpreters of Libras to act, since these professionals cannot track the students during the dynamics of the game. Frequently, it is left to the judgment of the one who conducts the game (teacher or arbitrator) to signal to the practitioners the actions and commands pertinent to the practice of the referred sport. Some signals are already used by handball referees being contained in the rule book (free throw, goal throw, overlap, 2 dribbles, exclusion for 2 min., disqualification/exclusion, area invasion, foul of attack, stop, hold or push, foul, time - out or time). However, those were indicative gestures and were added to Libras, becoming part of the Brazilian sign language through the manual.

Thus, the possibility of creating this manual would allow more accessibility to the participation of deaf students in practical classes, since, through it, it would be possible to understand the basic principles of the sport, as well as allow teachers and coaches to work the content more comprehensively during the classes.

Regarding inclusion, the manual would promote greater interaction between deaf students and hearers, since deaf students tend to interact primarily with other deaf due to language barriers imposed naturally. This is because of the inclusive characteristics that every collective sport promotes in its practice. The insertion of Libras in the practical context of physical education classes should arouse greater interest of teachers and students listeners and thus spread the Brazilian sign language in a very broad way, significantly improving the inclusion and socialization of deaf students in the school context.

As can be seen in this research and other scientific literature, one of the major problems concerning inclusion is the lack of preparation of teachers to deal with deaf students, since these students depend solely and exclusively on the interpreters to develop the content. Therefore, based on the above, we emphasize that the technical manual in Libras is a very efficient tool for inclusion in the teaching of handball in physical education

Chart 1 - Terms in Libras created for the handball modality

Team Players	Balls	Techinical basics	Rules	Court marking
- left wingman	- ball size 1	- shooting	- 7 meter shot penaltythrow	- goal area line
- left backcourt	- ball size 2	- chest pass	- goalkeeper throw	- free throw line
- center backcourt	- ball size 3	- one-handed shoulder pass	- throw in	- seven meter line
- right backcourt		- pick pass	- goal	
- right wingman		- jump shot	- double dribble	
- pivot		- standing shoot	- two minute suspension	
- goalkeeper		- receiving	- disqualification/exclusion	
		- dribble	- attack foul	
		- feint	- holding the opponent	
			- hitting	
			- team time-out	
			- free throw	

classes. This resource, besides allowing a greater understanding of knowledge is a very effective tool for the inclusion of hearing-impaired youth.

It is interesting to point out that it is urgent that the undergraduate courses include in their curriculum, subjects aimed at attending not only deaf students, but also students with other types of disabilities. As well, it would be pertinent that the training institutions themselves invest in the continued development of teachers and technicians to meet this growing demand in our society.

As future works, we intend to develop an Open Educational Resource in book format that is a Handball Technical Gesture Manual for Physical Education classes. Aiming that this instrument can contribute significantly as a teaching resource used in physical education classes.

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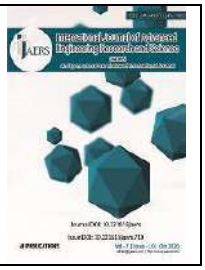

Development of a Decision Support Tool to Evaluate New Ideas Validation in Idea Generation Process in Organizations

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Keywords*— *Competitive Advantage, Integrated Strategic Management Tool, Idea Generation, PESTEL, Porter Five Forces, Project Portfolio Management, SWOT Analysis, Validation, VRIO

***Abstract*—** *Using strategic management aspects can be very beneficial specially in decision making process. Establishing a methodology that can motivate the employees to speak up their minds and increase their levels of loyalty and retention with suggesting new successful ideas that can take place in front of them to make their organization with a better work environment. The purpose of this research, as there is a pilot study suggestion of Integrated Strategic Management Tool designed and a solid structural flowchart that can help organizations, is to save their efforts and time with the most optimum results in terms of efficiency and effectiveness for organizational growth advantages. The tools are being considered in the final design of the tool is designed to be aligned with competitive advantages principles such as SWOT analysis, VRIO, Porter Five Forces and other general critical business aspects in PESTEL.*

I. INTRODUCTION

The Kingdom of Saudi Arabia has launched its 2030 vision back in 2016. The vision aiming for future ambitious goals for the country to reform magnificently the economic structure from depending on one source of income to diversification of sources to reach the steady state of GDP without the huge impact of oil dependency. This ultimate goal wouldn't happen without the full alignment between the private sector, public sector and quality of life for citizens and residents. The 2030 transformation vision focuses on two main areas in decision making, which are decision making and process improvement for short-term and long-term applying. Empowering people to speak up their minds and come up with their flow of ideas is critical in such transformational change management. Here comes the role of Industrial Engineering as one of the central and important part to achieve Kingdoms' Vision 2030, both Industry and Academic sectors need a perfect management system to enhance the decision-making process and to increase the productivity of the organization through their employees' abilities. Sometimes the organization has very effective and efficient employees, but due to some miscommunication of delivering the right ideas to the right people and weakness of management and wrong decision making, they got a drop in their performance. In this study, the researcher will try to use technical and management skills that integrate Strategic Management tools in one model in a certain way to achieve research goals. This integration will enhance capabilities of organizations to take an efficient decision for large group of set of ideas. This study will be conducted in Saudi Glass Company in the private sector, one of the biggest companies in glass

sectors, that has more than 1000 employees, and it works 24 hours / 7 days. Saudi Glass Company is making a good profit. By the end of this study, we can come up with the best combination of methods to develop a decision support tool to evaluate new Ideas validation in idea generation process.

II. RESEARCH MAIN POINTS

A. Problem Statement

Idea Generation Process is essential to any kind of new ideas or projects to be implemented at any organization. In order to evaluate new project success, team members in strategic departments should follow standard rules through their organizations' objectives to check if the new idea is feasible to take into consideration or not. Most of organizations take into considerations only popular quantitative economical methods such as: NPV, ROI, & Payback period, which take more time, effort, & budget.

B. Research Objectives

The main objective of this research is to help organizations that have Project Portfolio Management method to control flow of new ideas by employees to check the level of confidence for a certain kind of project in strategy department team members, who usually conduct idea generation sessions for new notions and projects. Therefore, there should be a standard scoring model that can be followed and assist to let decision makers take the right decision, whether to start implementing the idea generations sessions, before wasting teams' times and efforts. The objectives of thesis can be listed as followed:

I. Analyzing Industrial Engineering & Strategic Management techniques such as Competitive Advantage, VRIO, Porter Five Forces, PESTEL, SWOT analysis, Analytical Hierarchy Process, TOPSIS, NPV, ROI, & Payback Period.
II. This thesis will help organizations to seek the best combination of methods to develop a decision support tool to evaluate new Ideas validation in idea generation process.
III. Validating the decision support tool in SAGCO.
IV. Recommendations for next phases of improvement for the new tool.

C. Research Questions

This research aims to answer the following questions:

1. Is the proposed idea compatible based on group of expertise to reduce time of analysing ideas and encourage employees for speaking up their minds?
2. Could there be a specific model for applying strategic management methods in survey type of tool?

III. METHODOLOGY

Methodology is a systematic and theoretical analysis of methods applied and it is the path researches follow to reach to a certain goals and objectives, moreover, methodology is the mechanisms recognized by scientists can be used to observe, detect and investigate the acquisition of knowledge. This chapter includes the methodology used in applying strategic management tools with the steps and procedures carried out in this research. This chapter aims to demonstrate how the Integrated Strategic Management Tool can work and what it is consist of and how its important (PPM) Project portfolio management is the process by which an organization focuses its limited resources on the development of new products and operational enhancements. It is primarily responsible for the evaluation and prioritization of current and prospective projects together with other ongoing initiatives.

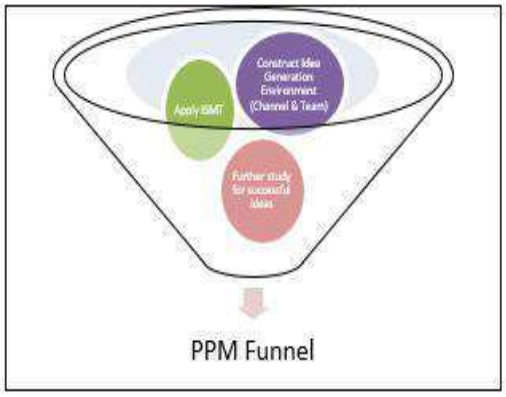

Fig.1: Project Portfolio Management

A. What is Integrated Strategic Management Tool?

ISMT consists of four pillars & aspects of strategic management techniques used in very efficient way to minimize the lead time of confirming ideas for PPM & idea generation process. First, after collecting the ideas, there should be a committee team with diversity of multi-functions & experience, who are at least aware of the following terms:

- Competitive Advantage (Michael Porter 1985)
  A competitive advantage distinguishes a company from its competitors. It contributes to higher prices, more customers, and brand loyalty. Establishing such an advantage is one of the most important goals of any company. In today's world, it is essential to business success.

- SWOT Analysis (Albert Humphrey 1960s & 1970s)
  - ❖ It is a source of information for strategic planning.
  - ❖ Builds organization's strengths.
  - ❖ Reverse its weaknesses.
  - ❖ Maximize its response to opportunities.
  - ❖ Overcome organization's threats.
  - ❖ It helps in identifying core competencies of the firm
- Porter Five Forces (Michael Porter 1979)
  Five forces analysis helps organisations to understand the factors affecting profitability in a specific industry and can help to inform decisions relating to: whether to enter a specific industry; whether to increase capacity in a specific industry; and developing competitive strategies.
- VRIO (Barney, J. B. (1995))
  VRIO analysis is a tool in strategic planning, used by firms to make effective business decisions. The analysis provides information and the results will hopefully provide a competitive advantage. Firstly, VRIO is an internal analysis. It's used to identify and evaluate resources in the company.
- PESTEL (Francis Aguilar 1967)
  It encourages the development of external and strategic thinking. It can enable an organisation to anticipate future business threats and take action to avoid or minimise their impact. It can enable an organisation to spot business opportunities and exploit them fully.

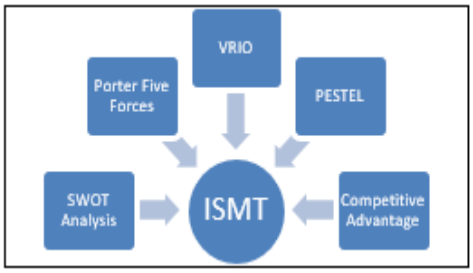

Fig.2: Integrated Strategic Management Tool

B. Applying Integrated Strategic Management Tool (ISMT)

As a pilot study conducted in SAGCO, the committee was constructed to contain the following:

Then, announcement has been distributed to employees' sample for large scale session of idea generation. Then, filtration was done by applying ISMT suggested tool. One of the ideas was very interesting and the management accepted it essentially with high potential of implementation. Moreover, the idea simply was to use some portion of the recycle material and respond for low number of quantity request.

SAGCO produces 1000 tons of glass bottles daily (4 million bottles) with minimum accepted order of 1 million bottles in 13 lines with 5 furnaces and 2-3 hrs downtime to change the molds and machines setting up. On the other hand, due to the rapid increase of requests for thousands quantity orders by individuals and small establishments in this growing era of entrepreneurship, the idea came to satisfy the market need with higher profit and less capital investment.

As the following sample of ISMT tool took place in above example, here is a brief description of the mechanism of applying the method:

1- Establishing a channel to receive employees' ideas and communicate properly.
2- Construct a multi-disciplinary functions team to use the ISMT tool with 8 answers in the case of SAGCO pilot study.
3- In ISMT tool, there is 20 questions with a scale from 1 to 10, where 0 is not applicable and won't be calculated in the averages, it is consisted of five aspects of strategic managements techniques and theories. First, SWOT analysis which discuss internal and external factor and seeing how the idea is related to each point after that the rest of VRIO, PESTEL, & Competitive Advantage.
4- Calculating the average of all answers and agree on passing percentage where the research is suggesting 50%, less than 30% is failed and in between it will be left for voting.

C. The Benefit of Applying ISMT

a- Determine level of feasibility in percentage to check if teams going to modify or drop the listed idea.
b- Save time and efforts of the team to increase credibility between team members and leaders.
c- Having enough time to focus on more feasible ideas.
d- Continuous improvement for PPM in companies using accredited strategic management techniques.
e- Easy model to use.

IV. RESULTS

Date:	05-Jan-21	Name of Idea: Small Volume Production Line	0 = Not Applicable 1 - 3 = Moderate 4 - 6 = Good 7 - 8 = Very Good 9 - 10 = Excellent	
Number of Evaluters:	8			
Idea Number:	1			
#	Elements	Questions	Average	NA Check
1	Strength	How would you rate the **strength** of your organization comparing to the idea?	8	10
2	Weakness	How would you rate the **weakness** of your organization comparing to the idea?	7	10
3	Opportunity	How would you rate the **opportunity** on your organization with regard to the idea?	9	10
4	Threat	How would you rate the **threat** on your organization with regard to the idea?	4	10
5	Suppliers	How would you rate the number of **suppliers** with regard to the idea?	6	10
6	Customers	How would you rate the number of **customers** with regard to the idea?	8	10
7	Rivalry	How would you rate the number of **rivalry** with regard to the idea?	1	10
8	Substitute	How would you rate the number of **substitutes** with regard to the idea?	1	10
9	New Entrants	How would you rate the number of **new entrants** with regard to the idea?	5	10
10	Valuable	How would you rate the following question, Is the idea **valuable**?	9	10
11	Rare	How would you rate the following question, Is the idea **rare**?	7	10
12	Imitiatable	How would you rate the following question, Is the idea **imitiatable**?	1	10
13	Organization	How would you rate the following question, Is the idea well **organized**?	8	10
14	Political	How would you rate the following question, Is the idea **politically** complied?	0	0
15	Economical	How would you rate the following question, Is the idea **econimcally** feasible?	8	10
16	Social	How would you rate the following question, Is the idea **socially** accepted?	10	10
17	Techonolgical	How would you rate the following question, Is the idea **technologically** well served?	7	10
18	Environmental	How would you rate the following question, Is the idea **environmentally** friendly?	9	10
19	Legal	How would you rate the following question, Is the idea **legally** complied?	10	10
20	Competitive Advantage	How would you rate the **competitive advantage** of this idea to the organization?	8	10
		Total Pecentage of Approval	66%	190
Name of Evaluater:	Average Sheet		Suggested Passing Percentage	
Years of Experience:	Average Sheet		< 30% Failed	
Department:	Average Sheet		30% < x < 50% Voting	
Signature:	Average Sheet		> 50% Passed	

Fig.3: ISMT Tool in Practice

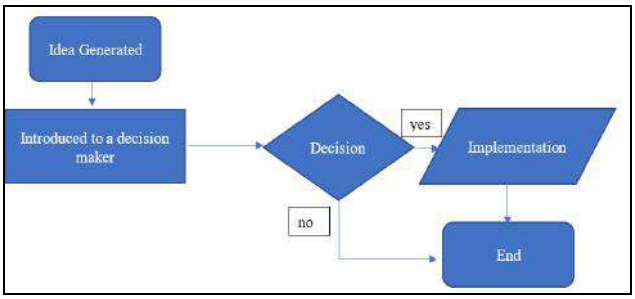

Fig.4: Old Process Flowchart

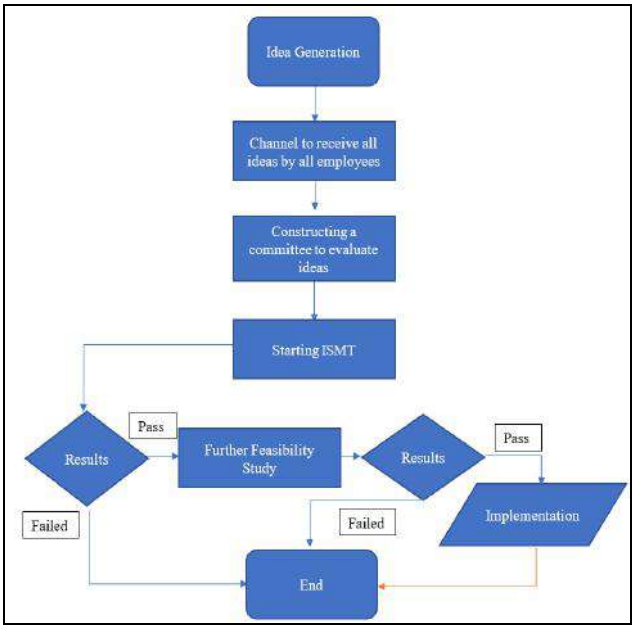

Fig.5: Suggested New Process Flowchart

V. CONCLUSION

All in all, organizations would magnificently benefit from using the methodology of ISMT application, which has five important aspects of strategic management techniques. Starting with establishing a channel to let their employees speak up their minds clearly, and constructing an expert team to evaluate, then the efficiency and effectiveness of applying the method right with the right time will highly positively impact the company business and its environment.

a. Recommendations

The main recommendation is to continuously improve the method with adding more aspects to it. Also, applying the method in more companies and organizations in both private and governmental sectors to see the best practice can be applied.

b. Research Limitations

This research focuses on PPM and Idea Generation. Many organizations don't use the previous methods and its applications of controlling the flow of ideas and information, which might impact the accuracy of results. Therefore, the developed method of novel scoring model should be applied in more than three hundred organizations to see the normal distribution and get the right accurate feedback on how we can improve it further. Finally, there should be a reward system and recognition for participants.

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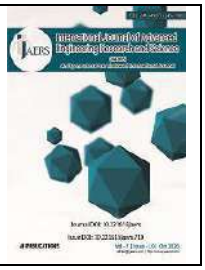

The effect of different bone level and prosthetic connection on the biomechanical response of unitary implants: Strain gauge and finite element analyses

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***Keywords*— Biomechanics, dental implants, prosthetic dentistry, bone, stress**

***Abstract*—** *Different prosthetic connections have emerged for better aesthetic and biomechanical performance to prevent peri-implant bone loss. The finite elements analysis and the strain gauge methodologies were used for the numerical analysis of the generated stress and the microstrain around the implants and their connections. Two implant models with the same length (13 x 3.75 mm) were analyzed according to the prosthetic connection: external hexagon or morse Taper. Both abutments received screw-retained metallic crowns in chromium-cobalt. The peri-implant tissue was simulated using polyurethane resin in two different heights (bone level and 5 mm of bone loss). A load of 300 N was applied on the occlusal surface. The results were analyzed in terms of von-Mises stress and micro strain. Samples identical to the numerical models were made for the Strain Gauge (SG) analysis; four SGs were bonded around the implant to obtain micro strain results. Finite element analysis and strain gauge corroborated in terms of similar mechanical response. Thus, there is no difference regarding the prosthetic connection for the generated stress and strain under axial load. However, bone loss increased the stress and strain magnitude for both prosthetic connections. In conclusion, both evaluated implant connections present similar biomechanical behavior regardless the bone height.*

I. INTRODUCTION

Even though dental implants have high success rates, failures can occur after osseointegration.[1] The main reasons for osteointegration failure are peri-implantitis and occlusal overloads.[2,3] Studies reported that occlusal overload induces unwanted bone remodeling.[4,5] The occlusal overload promotes a moment in the implant that entails on peri-implant bone permanent damage.6 It is reported that axial loads are less harmful to the bone tissue due to the stresses transmission throughout the implant; while oblique loads generate higher bone microstrain due to a non-uniform load transmission in the implant long axis.[7-9] In addition to the occlusal overloads, the prosthetic connection can modify the mechanical response in some situations.[10-14]

Implants with internal conical connections (Morse Taper) have been associated with bone crest maintaining, avoiding screws loosening and fracture.[15-18] However, the

biomechanical benefit of morse taper implants are still controversial in the literature.[12-18]

To analyze the generated strain around the implants, finite element analysis and strain gauge methodologies can be applied in dentistry. Both methods are able to generate numerical results to evaluate the mechanical response after chewing load simulation.[19-23]

Finite element analysis consists on theoretical simulations of applied loads and constrains. This method offers predictable results of in vivo events with acceptable accuracy. Associated with the strain gauge analysis, they allow the evaluation of complex situations with a valid model.[23-25]

In view of the above, the present study aimed to evaluate, *in silico* and *in vitro*, the stress distribution and strain of unitary implants with different prosthetic connections and bone height. The hypothesis of the study consisted that prosthetic connection and bone height would not influence the mechanical response under axial load.

II. MATERIAL AND METHODS

Two different implant connection models were simulated in the present study: a regular morse taper and an external hexagon (Titaoss® TM cortical Intraoss®, SP, Brazil); both created according to the manufacturer's dimensions (3.75 x 13 mm) using CAD (Computer Aided Design) software (Version 4.0 SR8, McNeel North America, Seattle, WA, USA). Next, the morse taper model received an anatomic prosthetic solid abutment (0.8 mm) and the external hexagon received an UCLA abutment (4.1 mm). Both abutments indicated for screw-retained fixed prosthesis. The implant was inserted at the center of a three-dimensional bone model (40 x 40 x 20 mm) with 3 mm of exposed threads. An anatomic first upper molar was modeled, duplicated and positioned on each abutment (Figure 1).

To simulate an isotropic substrate, a polyurethane resin block was used to receive the implants. In addition, 5 mm of bone loss has been simulated in half of the models totaling 4 clinical situations (2 implant systems x 2 bone height levels). The mechanical properties of polyurethane and the simulated materials were summarized in table 1.[26,27] The materials were assumed as isotropic, linear, elastic and homogeneous. After the modelling process, the solid volumetric three-dimensional models were exported to the analysis software (ANSYS 17.0, ANSYS Inc., Houston, TX, USA) in STEP format. The contacts were considered bonded between all bodies.

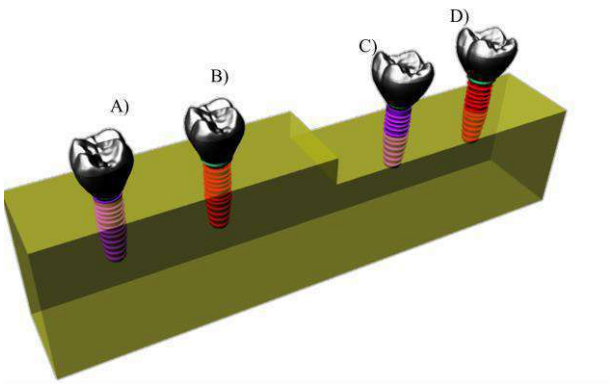

Fig.1: 3D model with A) MT without bone loss, B) EH without bone loss, C) MT with bone loss and D) EH with bone loss

The fixation was defined on the bottom surface of the polyurethane block and the load was defined as axial and applied in the center of the crown. Tetrahedral elements (Figure 2) formed the mesh (754.936 nodes with 440.893 elements) and the results were obtained in von-misses stress for metallic solids and micro strain for peri-implant tissue.

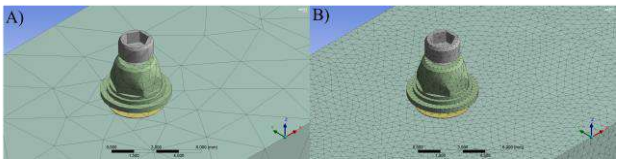

Fig.2: Finite element-mesh generated in A) automatized and B) after the convergence test.

Table.1: Mechanical properties used in the present study.

Material	Young Modulus (GPa)	Poisson Ratio
Titanium	110	0.33
Co-Cr	218	0.30
Polyurethane	3.6	0.30

To simulate the bone tissue, two blocks (95 x 45 x 30 mm) of polyurethane (F160 Axson, Cercy - France) were obtained through a rectangular stainless steel metal matrix. After polymerization of the polyurethane, the blocks were removed from the matrix and had their surfaces polished with sandpapers #220-600 under water.

In this study, Titaoss® Max Cone Morse implants and Titaoss® TM 3.75 X 13 mm implants (Intraoss, SP, Brazil) were used. For the installation of the implants in the blocks, a set of milling cutters was used according to the manufacturer's recommendations.

Two implants (one of each system: external hexagon and morse taper) were inserted at the bone level. Other two implants were positioned 5 mm above the polyurethane surface simulating a 5 mm bone-loss condition. Next, the respective abutments were installed with the aid of a manual torque wrench and the manufacturer's guidance (Figure 3). The selected crown to perform a direct comparison between *in silico* (FEA) and experimental (strain gauge) tests was the Cr-Co crown due to the facility in manufacturing and simplicity for polishing.[19]

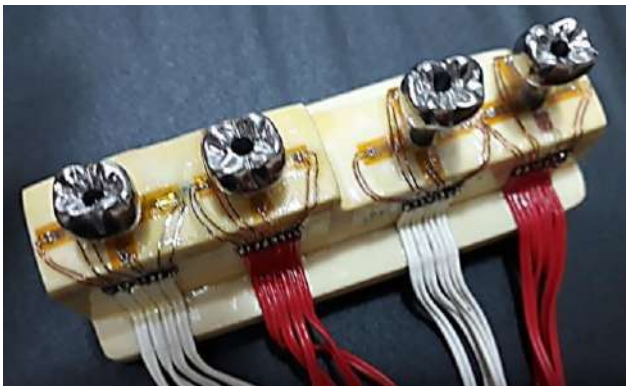

Fig.3: In vitro model similar to the virtual model

The strain gauges (PA-06-060CA-120L-Excel Sensors Ltda., São Paulo, Brazil) were bonded with cyanoacrylate adhesive (Super Bonder Loctite, SP, Brazil) around the implants in the cervical third, according to colorimetric maps of the region with the highest bone microstrain detected in the finite element analysis.8 A load application device was used to apply the occlusal load on the crowns occlusal surface.[21] The device has a spherical tip that is positioned in the center of the crown with a load of 30 kg during 10 seconds.[20,21]

Variations of electrical resistance were converted into microstrain-rate units through an electrical signal conditioning apparatus (Model 5100B Scanner - System 5000 - Instruments Division Measurements Group, Inc. Raleigh, North Carolina, USA). Electrical cables allowed the connection between the strain gauges and the data acquisition apparatus, where the acquisition channels were installed.[22] The magnitude of micro-strain was recorded in µm/µm and compared with the finite element analysis results.

III. RESULTS

In the present study, the strain gauge was used to validate the computational models with the in vitro test using one specimen per group. According to the strain gauge test, there is no value capable do induce unwanted bone remodeling (Table 2). According to the similarity of results from FEA and strain gauge (Fig. 4), it was possible to observe that the models were considered valid and the conclusions from the numerical method are possible with reduced error and acceptable behavior.

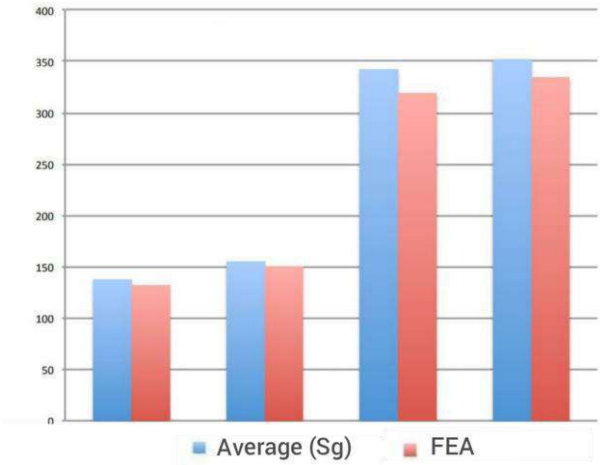

Fig.4: Microstrain peaks measured in both methods

Table.2: Average values (µStrain) obtained in vitro

Type	Bone	Mesial	Distal	Buccal	Lingual
MT	Bone level	138	136	137.	136
EH		155	161	154.	146
MT	5 mm bone loss	326.	361	356	323
EH		335.	376	358	338

For the Von-Mises stress in each model, a qualitative comparison showed a stress increase in the models with bone loss when compared to bone level ones (Fig 5).

According to the implant connection, it is not possible to note visible differences in the stress concentration in the titanium implant. The difference between both implant systems is visible in the prosthetic screw region, with highest stress magnitude in the external hexagon screw neck. No difference was reported between models (10%) with similar bone height for the micro strain (Fig 6).

For the apical and cervical regions of the set, the factor “bone loss” was significant; showing that for the mechanical response, the peri-implant tissue maintenance was more important than the implant connection itself.

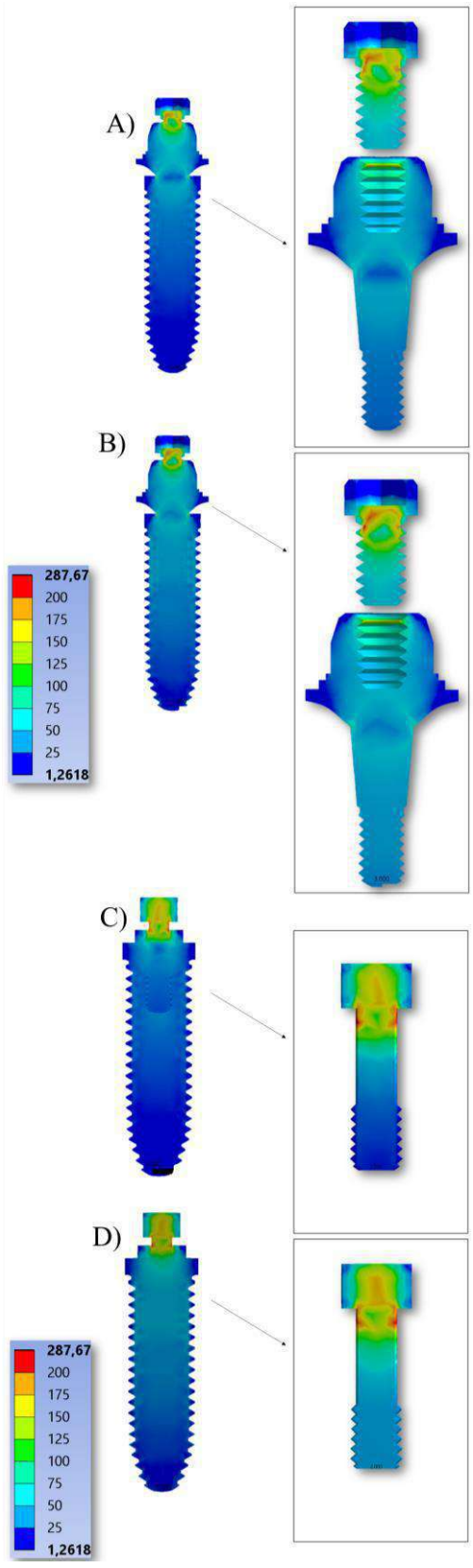

Fig.5: Von-Mises stress maps in dental implants and screws. A) MT without bone loss, B) MT with bone loss, C) EH without bone loss and D) EH with bone loss

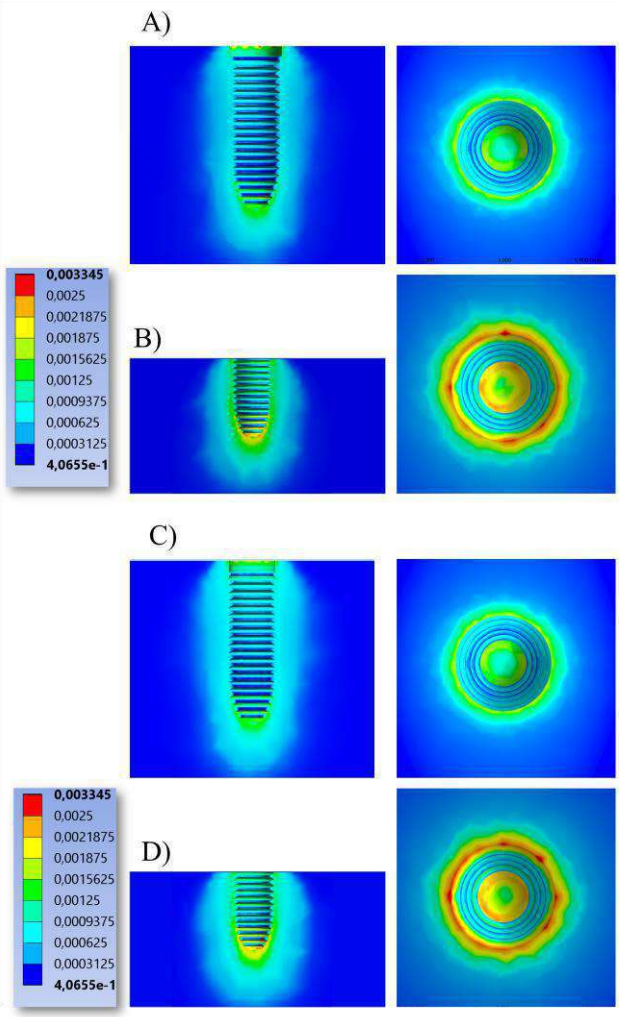

Fig.6: micro strain maps in peri-implant tissue with sectioned and occlusal view. A) MT without bone loss, B) MT with bone loss, C) EH without bone loss and D) EH with bone loss

IV. DISCUSSION

The present study aimed to evaluate, *in silico* and *in vitro*, the stress distribution and strain of unitary implants with different prosthetic connections and bone height. The results showed that there was no difference between the external hexagon and Morse taper system, regardless the bone level.[29-32] However, there was higher strain in the cervical and apical regions in the models with bone loss.

In addition to bone strain, it was observed with FEA that, regardless the implant system, Von-Misses stress in the implant and in the screw was higher when there is a bone loss situation, which corroborates with previous studies that have evaluated bone loss in dental implants.[33-35]

When evaluating the screws, it is possible to observe a high stress concentration in the screw neck in all groups.

This finding can indicate loosening or even fracture of these screws similarly between Morse taper and external hexagon systems.[12,22] These results go against previous studies that indicated an higher failure risk in external hexagon implant for unitary restorations.[27,28]

The unitary restorations are biomechanically complex, especially when replacing posterior missing elements, since the occlusal forces are higher,[21] which can lead to high stresses in the abutment and in the bone, making the system more susceptible to failure.[29] During the load dissipation, the lateral component of the force can be responsible for the torque moment, which have a destructive effect on the cortical bone and can cause complications in the long-term.[30]

Frost (1994)[4] conceptualized that the mechanical stimuli in the bone can induce the predictable bone behavior. The basic activities of remodeling determine the architecture and strength of the bone tissue. Basically, regions where the bone strain remains below 50 μ, means that it is in disuse. micro strain above 1500 μ tend to promote lamellar remodeling by reconfiguration. However, with micro strain equal to or higher than 3,000 μ, there is an irreversible tissue damage. In this study, all simulated models did not exceed borderline micro strain values, similar to previous reports.[7-23]

During the loading condition, 300 N was simulated as an average load obtained in the posterior region.[8,30] However, the present study did not consider the bone variation conditions present as different bone types. In order to improve the samples standardization, this study applied an *in vitro* evaluation, using isotropic substrate following the methodology described and applied by several previous reports.[5,7,12-14,18]

Regarding the bone loss, a previous study indicated that bone loss occurs in the neck of the implant, because the stress concentration in the crestal bone gives rise to damage in this region; which affects the bone remodeling process by reducing bone volume fraction.[34] The present study is in agreement with that, showing a deleterious effect as the bone level decreases and the load was constant. In addition, when 50% of bone loss was considered (almost the bone loss simulated in the present study: approximately 38.45%), previous reports showed that the maximum stress was found in the marginal bone at the implant bone contact area for cortical bone and around the apex for cancellous bone. This behavior was exactly what occurred with both implant systems in the present study, showing that both areas will be affected by the new fulcrum position formed in implant/bone lever.[35,36]

The micro strain results were calculated by strain gauges. This method is based on the principle of electrical conductivity, considering terminals that have active areas of 3mm^2, which will accurately measure the strain.[7,18] The choice of the region for bonding the strain gauges was based on the finite element analysis results, implying that the highest strain peak was measured *in silico* and also *in vitro*. This cervical region that showed the highest strain values is also related to the area of the bone crest remodeling reported in clinical studies.[1-3]

The correlation and use of FEA and Strain Gauges is of great importance to evaluate the biomechanical behavior of a complex structure, e.g. dental implant model.[5,8,18,23] Also, using two different numerical methods of strain measurement, the errors and limitations of each analysis can be minimized by the complementary method.

The restoration was made in Cr-Co, which does not fit the most common practice found in clinics to manufacture an implant-supported dental crown.[18] However, a previous report has demonstrated that the elastic modulus and the stress behavior will be proportional between a common crown geometry.[18] In this sense, it was expected that different crown materials will behave similarly between the models, allowing the comparison between bone height and prosthetic connection regardless the restorative material used to receive the load.

V. CONCLUSION

Despite the limitations of this study, both methodologies demonstrated that there is no difference between external hexagon and Morse taper systems, regardless the bone height.

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Esthetic-functional multidisciplinary rehabilitation – Case report

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***Abstract*—** *The esthetic demands have increased considerably over the years in the routine dental practice. Facial harmony is directly related to the smile, which is formed by the combination of three components: teeth, gingiva and lips. The excess gingival exposure, commonly described as "gingival smile", has received greater emphasis in Dentistry in the last years and has been the complaint of many patients, because this situation can influence the self-esteem and social relationships. It is fundamental to establish the correct diagnosis of gingival smile to allow a specific therapy for the patient. This paper presents, by a case report, the esthetic and functional scope by a multidisciplinary approach with association of correction of gingival smile and placement of esthetic ceramic crowns. The interaction between Periodontology and Prosthodontics proved to be essential to achieve health and harmony between dental and periodontal tissues, allowing to meet the patient's expectations, optimizing the esthetic and functional result, besides providing longevity.*

I. INTRODUCTION

The communication means have increasingly diffused and demonstrated the importance of esthetics and wellbeing on the self-esteem and quality of life of individuals. The current standard of dental beauty, under influence of a consumer culture, establishes that the smile is considered pleasant when there is harmony between teeth and gingival tissue, without discrepancies in the proportion between teeth and correct gingival contour [1,2].

Several parameters interfere and are assessed in the esthetics of smile, such as the extent of gingival exposure, midline, buccal corridor, ratio between width and height of incisors, inclination of incisor crown, gingival contour and the smile arc aspect, among others [3-5].

The excessive gingival exposure during smile, known as a gingival smile, associated with short clinical crown of upper anterior teeth, can result in esthetic problems, and interventions for gingival tissue remodeling are often indicated, reestablishing the anatomical characteristics and

ideal relationships between teeth and protection periodontium [6].

The esthetics of smile only becomes pleasant when there is a harmonious correlation between lips, teeth and gums, when these elements are arranged in adequate proportion, and the exposure of gingival tissue is limited to 3mm [7,8]. In cases where there is gingival exposure greater than 3 mm, the condition is considered unesthetic, called gingival smile [9-13].

Several etiologies are related to excessive gingival exposure, such as altered passive eruption, anterior tooth extrusion, vertical maxillary excess, short and hyperactive upper lip or a combination of these factors [14]. The altered passive eruption occurs when the periodontal complex does not migrate apically towards the cementoenamel junction, covering part of the clinical crown, leading to short teeth [15]. It is fundamentalto know the correct etiology to establish an adequate and structured treatment plan for each individual [16,17]. The correct diagnosis of the cause and adequate selection of the surgical technique to correct the gingival smile are fundamental for the success of treatment that may involve orthodontic, periodontal and surgical therapies [18,19]. Besides the treatments for gingival smile, which are mostly basedon surgical corrections, there are other less methods to correct this smile characteristic, such as the use of botulinum toxin [20-25].

The amount of vertical dental and gingival exposure in smile has called interest in smile esthetics [26], and thus the multidisciplinary approach involving periodontal and restorative treatments has become increasingly common in Dentistry, since the demands have increased by the patients, especially in cases with involvement of the anterior region [2].

The clinical crown augmentation for esthetic purposes is indicated when the anterior teeth are short or have excessive gingival tissue exposure and when the gingival contour is irregular [27,28]. The therapeutic procedure depends on the etiology and severity of the case, which may indicate the excess removal and remodeling of gingival tissues. This surgery is one of the tools of Periodontology in the search for esthetics, and the correct planning and accomplishment provides great esthetic and functional results [29].

Gingivectomy is indicated when there is need to remodel only gingival tissues; if the bone level is adjacent to the cementoenamel junction or even covers it, gingivectomy is performed together with osteotomy. Surgical techniques to augment the clinical crown can effectively solve esthetic problems [30-32].Planning of the surgical technique for apical repositioning of the gingival margin, not exposing the root surface, is based on the amount of keratinized gingiva and relationship of the cementoenamel junction with the gingival margin and alveolar bone crest [20,33-35].

Esthetic resolutions in the smiles of patients may include periodontal procedures, such as periodontal plastic surgeries for clinical crown augmentation and direct or indirect restorative procedures, such as reshaping with resin composite or placement of ceramic veneers/crowns [8]. An accurate treatment plan is necessary based on knowledge of gingival morphology, bone architecture, dental anatomy, indications and limitations of current restorative materials[36].

Considering the need for coronal reconstructions in esthetic areas, such as anterior teeth, dental ceramics have been widely used because of their good optical characteristics, biocompatibility and resistance to corrosion [37,38]. The preference for ceramics in dentistry is related to their excellent esthetic results, improved optical and mechanical properties, besides their known longevity [39,40]. They were developed to replace ceramometal restorations, which present remarkable mechanical durability for more than four decades but have the disadvantage of metal appearance by transparency at the cervical margin, compromising the esthetics. All-ceramic crowns present biocompatibility, resistance to compression, thermal conductivity similar to the tooth, color stability, translucency, opacity, opalescence and fluorescence.

Crowns made with IPS E-max ceramic system (Ivoclar Vivadent), composed of lithium disilicate,are consolidated in the scientific literature [41,42]. The IPS E-max ceramic system presents as a modern and innovative alternative, composed of lithium disilicate crystals embedded and joined to a glass matrix in a proportion ranging from 60 to 70% in volume of crystals. It presents a structure with good translucency, which reflects light very well, due to the low refraction index of lithium disilicate crystals and high flexural strength [43,44]. Correct diagnosis, adequate planning, knowledge on materials and techniques are essential for the treatment success [45].

Considering the importance to achieve harmony for the reestablishment of smile esthetics, this paper study reports a case of an interdisciplinary therapeutic approach, using protocols of restorative dentistry and periodontal plastic surgery.

II. CASE REPORT

A 35-year-old female patient attended the dental clinic searching for esthetic rehabilitation of smile, complaining

about short teeth with altered colorand excessive gingival appearance. Clinical examination revealed that the patient had a wide gingival smile and ceramometal prosthetic crowns on teeth 11, 21 and 22, with unsatisfactory characteristics (Fig. 1 A-C).

For better oral health adequacy, sessions of root scaling and oral hygiene were performed. Radiographic examination revealed that these teeth (11, 21 and 22) presented endodontic treatment and cast metallic posts with satisfactory conditions (Fig. 1 D).

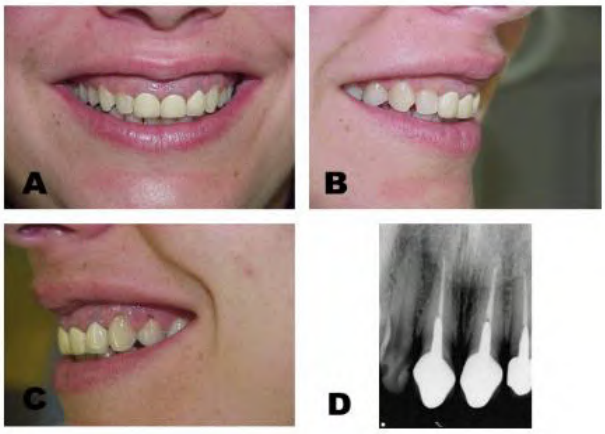

Fig.1 –(A) Initialclinical situation, evidencing altered smile esthetics, wide gingival smile and ceramometal prosthetic crowns on teeth 11, 21 and 22; (B-C) Viewof the patientsmile in profile, showing great gingival exposure and short clinical crowns; (D) Periapical radiograph of the anterior region.

Dental casts were obtained, and after planning a multidisciplinary treatment was proposed to the patient comprising gingival plastic surgery with esthetic purpose for clinical crown augmentation, and fabrication of new ceramic crowns on the upper incisors for a better esthetic harmony of smile. Gingival resection surgery (gingivectomy) is an effective adjutant procedure for gingival adequacy, aiming not only at satisfactory esthetic results, but also at maintenance of periodontal health.

The ceramometal crowns on the upper incisors were removed for placement of properly adapted provisional crowns, which were maintained during the planned treatment stages.

In a subsequent clinical session, an adequate protocol for gingival plastic surgery (gingivectomy) was carefully followed. First, local anesthesia was performed from upper canine to upper canine. Then, the bleeding points were marked with a millimeter probe and joined with a *Kirkland*knife to prepare an excision line. Following, external gingivectomy incisions were made using only a surgical blade n. 15c (*Hu-Friedy*) positioned at 45°with the tooth long axis, apically to the bleeding points.

Then, the excised gingival tissue was removed using pliers and an *Orban* knife. Subsequently, the gingiva was contoured and scraped to remove residual tissue marks. For complementation of the technique, bone exposure was necessary to promote a better architecture, performing escape grooves with round diamond burs, vertical wear at proximal regions, maintaining interproximal peaks and depressions in free surface regions, completing the entire process of bone treatment with horizontal wear to reduce the bone thickness and smooth the previously made escape grooves.

After this stage, the gingival tissue was sutured, providing the new gingival contour. The provisional crowns were cemented, and the patient was prescribed analgesic and oral antiseptic (Dipyrone 500 mg / Chlorhexidine 0.12%) postoperatively, as well as local care. The postoperative follow-up was performed for 60 days until complete healing of the area was completed. After this period, the new esthetic ceramic crowns were initiated (Fig. 2 A).

Teeth 11, 21 and 22 were prosthetically re-prepared, respecting the appropriate biomechanical principles, recommended wear thickness, obtaining longer clinical crowns and intrasulcular cervical ends. Tooth 12 was also ground to receive a ceramic veneer, to harmonize with the anterior esthetics (Fig. 2 B).

To obtain the working dental cast for fabrication of ceramic crowns (Fig.2 C), gingival retraction was achieved by the dual cord technique and the impression was obtained with addition silicone in one step, i.e. the putty and light materials were applied simultaneously, to achieve impression of the entire arch using an unperforated rigid metallic tray.

Fig.2 – (A) Clinicalaspect of patient's smile after corrective surgery for clinical crown augmentation. Note the amount of increase by placement of provisional crowns place before the surgical procedure; (B) Prosthetic re-preparation on teeth 11, 21 and 22 and initial prosthetic preparation on tooth 12; (C) E-Max ceramic crowns on the upper incisors.

After laboratory preparation, functional and esthetic adjustments were performed on the ceramic crowns in the

patient's mouth. Subsequently, they were cemented with self-etching resin cement, which has advantages of easy handling, no need of pre-treatment of the tooth, high resistance to compression, good esthetic properties, chemical adhesion to the tooth and high bond strength to all restorative materials. Before cementation, prophylaxis was performed with pumice and water on the preparations, followed by washing and air-drying.

The crowns were etched internally with 10% hydrofluoric acid for 20 seconds, followed by abundant water rinsing and air drying. Soon after, silane was applied for 1 minute, which reacts with the crystalline phase of ceramic and with the organic phase of the resin cement, to act in the connection between structures and adhesive application. After loading with cement, the crowns were placed in the teeth and inserted inthe preparations, and the excess material was removed for later light curing (Fig. 3).

Fig. 3 – (A-B) Ceramic crowns placed on teeth 11, 12, 21 and 22.

The occlusal contacts were evaluated in maximum intercuspation and eccentric movements, making the necessary occlusal adjustments with diamond burs and final finishing and polishing with a ceramic rubber system. The final result demonstrated a natural and functional estheticsby the integration of esthetic techniques for dental rehabilitation combined with gingival plastic surgery (Fig. 4).

Fig. 4 – (A) Final aspect of frontal smile after the multidisciplinary approach, evidencing the harmony between the patient's teeth, lips and gingiva; (B-C)Lateral views of patient's smile.

III. DISCUSSION

Dental treatment in esthetic areas represents a challenge for clinicians, since it can involve complex decision making for the concomitant search for health and harmony between dental and periodontal tissues. For these cases, the balance between white and red esthetics depends on the professional's skill, scientific knowledge in anatomy and morphology of involved tissues and needs and preferences of patients seeking for treatment [46]. Currently, many surgical procedures are available for proper management of periodontal tissue, aiming at establishing gingival-dental esthetic standards, combined with restorative procedures. The most employed periodontal procedures are clinical crown augmentation of upper anterior teeth, performed only on the gingival tissue, associated or not with bone tissue. The esthetic appearance changes and patients are usually surprised by the new size of teeth [47,48].

A beautiful smile provides a correlation of harmony between proportions, positioning, shape and colors of teeth, as well as appropriate interrelation between teeth, gingiva and lips [49]. The literature shows that the increased gingival exposure in smiling has worse esthetic perception by dentists and laypeople [50,51]. Concerning the patient's smile, the line formed by the lips when a person smiles can be classified as low, which refers to exposure of about 75% or less of the height of clinical crown of upper anterior teeth; average, in which the entire teeth can be seen or at least 75% of their clinical crown, besides the interdental papillae; and high, when the cervical-incisal height of teeth is completely seen and the amount of visible gingival tissue is greater than 3 millimeters, being then classified as gingival smile [52].

The attractiveness of smile is influenced by the extent of gingival exposure, in the opinion of both dentists and laypeople [16]. Therefore, it is essential to perform a dental planning integrating different areas, to accurately diagnose, prognose, plan and perform the oral rehabilitation procedures [8,53,54].

In the functional and esthetic reconstruction of teeth, lithium disilicate ceramics (IPS E-max) have presented as one of the main materials, with important characteristics as high resistance to compression and abrasion, color stability, biocompatibility, radiopacity, coefficient of thermal expansion similar to the dental structure and great ability to simulate the natural appearance of teeth [2,55,56]. In this case, we selected the esthetic rehabilitation of anterior teeth with ceramic crowns due to the esthetic excellence, mainly due to absence of metallic margin [57].

The acceptance of this procedure is so significant thata study conducted among American dental professionals revealed that 91% considered ceramic restorations as the best choice for esthetic restorations [58]. Dental ceramics have very satisfactory characteristics for an indirect restorative material: optical properties similar to the dental

structure, favoring the esthetics, smooth surface contributing for periodontal health; low thermal and electrical conductivity and biocompatibility [59-61].

The key to the success in achieving results with excellence in rehabilitative treatments is closely related to the balance between white dental esthetics and pink gingival esthetics [54,62].

IV. CONCLUSION

Considering the constant search for improved procedures that simultaneously allow the rehabilitation of smile harmony, biological complex and recovery of patients' self-esteem, interdisciplinarity plays a fundamental role in treatment planning and accomplishment, for which periodontal and restorative esthetic approaches must be within the clinical team's skills. Knowledge on esthetics for a good planning, followed by treatment with combination of multidisciplinary techniques, allows more predictable and satisfactory results. As shown in this case, the clinical results achieved by the interdisciplinary approach provided optimization of pink and white esthetics in a patient with gingival smile and unsatisfactory dental morphology.

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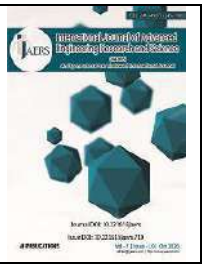

The Manufacturing Industry and the Big Data Challenges: The case-study of the Global Tech Company

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Abstract*—*Big Data is a crucial component not only to support business decisions, but to gain competitive advantage in an increasingly globalized world, where those who have more information are one step ahead, in this concept companies like technology companies like Facebook, Google and traditional manufacturing companies are making high investments in Big Data and Advanced Analytics with the challenge of translating this huge volume of data. This research effort aims to map the challenges that traditional Manufacturing Industry companies must take advantage of the potential of Big Data and Advanced Analysis to generate real value for the Business through a case study of a global technology company. We found that despite the professionals working on technological development, they understand that the generation of value and the lack of strong evidence of how much Big Data is adding to the current scenario of the Manufacturing Industry was one of the biggest motivations behind this research, which after the case study carried out gave a clear understanding that the manufacturing industry is not prepared to make the most of this new era of Analytics. Another important fact revealed by the surveys is the common concern about the need to invest in improving the competence of the resource in any organization to explore the Big Data environment.

I. INTRODUCTION

The Information Chain generated in several steps of the Supply Chain Management from design until after sales have been collected, analyzed and used to support the business decision in several areas of sales, customers behavior, and inventory (Davenport & Dyché, 2013) creating one of the most valuable assets (Knowledge Management) that can define a company competitiveness since the beginning of the modern industry, perhaps even before (Côrte-Real, Oliveira & Ruivo, 2017).

The exploration of the full potential of this scenario is sustained by the technological achievements in data collection, new forms of data organization and analysis that are creating the new environment with large data of volumes that are also pushing the companies to create capabilities in new areas of knowledge (Malladi, 2013) bringing up the Big Data and Advanced Analytics on the top of all recent investments on technology companies like Facebook, Google, and the traditional Manufacturing companies, with the challenge to translate these huge volume of data (Hu et al., 2014) into strategic decisions as was defined by W. Edwards Deming and Peter Drucker - "You can't manage what you don't measure." (McAfee et al., 2012).

The acronym 3V's (McAfee et al., 2012) was one of the first ways to describe the Big Data characteristics defining them as volume – The quantity of data extracted, stored and analyzed, Velocity – Real-Time data, data

extracted and transported as is generated and Variety – text, messages, images, sensors, videos, etc. Other characteristics have been added by different theories and studies lately, like Veracity – data reliability and data sources credibility (Abbasi et al., 2016), Value – to measure value generated by the Big Data to support the Business Decision – and Complexity – the level of interconnections and interdependencies between the several data structures (Kaisler et al., 2013). To be able to generate value and enhance competitiveness it is necessary to manage the Business Data Analytics managing its characteristics properly (Wamba et al. 2015).

Nevertheless, the benefits of Big Data implementation have been researched and studied heavily last ten Years, even before. A simple research in Google Scholar using the keyword "Big Data" during the Year of 2017 returns more than 65.700 results. The companies are trying to enhance their organization's skills in the Data Scientist area in order to be able this handle the new volumes of data, what can be much more challenge than the traditional quantitative analysis that has been used historically to support the business decisions. New competencies in the Data Science area are required (Davenport & Dyché, 2013) to understand the value that can be generated by the data exploration, run the predictive and prescriptive analysis, "tell a story with data" and explore deeper than what the first layer of data is showing and take advantage of the potential value realization (Agrahri et al., 2017) that the Big Data Era is promising.

The Return on Investment between investments in traditional Data Warehouse and a Big Data environment in large companies was published by Davenport & Dyché (2013) showing a clear advantage of investments in Big Data with return on cash flow and time to value, but the lack of real and rigorous proof of return of investments generated by Big Data investments brings us the conclusion it is a long-term strategy taken by the company's Senior Management.

In this way, we have the research question that greatly impacts the manufacturing enterprises: How is the Manufacturing industry preparing itself to take advantage of Big Data environment to generate value? The aim of this research effort is to map the challenges that traditional Manufacturing Industry companies have to take advantage of the Big Data and Advanced Analytics potential generating real value to the Business.

All of these aspects are the reason to conduct this study and look for how to understand the Manufacturing Industry challenges to generate value that is advertised by the Big Data community.

This study will be valuable to support the Manufactory Industry journey in the Big Data area providing the experience and best practices in the company preparation and enhance the knowledge that is important to reduce the time to collect the value generated by such investment, in technology and knowledge.

II. LITERATURE REVIEW

In the various researched sources, we will make a critical assessment of the different approaches, theories and findings reported by researchers and technical publications flowing through different areas related to Big Data and Big Data Analytics. First, we will assess the definitions of Big Data and how different authors and companies are driving this impulse, secondly, we will do an analysis of publications and studies with the objective of understanding and defining how companies are approaching Big Data Environment. Data to support your investments in this area, thirdly we will analyze the definitions of value generated by investments in Big Data, evaluating different models proposed to measure the effects of Big Data on the company's performance and on the experiences reported by companies through case studies of the same. implementation in different business sectors.

The volume of such data generated and captured by different areas has been increasing exponentially (Agarwal & Dhar, 2014) due to several reasons but mostly driven by the technical achievements in telecommunication and mobility with the advent of devices like RFID, IoT sensors, and mobile phones, as examples, supported also by the strong costs reduction in data storage with the cloud option offered by different companies.

Estimations have been done by Cisco predicting that the number of electronic connections is surpassing the number of people by 2020 (Evans, 2011) as the same said by Gartner (Gartner, 2014) that we will reach 26 Billion of devices in this planet generating 40 ZettaBytes (1 ZettaByte stands for 1 Trillion GigaBytes) (Gantz & Reinsel, 2012) growing up to 163 ZettaBytes by 2025, ten times more the estimated data generated in 2016 (Reinsel, 2017) revealing an enormous potential of exploration and revenue generation. However, it won't be easy to explore and take the advantages of this business opportunity looking due to the variety of how this data is generated currently, as it has been the most common as structured data way in text/numeric format or going to a totally new variety as unstructured like audio, video, images, etc. (Silvarah et al., 2017).

Nevertheless, what is Big Data after all? What is the difference if we compare the current data landscape against the traditional definition of data? We don't have a certain origin of the definition and the concept of Big Data, but (Diebold et al., 2012) argues that this definition probably was coined during a conversation at Silicon Graphics at the 90's and have been promoted by companies like IBM and other leaders in this area since there. (Laney, 2001) was one of the firsts to use the acronym 3V's to describe the main characteristics of Big Data: Volume/ data size in terms of storage and quantity of information (order of Zettabytes ZB), Variety/ structure (texts), semi-structured and unstructured data (audio, video, image, etc.), and Velocity/ real-time data streaming, data collected as is generated. More characteristics have been added later by other scholars, like Value/ information value extracted from the data and Veracity/ Data reliability.

Another ways to reference the data understanding layer when we talk about the tools and technologies used to explore the information relying on the BD layer is Business Intelligence (BI) or Business Analytics (BA) that has been nominated as part of the Top priorities for CIO's in Gartner annual survey in three of the five years between 2007-2011 (Seddon et al., 2012) creating the believe that it will make a remarkable contribution to leverage firms performance in the coming years. As defined by Wieder & Ossimitz, 2015) BI is the analytical layer used to interpret the raw data through software products used to manage the databases until to generate the analysis and create the visualization dashboards used to investigate and support the business decision.

Despite of the different definitions of how to describe Big Data (BD) using its primary characteristics based on data volumes or based on the analytics layer (BI, BA or BDA) it is a common sense that this new scenario is bringing new opportunities and also challenges to be properly explored by the companies to generate value. It is heavily promoted by technologies companies that are developing the framework and several positive business cases especially using the social media and public information, but it is still an area to be explored and validated by the manufacturing industry.

That Big Data is a reality and has an enormous potential to leverage business competitiveness in different areas that have been promoted, researched and discussed last decade is a fact. It is also a fact that it is bringing the advent of new technologies, requiring new competencies and pushing the company's mindset on how to use properly the data owned by the company combined with public information. In order to be able to handle this environment, it is necessary to have the right framework. Malladi, 2013) used the TOE (Technology – Organizational – Environment) approach to evaluate the framework challenges faced by the companies to implement the tools and systems used to support the Big Data Analytics evaluating the benefits, organization readiness, and internal technology competencies.

According to Akerkar (2013) and Zicari (2014) this framework can be defined based on the challenges through the data life cycle starting from the data characteristics, the process in how to handle the data and the data governance in the aspects of privacy, security, and ethics. However, Silvarah et al. (2017) define the Big Data framework using the a different approach, also based on the data lifecycle but naming five different steps instead three: Data Acquisition and Warehousing, Data Mining and Cleansing, Data Aggregation and Integration, Data Analysis and Modelling and Data Interpretation once (Bizer et al., 2012) named six steps: capturing, storage, searching, sharing, analysis, and visualization. Nevertheless, how we identify and name each phase since the beginning, each of these steps has its challenges once that the data grow in volume and diversity coming from several sources (Paris, Donnal, & Leeb, 2014).

The first challenge that is faced by the companies that are looking for to explore this new world is the technology necessary to handle this data. It not just a matter of acquiring data but also store and secure the information what could demand a high level of investment due to the cost of infrastructure (Wang & Wiebe, 2016). The decision to move to a cloud storage area offered today by several companies is an alternative to get down costs for this infrastructure and the company lack of expertise to administrate this environment. However, this option will bring up another concern about data privacy, performance, and security (Muriiti & Kotzé, 2013).

There is no silver bullet in this choice, the decision must be taken by the company based on its investment capacity, knowledge base in this area and which risks being assumed. This is all about the first part of this environment that has been defined by (Malladi, 2013) as a crucial knowledge for the company ambition. On top of that, (Popovič et al., 2012) emphasize that it is also important to establish the analytical capabilities of the organization that will process and execute the analysis.

Even more challenges have been advised and described by different researchers and published white papers based on several experts in this area, like is well described in the study published by Heyns (2015) on how to prepare the organization structure, data security, creating the high insight and the necessary talent to convert data into information, the right information used in

the right way. This survey indicates that 56% of the companies have concerns to adapt their organizational structure and 50% to find the suitable skills necessary, the required competence What to do with the huge volume of data and variety of information collected and stored in these big capacity data systems in the owned company IT infrastructure or in the cloud?

This question brings us to the second layer of the Big Data Framework: Analysis. This is recognized as a valuable and unreplaceable capability that drives the organization towards the competitive advantage unlocked by the Big Data Analytics (Wamba et al, 2017). One of the premises to move towards the Big Data Analytics is the possibility to enhance business decisions moving from the reactive traditional descriptive ways of working ("What happened?") to take advantage of its different analytics possibilities and becoming more predictive and prescriptive what can turn into a quite complex process that requires the right competencies inside the organization or using companies that provide such kind of service (Assunção et al., 2015).

In this case, the challenge is how to create the domain knowledge that is necessary to look for the correct answers when exploring the process data, (Waller & Fawcett, 2013) described this as the difficult to teach the related area knowledge that is created with the experience as we can teach the technical tools usage, like statistical programming languages like Python or R what can be one of the reasons for implementation failures faced by the companies. In the (Genpact & Fortune , 2017) survey only 38% of the company participants said that they are preparing their employees with training opportunities or reskilling options in these new technologies. Data Analysis is an area that has been evolving exponentially last 10 Years

All of the aspects described here have been discussed and researched by several scholars lately with the common indication that the implementation of Big Data Analytics is not a riskless journey that demands an enterprise heavily planning and preparation (Côrte-Real, Ruivo & Oliveira, 2017). However, the success only can be achieved with the combination of the company knowledge base together with the combination of the new modern technologies and approaches like the ELTA (Extract, Load, Transform and Analyze) and the well tested and proved existent techniques (Marín-Ortega et al., 2014).

III. METHOD

A. Research Philosophy

The nature of this study is supported by the philosophy of the Critical realism combined with the abduction approach once that the main objective is to understand and explain observable events and information collected during the interviews. A Qualitative research was the method decided to be applied in this study to support the research question investigation and conclusion. Qualitative research is based on different ways to collect non-numerical data from small samples once that Quantitative method is based on numerical data normally collected from larger sources of information (Saunders, Lewis & Thornhill, 2009).

Case Study is one of the genres of a Qualitative research and creates the right environment to allow a deep investigation of a particular event (Saldana, 2011). This decision was made based on the characteristics of this study when we compare with the four reasons described by (Yin, 2003) that support a Case Study design consideration: a "how" research question, the participants behavior cannot be manipulated, the contextual conditions are important to the phenomenon under study the unclear overlay between the phenomenon and the context of the study.

B. Research Strategy

A Case Study can be defined as a mixed approach in terms of to be inductive or deductive because involves real events investigations in order to understand a specific contemporary phenomenon (Datt, 2016) therefore the following strategies were adopted.

Our research strategy consists of three types of procedures: (i) Documentary: The company data structure before the Big Data implementation was described and the main constraints that drive the decision of the change delineated. The new data architecture and the achievements expected with this implementation compared with the real results. The observation will be also important to describe the challenges and how the organization was prepared to face them. (ii) Internal Survey: The Individual opinion from experimented professional from different areas of expertise involved directly and indirectly in the Big Data implementation project was collected in form of a questionnaire to understand how the organization knowledge and perception of such change are aligned and coordinated between heterogeneous background and responsibility. A questionnaire based on closed questions was used to limit the amplitude of possible answers and as the most effective way to gather concrete information from the participants (Ranjit, 2011) and (iii) External Survey: An external survey was used to capture how other companies from different sectors are seeing the Big Data revolution, their intention to invest in this area or not, what how they perceive the potential benefits and challenges correlated to this area.

C. Research Design

The research was designed in a way to make possibly understand the company approach to its Big Data implementation project, collect the achievements targeted with this implementation and the perception of the main resources involved in this area about the challenges faced by the organization. On top of that, an external Survey was released to also capture the opinion of professionals involved in similar projects at another company.

The following details of each step of the Case Study process as was defined by (Yin, 2009) was applied for this study realization. The Plan phase was mainly composed by the search of the relevant literature in this area to support and justify the research motivation and the understanding of the company investments in this area to be the right object of study. The Design phase was focused on to decide how to collect the data necessary to support the conclusions to answer the research question, how to understand the company environment and the creation of the survey.

The prepare phase was focused on the test the surveys and identify the channels to be used to share the surveys and collect the data. The data collection based in the surveys was done using two different channels, one internal and another one external exploring the researcher professional networks, the organization implementation project was mapped to make possible to compare the environment before the implementation and correlate this initiative with the data collected through the surveys. After that, data analysis was done looking for to identify the information collected and how to conclude if the research question was properly answered and what are the study conclusion. The result was shared with the organization and also compiled to be sent to all participants of the external survey that register the interest to have it.

To answer our research question, we have some objectives to be fulfilled, namely:

1. To understand the investments to capture, inject, store and explore the data
2. To understand the new competencies required by this new scenario
3. To understand how the Manufacturing Industry is preparing its organization to embrace this change
4. To understand the differences between Big Data exploration experience at technology companies and Manufacturing Industry
5. To define how to measure the Business Value of Big Data in the Manufacturing Industry.

In this way, the research questionnaire was elaborated based on eleven questions in order to guide the understanding of the proposed goals.

Table 1: Survey questions

Nr	Survey Type	Question	Objective	Goals
1	Internal	What is your area of work currently?	Identify the participant area of work	
1	External	What is your company primary area of actuation?	Capture the participants companies' business area	
2	Internal/External	What is your understanding about Big Data and Advanced Analytics like Machine Learning and Artificial Intelligence?	Identify the participant level of knowledge about Big Data and Advanced Analytics	
3	Internal	Have you been involved in any project connected to Big Data or Advanced Analytics recently?	Map the participant experience in Big Data and Advance Analytics projects	
4	Internal/External	How much do you agree with the statement: "Information is the Oil of new era - (Gartner)"	Understand the participant's opinion about the importance of Big Data in the actual scenario	3
5	Internal/External	How much do you agree with the statement: "Big Data is applicable to any kind of Business"	Understand the participants level of knowledge about Big Data and Advanced Analytics	2,3
6	Internal/External	How much do you agree with the statement: "The Manufacturing Industry is prepared to explore Big Data environment"	Understand how the companies perceive themselves prepared to explore Big Data environment	2,3
7	Internal/External	How much do you agree with the statement: "Big Data value generation is strongly tested and proved in the Manufacturing Industry"	Understand the participant's perceptions of Big Data successful implementation knowledge	2,3
8	Internal/External	How much do you agree with the statement: "The Manufacturing Industry has the appropriate Analytics Maturity Level to explore the Big Data Environment"	Understand the Participant opinion about the Manufacturing Industry Analytics stage	2,3,4

In order to answer the research question already presented in the introduction: How is the Manufacturing Industry preparing itself to take advantage of Big Data environment to generate value? Based on this research question, we elaborate the hypothesis: Is the Manufacturing Industry prepared to implement and generate value from Big Data and Advanced Analytics technologies?

To collect the data necessary to validate the hypothesis and evaluate the objectives connected to this question we follow the procedure: Firstly, all the information about the organization object of this study was collected to understand the original environment, the project ambition, the implementation plan, the challenges faced, and the results achieved. Secondly, an internal survey was released to collect the opinion from worldwide professionals involved directly and indirectly in this project regarding the theme and the organization approach. Thirdly, an external survey was released to capture the

opinion from different sectors of manufacturing and correlate them with the internal survey data and the project information.

D. Case-Study: The Company Description

The company object of this study is a high technology equipment manufacturer with production facilities in several places around the world using a well-established IT network to collect production information from its own sites and from third part suppliers producing on behalf of this company based on supplied design and test environment. These data providers delivery thousands of records every minute twenty-four hours per day to support local and global performance reporting and analysis (Figure 1).

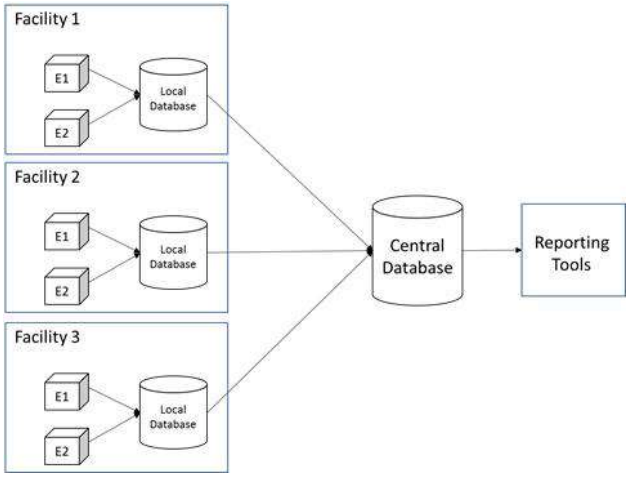

Fig. 1: Company Production Data IT structure

The data flow from the production and test equipment to the local databases that create hourly batches to be transmitted towards a security channel with a latency between two and four hours depending on production volumes, which type of data and the facility location. All the information retrieved from the production facilities is used to monitor the Product Quality, Production performance, support Root Cause Analysis when it is necessary and secure product traceability linking the products with the results and components used during the manufacturing process. This architecture is based on traditional SQL Databases technology and demand a high performance and capacity hardware to secure that the users will be able to explore such data without slowness and data quality issues. Therefore, data reliability and quality are crucial aspects to secure the investigation and decision required by the business

The Data Architecture described before proves to be efficient to provide to the company the right environment that was necessary in order to conduct the manual diagnostic and investigative daily work done by hundreds of Quality and Product Engineers in all of these facilities and the Product Designers interested to follow up the product performance comparing volumes results against design expectation. However, with the explosion of Big Data and Advanced Analytics tools providing the analysis capabilities and the hardware technology evolution providing the computing capacity to evaluate thousands of measurements per second a new scenario started to be achievable by the manufacturing industry that is under a fierce competing in this area looking for new ways of reducing costs and increase its competitiveness (Figure 2).

The Big Data implementation project had the main following objectives:

1. Reduce the data latency from 2-4 hours to not more than 30 minutes
2. Provide the right environment to run advanced analytics tool

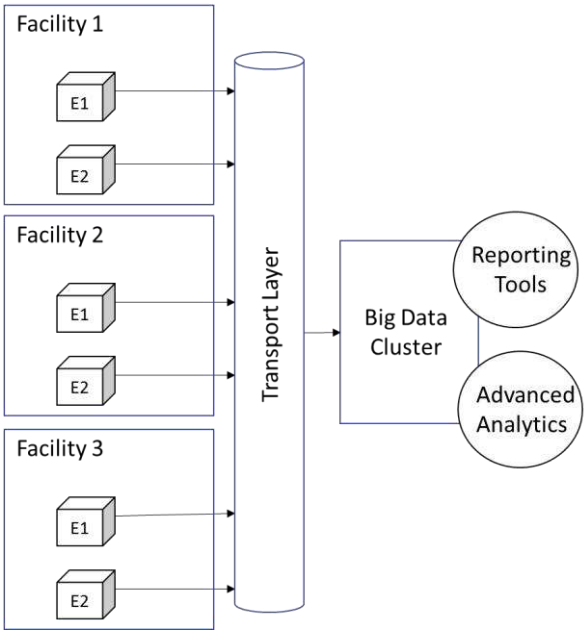

Fig.2: Big Data infrastructure design

This new infrastructure would create the right environment to support the company ambitions to reduce production costs worldwide moving from the traditional descriptive and diagnostic ways of work to predictive and prescriptive analysis detecting anomalies and not expected behavior as early as possible to analyze and react reducing losses with bad quality and production shortage risks.

Due to the confidentiality and the objective of having more objectivity in the answers, the participant's name data will not be requested and the company, all the participants contribute to this study voluntarily.

IV. FINDINGS

The first part of our findings was based on the observation and collection of information regarding the Big Data implementation project driven at the company under study. We follow the project implementation since the beginning what help us to understand how the company address our research questions objectives by topic.

About the first objective proposed: "To understand the investments to capture, inject, store and explore the data." we were not able to understand this point once that the company under evaluation already have the necessary infrastructure available by other areas to be explored and was not necessary to make specific investments in infrastructure. Nevertheless, it is an advantage if the company is able to share infrastructure between different areas.

In the second objective: "To understand the new competencies required by this new scenario". The company defined a couple of specific Use Cases to explore the data and identify what kind of advanced analytics and machine learning algorithm could be used to run predictive analysis and generated the target value. This work demanded a new cross organization team composed by resources with knowledge and data access, the product domain knowledge and data scientists with the required knowledge to apply the tools and technologies available in the market to execute this work.

About the third objective "To understand how the Manufacturing Industry is preparing its organization to embrace this change", another aspect of this implementation was the idea promotion through intensive discussions involving different areas of the company in order to align the understanding of the organization around the theme, get the right attention, secure the necessary engagement from the right stakeholders and understand the Analytics company strategy to secure the project alignment.

As regards the proposed fourth objective "To understand the differences between Big Data exploration experience at technology companies and Manufacturing Industry", we could notice that one of the major differences between the Manufacturing Industry and the technology companies is the data characteristics. The technology companies explore unstructured data using several different machine learning algorithms with high focus on customer understand (external) once that the manufacturing data is more composed by structure data with attention in process performance and production quality (internal), however the usage of unstructured data like image, IoT devices and binary large objects is also increasing in this environment.

And as the fifth and final proposed objective "To define how to measure the Business Value of Big Data in the Manufacturing Industry", in this specific case, the expected value generation was connected to detect test results anomalies during the manufacturing process and take the corrective actions to adjust the performance to the desired level without reduce the production throughput and affect the product quality. However, we could not quantify and validate this achievement because the project was not finished before we conclude this study. The theory was tested and proved using historical data extraction where the models were created and tested ratifying the possibility to use this approach, but it was not possible to testify this structure up and running.

The second part of the findings were based on our Internal and external Survey answers compilation. The Internal survey was sent to 95 professionals that were directly or indirectly involved in the Big Data implementation project, another area of Analytics and Product Quality reports consumers. The response rate was 55% which means that we got 62 answers. The external survey it was sent for 95 professionals and was received 56 answers, the response rate it was 59%.

About the question 1 of the questionnaire: What is your area of work? (Internal) / Company Business area (External) the results are shows in the chart1. The vertical bars show the number of participants per work area (scale to the left of the graph) and the lines the respective accumulated percentage (scale to the right of the graph), for example, in the internal participants of the company, in the test development area we had the participation of 14 professionals representing approximately 20% of the total, the results are shows in the figure 3.

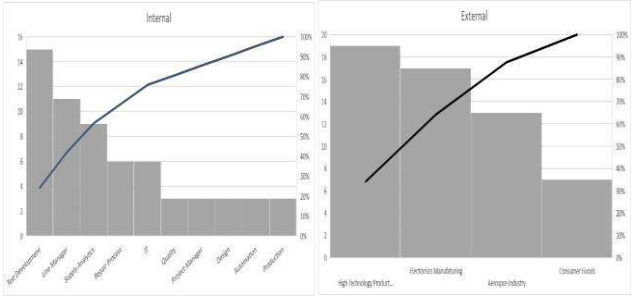

Fig.3: Participants area of work

As regards the question 2 of the questionnaire: What is your understanding about Big Data and Advanced Analytics like Machine Learning and Artificial Intelligence? the results are shows in the figure 4.

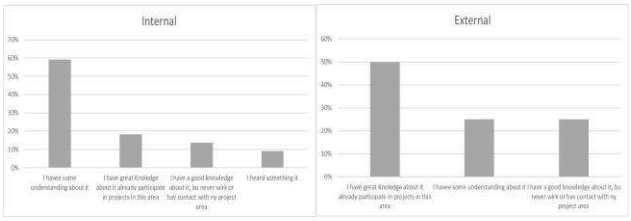

Fig.4: Participants level of understanding about Big Data Technologies

On question 3 of the questionnaire: Have you been involved in any project connected to Big Data or Advanced Analytics recently? the results are shows in the figure 5 (Internal only).

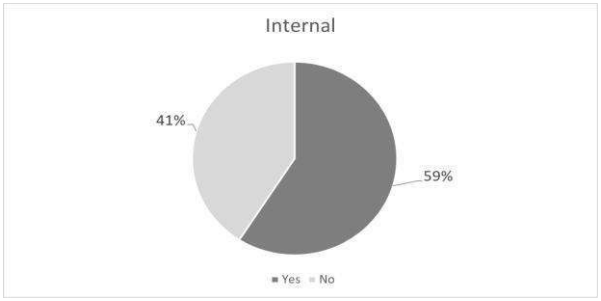

Fig.5: Big Data Project participation

The three first questions were designed to create a good understanding of the participants involvements in our research area and their level of knowledge of Big Data technologies. We can conclude from the answer's compilation that most of the participants have a good understanding and have been involved in different projects in this area.

About the question 4 of the questionnaire: How much do you agree with the statement: "Information is the Oil of new era - (Gartner)" the results are shows in the figure 6.

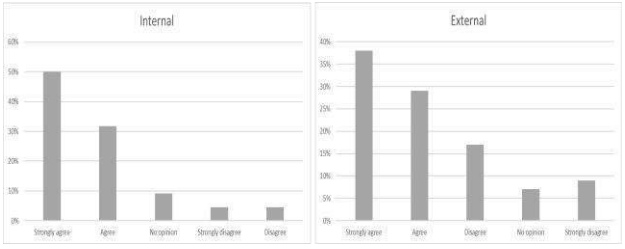

Fig.6: "Information is the Oil of new era (Gartner)"

In the question 5 of the questionnaire: How much do you agree with the statement: "Big Data is applicable to any kind of Business" the results are shows in the figure 7.

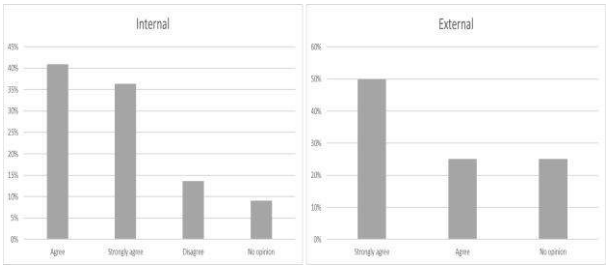

Fig.7: "Big Data is applicable to any kind of Business"

As regards the question 6 of the questionnaire: How much do you agree with the statement: "The Manufacturing Industry is prepared to explore Big Data environment" the results are shows in the figure 8.

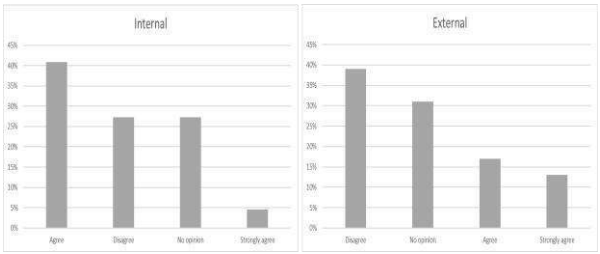

Fig.8: "The Manufacturing Industry is prepared to explore Big Data environment"

About the question 7 of the questionnaire: How much do you agree with the statement: "Big Data value generation is strongly tested and proved in the Manufacturing Industry" the results are shows in the figure 9.

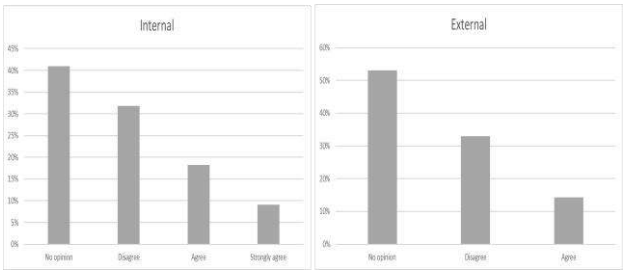

Fig.9: "Big Data value generation is strongly tested and proved in the Manufacturing Industry"

In the question 8 of the questionnaire: How much do you agree with the statement: "The Manufacturing Industry has the appropriate Analytics Maturity Level to explore the Big Data Environment" the results are shows in the figure 10.

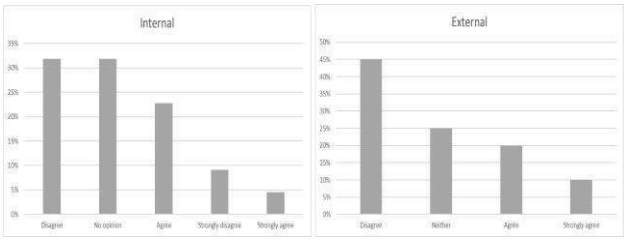

Fig.10: Manufacturing Industry maturity to explore Big Data

The questions four to eight were designed to capture the participants opinion of how Big Data and Advanced Analytics is perceived as an important asset to generate value, how it could be applied to the Manufacturing Industry environment, what is the Manufacturing Industry stage in terms of knowledge and how the Manufacturing Industry perceives their maturity to use predictive and prescriptive automatic analysis instead the ordinary manual diagnostics ways of work. It is important to notice that there is a strong alignment between the internal survey done at the company under study and the external survey despite the low number of samples collected.

About the question 9 of the questionnaire: Which area do you believe that Big Data can be most applicable to the Manufacturing Process? the results are shows in the figure 11.

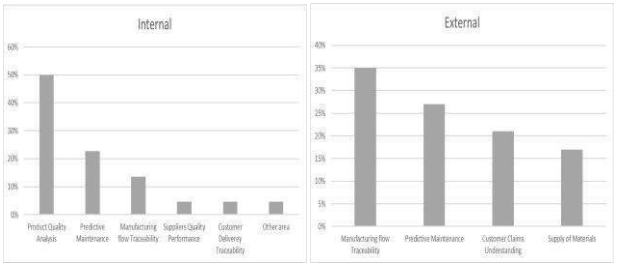

Fig.11: Manufacturing Industry applicable areas

As regards the question 10 of the questionnaire - Which layer do you believe is most challenge to achieve the promised Big Data results? (Internal only) the results are shows in the figure 12.

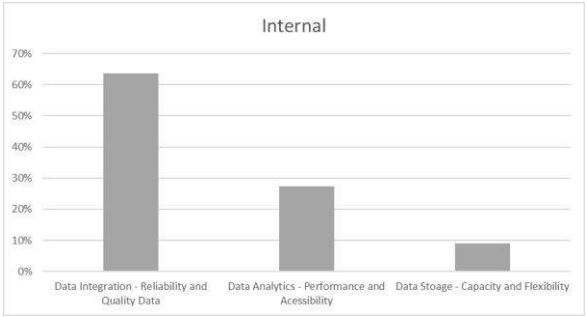

Fig.12: Layers challenges

About the question 11 of the questionnaire: Which area do you believe that the companies are facing most critical challenges in the Big Data implementation? the results are shows in the figure 13.

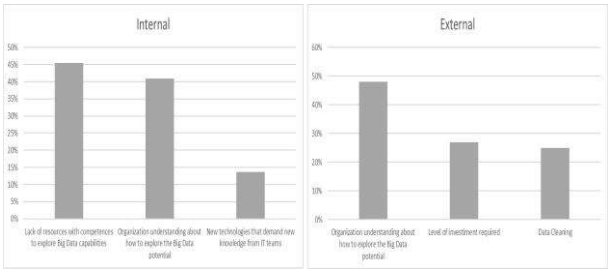

Fig.13: Manufacturing Industry Challenges

In the question 12 of the questionnaire: In your opinion, what is the most important area to receive major investments from the Manufacturing Industry to explore the full potential of Big Data and Advanced Analytics? the results are shows in the fig. 14.

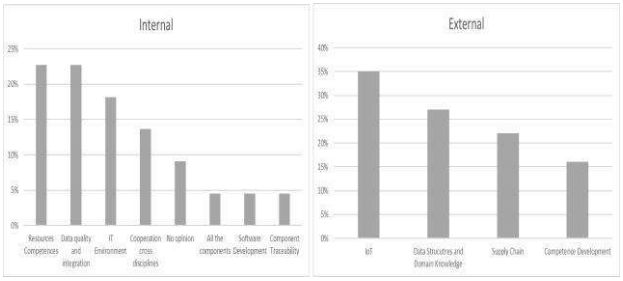

Fig.14: Major areas of investment

Questions nine to ten were designed to capture the participants vision about areas of future investments, Big Data and Advanced Analytics applicability in the Manufacturing Industry and major areas of challenge. It is strongly noticed that the right competences to take advantage of the data exploration is an important area to be seriously addressed if the company wants to be successful in this area.

V. CONCLUSION

As this research effort is based on a case study of a Big Data and Advanced Analytics implementations following an implementation project in a chosen company combined with the application of internal and external surveys to capture information and data that could be used to validate our defined hypothesis: Is the Manufacturing Industry prepared to implement and generate value from Big Data and Advanced Analytics technologies?

It was mainly motivated by the high attention from different sectors of the Manufacturing Industry that is driving high level of investments (Bhadani & Jothimani, 2016) recently and in the coming years and the lack of strong evidence about the value generation provided by Big Data Analytics in this business segmentation.

The decision to follow a project implementation in a Global Company with a recognized and robust IT architecture supporting the ordinary ways of work with data analysis was a good approach because it was possible to understand the advantages and disadvantages of to move from a tested and well proved environment to new ways of work instead start a full implementation since the beginning without a strong experience and mature organization working with a different environment. Another good point of this approach was to have the possibility to contact several professionals from different sectors and background to understand this challenge from different perspectives. From another hand, the time was a crucial limitation to support this research to reach conclusions in areas like investments and value generation.

The idea of the external survey was explored to understand how the company object of the case study professional's vision and experience regarding the theme is aligned with professionals with the same or higher level of experience from another manufacturing business areas to validate their understanding, challenges an expectation.

The survey's results show a strong alignment when the answers are compared side by side and statistically tested and could be a valuable tool to ratify the hypothesis conclusion if a more statistical relevant participant were achieved by both surveys, internal and external. The weakness point of the external research is the lack of possibility to certify the participants level of experience and knowledge regarding the theme.

Nevertheless, we strong believe that the facts and data collected during this work despite the challenges to complete some of the planned investigation and data collection provide a very good and reliable piece of work that is extremely relevant to contribute to the community base of knowledge and recommend directions for another company's investments in this area.

One of the aspects of this research to understand the needed investments in Big Data implementation compared to traditional warehouse architecture was mainly motivate by the divergent opinions and results from different studies and was already promoted by (Davenport & Dyche, 2013) that the Big Data environment investments has a better return of investments when compared to traditional warehouse architecture and the intense discussion around the "IT Productive paradox" with several other studies showing that not always this kind of investment is able to bring value to the organization (Anand, Fosso, & Sharma, 2013; Frisk, Lindgren & Mathiassen, 2014).

To understand how the Manufacturing Industry is preparing its organization to embrace this change it was collected good point by the surveys answers was the company understanding about the potential of Big Data as "The oil of new era" (Yi, Liu, Liu, & Jin, 2014) and its applicability to any kind of process and different areas of the Manufacturing process as it was clearly appointed with the alignment of all participants answers confirming previous theories and different business investments in this area (Bhadani & Jothimani, 2016). The results also show us that this has been a topic of discussion and an area with several projects in different companies due the level of understanding about the theme demonstrated by the participants internally and externally.

To understand the differences between Big Data exploration experience at technology companies and Manufacturing Industry, the main point identified in this area was which part of the process the Manufacturing Industry could get the best benefits when applying Big Data Analytics when we compare with retail and technology companies where customer consumption trends and behavior are the mains addressed areas (McAfee et al., 2012) together with inventory management (Chen & Zhang, 2014) once that in the Manufacturing Industry the major concerns are on the internal process optimization and costs reduction.

However, we cannot simply assume it as the only areas to be addressed once that our survey participants are mainly from product quality and manufacturing process and not from Customer Units area or Marketing where probably we could get a different result. We got some inputs from our surveys that the Supply Chain Information management (ISM) (Agrahri et al., 2017) is also an area relevant to secure the Manufacturing Industry competitiveness and deserves to be in the agenda for investments on Suppliers Quality, Products and Customer delivery traceability.

We can conclude that even though we were not able to prove and justify all objectives in our research questions the overall understanding and some theories evaluation were successfully addressed in this work bringing a valuable contribution applied in the real technology company to the community knowledge base.

ACKNOWLEDGEMENTS

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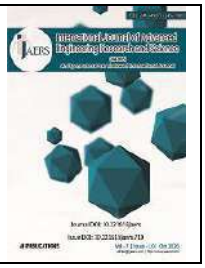

Potentially Meaningful Teaching Unit: Building Mathematical Problems Involving Power

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***Keywords*— Energy generators, Interdisciplinarity, Following teaching, PMTU.**

***Abstract*—** *In this work we aim to develop a Potentially Meaningful Teaching Unit (PMTU), capable of satisfying the interests and theories of meaningful learning. Using interdisciplinarity to make classes more attractive and a better transfer of information in order to form the concepts of teaching energy. Methodologically the research has a qualitative approach. Focused on the formation of the PMTU, before discussing the concepts of Physics and Mathematics, students are worked on a conceptual map produced by them, from the topic Energy Generators, making it possible for the teacher to observe the previous knowledge of each student regarding the theme. After all the content has been worked on, the proposal is to create a new conceptual map using the same theme of analysis, so that the teacher can observe whether the student has incorporated the fundamental concepts in his knowledge and for himself to evaluate his classes.*

I. INTRODUCTION

Teaching methods aimed at improving classes and their efficiency in relation to students` learning have long been discussed. With this, it is important that the teacher defines strategies and techniques to be used in the teaching process, such as adapted approaches, which guides the resources to be used, and components that intermediate the relationship between teacher and student [1]. According to Almeida [2], students are having a lot of learning difficulties, a fact that is proven by the number of failures, mainly in the areas of mathematics and physics.

Our work justified by the current lack of teaching methodologies centered on meaningful learning, aimed at more efficient teaching, since the teacher finds it very difficult for the knowledge to have meaning [3]. The question that worries us to answer is: how should teachers proceed in order to discuss the concepts of energy generators using a Potentially Meaningful Teaching Unit (PMTU)? In formal book education, it is necessary to act generally through controlling strategies, which ends up generating discomfort between student and teacher, causing the demotivation of both.

Analyzing these facts, the objective of this research is to contribute to teaching, developing a didactic sequence capable of enabling the teacher to organize, evaluate and guide the learner in the teaching process. Since the PMTU bring this perspective, in meaningful critical learning the learner is the person who must critically capture the meanings of the contents of the teaching material. That is, it must have an intention to capture and internalize meanings accepted in the context of the teaching subject, but not as if they were unique and definitive [4].

As a basis we have interdisciplinarity, with mathematics being the main subject, and considering

physics, geography and others as secondary subjects, but no less important, so as to make classes more attractive, to seek greater participation of students during activities. According to Braβler [5], a teaching process is characterized by the combination of activities, where the teacher directs the teaching of the subjects, and the student learns progressively, carrying out interdisciplinary work. The concept of interdisciplinarity becomes clearer when considering the trivial fact that all knowledge maintains a permanent dialogue with other knowledge, which can be questioning, confirming, complementing, denying, expanding [6]. In this work, a methodological search of bibliographic revision type was sought, with a qualitative approach where the bibliographic research was made from the survey of theoretical references already analyzed, and published by written and electronic means. The main focus of the work is to develop and organize a didactic sequence, building mathematical problems when possible, with problem situations involving the types of energies, based on a Potentially Meaningful Teaching Unit (PMTU). We tried to develop this work by bringing together several subjects in an organized manner, involving calculations of mathematics, the types of energy generators in physics, facts worked on in geography and history, and reading and interpretation of Portuguese ... Therefore, it will be demonstrated how to elaborate a didactic sequence of the PMTU type, established by Moreira [6], structured in the form of meetings (Classes) in which the types of energy generation will be used as a generating theme. In all cases, this "integration module" or "integration work" is about proposing a complex work to the teacher, whether it is a problem situation that must be resolved or an original production that must be carried out [7]. Among the specific objectives we have, to investigate how to organize a didactic sequence based on a Potentially Meaningful Teaching Unit, to develop a contextualized Didactic Sequence proposal on the classification of types of energy involving mathematical problems and to present a way of working in an interdisciplinary way in basic school.

II. THEORETICAL FRAMEWORK

The didactic sequence is a way of organizing a pedagogical work allowing to anticipate what will be studied in a given time, taking into account the students' prior knowledge and what they need to learn, with constant monitoring and follow-up by the teacher before the students through activities, evaluating the progress and the end of the work. It corresponds to a set of interconnected activities and objectives that are planned with the intention of reaching a certain didactic objective, organized around a specific content, aiming to help / assist the student to learn certain content and build knowledge, not only that the student memorizes the concepts [8]. As stated, didactic sequences are a very important tool for the construction of knowledge: When organizing the didactic sequence, the teacher may include different activities such as reading, individual or collective research, dialogued class, textual productions, practical classes, etc., because the sequence of activities aims to work on a specific content, a theme or a textual genre from the initial exploration until the formation of a concept, an idea, a practical elaboration, a written production [9]. For Pessoa [10] it is important to take into account some aspects for the elaboration of a Didactic Sequence, which are:

• Define the theme of the didactic sequence: the theme must be chosen according to what the teacher intends to work on and expects the student to be able to develop and learn during a certain period.

• What to take into account in the initial survey: always take into account what the student already knows and what he will learn during the didactic sequence.

• Establish contents and objectives: the contents worked on must be made very clear, and objectives must be established, keeping in mind what we want, which is intended for the student to know at the end of the sequence.

• How to link activities and objectives: think about strategies to reach the desired result, always observing what knowledge the student needs to have to move on to the next content. You can make a first proposal and analyze if you can advance content, or if you have to delay some activity for another time.

• Estimate the duration of the didactic sequence: this action must take into account the complexity of the content and not just the number of proposed tasks.

• Best way to organize the class: you should understand the didactic sequence and evaluate how the class will work best. Often working in a slightly larger group will allow the exchange of knowledge between the parties, but there may be difficulties if everyone does not cooperate.

• How to make activities more flexible: it is possible that in the class there is a student with special needs, he cannot be excluded or put to work separately, ways must be found so that he can participate together with colleagues in activities.

• If there is a need to change the plans during the application of the didactic sequence: when a didactic sequence is elaborated, it is necessary to analyze whether the students had a good base in previous classes, otherwise the planning must be changed to review contents that were not well designed, but will be needed during the next activity.

• How to assess what the class has learned: first, assess whether the student has moved from a smaller stage to one of greater knowledge. Taking into account the aspects already mentioned, an attempt will be made to develop a didactic sequence, capable of satisfying both the student's interest, showing a different way of learning mathematics, and that of the teacher, who may have a better use of his classes.

In schools, teachers often present certain content to students, they copy and try to memorize it for use during the test or for some proposed activity, and soon after they forget it. With PMTU, the student will be accompanied throughout the teaching process, the teacher will make sure that the student understands the content, and not just decorate to use it once, and then forget.

The use of PMTU for teaching different topics has been applied in several areas [11].

For Moreira [6], the information already mastered by the student is a significant factor that will influence his learning, having a certain mastery over a certain topic the student will be able to develop new learnings, facilitating the understanding of new concepts. Pessoa [10] believe that meaningful learning is based on the process where new information is developed and structured from knowledge that students already have. However, it is not enough for the teacher to be willing to develop a didactic sequence, based on a PMTU, the student must also be willing to develop his knowledge, being participatory, critical and questioning. Thus, you will have a better use of the content to be studied. A very important moment is found at the beginning of each meeting, as it is where the content of the previous class is resumed, taking time to clarify latent doubts, remembering that the content needs to be understood and not decorated by the student. The steps for the elaboration of a potentially significant Didactic Sequence were discussed, aiming to expand the possibilities of occurrence of Significant Learning in the development of activities. There are eight steps proposed by Moreira [6] for the elaboration of a PMTU:

1) Define the specific topic to be addressed, identifying its aspects to be studied as well as what content can be used.

2) Create / propose situations - discussion, questionnaire, concept map, mind map, problem situation, etc. with that the student will be able to show how much he already knows, and the teacher can work with the student to develop his knowledge from that.

3) Propose problem situations, with an introductory level taking into account what the student already knows, in these problem situations one can have the help of other types of materials such as games and software, making the class even more attractive, with greater participation of the student. student.

4. Once the initial situations are worked out, present the knowledge to be taught / learned, starting with more general, inclusive aspects, giving an initial view of the whole, of what is most important in the teaching unit, and then exemplifying, addressing specific aspects ; the teaching strategy can be, for example, a brief oral presentation followed by collaborative activity in small groups, which, in turn, should be followed by a presentation or discussion activity in a large group;

5. In continuity, resume the more general aspects of the content of the teaching unit, in a new presentation, but at a higher level of complexity in relation to the first presentation; problem situations must be proposed at increasing levels of complexity; give new examples, highlight similarities and differences in relation to situations and examples already worked on, that is, promote integrative reconciliation.

6. Concluding the unit, continue the process of progressive differentiation, returning to the most relevant characteristics of the content in question, but in an integrating perspective, that is, seeking integrative reconciliation, and in this part they must be proposed and worked on at higher levels of complexity in relation to previous situations; these situations must be resolved in collaborative activities and then presented and / or discussed in a large group, always with the mediation of the teacher;

7. The assessment of learning through PMTU must be made throughout its implementation, recording everything that can be considered evidence of significant learning of the content worked;

8. PMTU will only be considered successful if the assessment of student performance provides evidence of significant learning. Meaningful learning is progressive, the mastery of a conceptual field is progressive; therefore, the emphasis on evidence, not final behavior.

The evaluation methodology presented in point 7 of the proposal by Moreira [6] is also accepted by Training by Skills. They propose that “assessment must accompany the entire student's training process”, this being a fundamental principle of assessment by competences.

An interdisciplinary planning is when two or more disciplines relate their contents to deepen knowledge and bring dynamics to teaching. The relationship between disciplinary content is the basis for more interesting teaching, where one subject helps another. According to Braβler [5]: “interdiciplinarity does not dilute disciplines, on the contrary, it maintains its individuality. But it

integrates the disciplines from the understanding of the multiple causes or factors that intervene in the reality and works all the languages necessary for the constitution of knowledge, communication and negotiation of meanings and systematic registration of the results". This interdisciplinary process makes it possible to assist integration between students, and between them and teachers, and there may be an exchange and experiences between them, since in this type of activity the student will not develop his knowledge alone, but with other colleagues, with guidance of the teacher. It is known that teachers should always be studying, qualifying, looking for new ideas and methods, so that they can meet the needs of each type of student, an interdisciplinary educator will need even more study, according to Dube [12]: "an interdisciplinary educator does not it is built overnight. This demands from the educator initiative, a taste for risk, the ability to get out of pre-established schemes, personality maturation, in short, individualization".

According to the National Curriculum Parameters (PCN) [13]: Interdisciplinarity supposes an integrating axis, which can be the object of knowledge, a research project, an intervention plan. In this sense, it must start from the need felt by schools, teachers and students to explain, understand, intervene, change, predict, something that challenges an isolated discipline and attracts the attention of more than one eye, perhaps several. In this didactic sequence, we tried to work with interdisciplinarity, so that it will be possible to study certain content of mathematician, with the help of other disciplines such as physics, geography and Portuguese, interacting between them, but with the main focus on mathematics.

Within the Pedagogy of Integration, different schemes can be defined that represent modes or forms of integration. In this sense it proposes several ways, the first of which is Situations that mobilize knowledge acquired in various disciplines. In this way, the knowledge is developed in each discipline keeping strictly the specialization of the teachers [14]. Thus, the integration of the disciplines is only done when there is a work or integration module at the end of the year or also in complex problem situations that mobilize the knowledge of several disciplines.

For the development of the didactic sequence presented in this work, some types of energy generators were used, with the possibility of studying, understanding each one, and evaluating which type may be more useful and economical to be used in homes. The types of generators considered in this work are as follows [15, 16, 17]

• Mechanical Generator - this is the most common, efficient and varied among the types of generators. It can work through combustion, with fossil or organic fuels, external forces, such as wind or water, or heated fluids, whose steam generates the necessary mechanical movement for the activity. It can be a non-polluting generator using the wind, or highly polluting by burning fossil fuels.

• Chemical Generator - is capable of converting the energy generated in chemical reactions, into electrical energy usable in appliances. It stores the elements necessary for the reaction, which are usually activated by some external contact, such as the connection that completes the cycle between the positive and negative sides. This source is still little used as a generator of energy due to the high value that would need to be used to have a large scale of storage, however, the most used in this type of energy are batteries.

• Thermal Generator - uses thermal energy and converts it into electrical energy. It is capable of converting energy directly through heat, instead of converting the consequences of heat to another type of energy. In the case of many mechanical generators, burning fuel generates heat that turns a fluid into steam, which will drive the turbines and activate the generator. In the case of a thermal generator, the action does not go through the indirect process, using heat itself as a form of generation.

• Light Generator - uses light energy and converts it into electrical energy. This generator has no costs for the raw material, which is solar irradiation, and it is easy to implant solar panels, which can be placed even in small homes to produce energy during periods of irradiation. However, a material is needed to capture the solar radiation and convert it into usable electrical energy in common equipment. Generally, the material in question is silicon, which has a high market value, making the manufacture of this type of generator more expensive. • Wind Generator - uses wind energy and converts it into electrical energy. The kinetic energy of the wind is usually converted into mechanical energy by windmills and pinwheels, or into electrical energy by wind turbines (or aero generators). 2.4. Content In this didactic sequence, an interdisciplinary work was presented with mathematics as the guiding discipline, physics, geography and Portuguese as assistants in the development of questions. Mathematical problems involving the contents of: Scientific Notation; Graphics; Percentage and Exponential Function.

III. METHODOLOGY

We classified our research as a literature review type, with a qualitative approach. The methodological

definitions of scientific works are somewhat divergent at the present time. In this work, we use the classic classification of research described by Jakeman [14]. As for nature, we carry out applied research because we are interested in practical results. In relation to objects, we have an exploratory research because we are exploring a universe of data to draw conclusions about them. As for the way to approach the problem, the research can be classified as qualitative, so that the research considers that there is a dynamic relationship between the real world and the subject, that is, an inseparable link between the objective world and the subjectivity of the subject which cannot be translated into just numbers but an apprentice with high relevance in meaningful learning.

The bibliographic research was made from the survey of theoretical references already analyzed, and published by written and electronic means. Didactic materials and websites that bring knowledge about: energy generators, Scientific Notation, Graphics, Percentage, Exponential Function, Logarithmic Function were analyzed, as well as mathematical problems related to the students' daily lives, with the purpose of elaborating a Didactic Sequence. This Didactic Sequence was elaborated in the 1st (first) semester of 2018, without being tested in the classroom. The Didactic Sequence, was elaborated seeking to satisfy the interest of students of the 1st year of High School of the basic school, mainly because they are students with more experience of life, and thus the content will be useful in the activities carried out in their day-to-day activities. day. The data were collected through research and reading in textbooks, and articles published on the internet using the books recommended in the PNLD (National Textbook Program) [19]. To search for the articles, Google academic was consulted, using the keywords; Potentially Meaningful Teaching Unit, Didactic Sequence, Energy Generators, Scientific Notation, Graphs, Percentage, Exponential Function, Logarithmic Function.

After the articles and data were collected, analyzed and studied, a Didactic Sequence was developed based on a Potentially Meaningful Teaching Unit (PMTU). The didactic sequences are "a set of ordered, structured and articulated activities for the achievement of certain educational objectives, which have a beginning and an end, known both by teachers and by students" [16]. Thus, we will always try to follow the planning without skipping steps, trying to solve the difficulties using the knowledge that, a priori, the students already have on the topic to be studied. Each phase of the project will be organized in the form of PMTU, seeking to build meaningful learning, thus the student will be able to explain and apply the knowledge acquired to new situations. The PMTU according to Neto [4], "They are theoretically grounded teaching sequences, focused on meaningful, non-mechanical learning, which can stimulate applied research in teaching".

IV. RESULTS

We will present below an explanatory table with the steps and content to be developed in each stage of the PMTU according to the theoretical framework discussed.

Table 1. Didactic sequence.

Period	Content	Objective Strategies	Resource used
Lesson I 2 hour / class	Cientific notation, Graphics, Percentag, Power generators	That the student is able to demonstrate his previous knowledge about the contents to be studied.	Muc, Expository class dialogued, Examples.
Lesson II 2 hour / class	Cientific notation, Graphics, Percentag, Power generators	That the student is able to read and interpret the text by performing the activities	Muc, Expository class dialogued, Together with students discuss over the text, Exercises, Exercise correction.
Lesson III 2 hour / class	Graphics, Percentag, Power generator, Function Exponential	That the student is able to watch the video and debate, immediately after, the content of exponential function started to be worked	Muc, Expository class dialogued, Video about generators energy, Introduction to scientific notation content, examples, Exercises.
Lesson IV 2 hour / class	Exponential fucntion and systems	That the student is able to build graphs of the exponential function.	Muc, Dialogue lecture, In this class the students worked

			with the GeoGebra program in the computer lab. Exercises and correction.
Lesson V 2 hour / class	Exponential function: •Application, • Euler's number	That the student is able to understand where the exponential function and the Euler number apply	Muc, Expository class dialogued, Examples, Exercises and correction.
Lesson VI 2 hour / class	Exponential equation and systems	That the student is able to work the systems.	Muc, Expository class dialogued, Examples, Exercises and correction
Lesson VII 2 hour / class	Exponential inequality.	That the student is able to work with exponential inequality and check if the functions are increasing or decreasing.	Muc, Expository class dialogued, Examples, Exercises and correction
Lesson VIII 2 hour / class	Graphics, Percentage, Power generators, Exponential function	That students in groups can work each group with a type of energy generator, and create a letter.	Muc, Expository class dialogued, Students will be divided into groups so that they can work with the power generators, to present to colleagues.

Table 2. Potentially Meaningful Teaching Unit.

Period	**Potentially Significant Teaching Unit (PSTU)**	**Evaluation Indicators**
Lesson I 2 hour / class	Initial situation	Evaluation of students' prior knowledge through initial concept maps. Evaluation of questions under the study topic.
Lesson II 2 hour / class	Problem situations initials	Evaluation of a summary made by the student.
Lesson III 2 hour / class	Deepening Knowledge	Evaluation of the review on the use of concepts in the student's daily life.
Lesson IV 2 hour / class	Deepening Knowledge	Evaluation of concept maps developed by students at and presented at the end of class to other colleagues.
Lesson V 2 hour / class	Deepening Knowledge	Evaluation of the use of concepts in didactic applications.
Lesson VI 2 hour / class	Deepening Knowledge	Evaluation of questions under the study topic. Evaluation of initial concept maps.
Lesson VII 2 hour / class	Deepening Knowledge	Evaluation of questions under the study topic. Evaluation of initial concept maps.
Lesson VIII 2 hour / class	final situation	Evaluation of the use of concepts in daily applications

V. CONCLUSION

During the development of this Potentially Significant Teaching Unit, an attempt was made to work in an interdisciplinary way, using whenever possible situations of the student's daily life involving energy generation, so that, when applied, it is possible to keep the student focused and participating in the classes. , always leading the student to investigate the content.

This researched theme was necessary to realize that a math class can be much more than a simple class, where the student copies the book, solves the proposed questions, studies for proof and the next day he forgot, since many Sometimes he ends up asking the teacher, where and when he will occupy certain content in his life.

Although this Potentially Meaningful Teaching Unit has not been applied at this time, it is perceived that it is necessary and is extremely important for the teacher to be able to teach a good class, and that the student evolves during the classes from a mere spectator to a student capable of interpreting, investigating and transmitting what he learned during classes.

Thus, we conclude that we can make math and physics classes much more attractive by looking for new ways to work, using subjects from other areas to introduce content, interacting between disciplines, not forgetting the mathematical focus that is the main guiding discipline of our PMTU.

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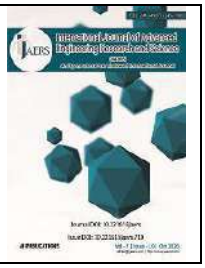

The Performance of the LGBT Space, unit I, João Pessoa - Paraíba, as an articulating body of protection and support to the LGBT+ population

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Keywords*— *Public Policy, LGBT phobia, citizenship, empowerment.

Abstract *— In this article, we intended to bring a brief discussion about the State Center for Reference of LGBT Rights and Confrontation with LGBTphobia of Paraíba, also known as LGBT Space - Unit I (João Pessoa - Paraíba). The applied methodology was qualitative, through bibliographic, documentary and field research in order to clear the institutional conjuncture that allowed the creation of the organ under study, its competencies and main results achieved over almost ten years of implementation.*

I. INTRODUCTION

The LGBT Space (João Pessoa), a state agency created on May 25, 2011, is the result of an agreement with the Federal Government. Its constitution stems from numerous demands of the local LGBT+ Movement, presented especially at public policy and human rights conferences for the LGBT+ population.

It should be highlighted that the Brazil Without Homophobia Program, launched in 2004 by the Secretariat of Human Rights of the Presidency of the Republic, was the first milestone of state awareness, at the federal level, to promote the citizenship of the segment. In this sense, it should be emphasized that the creation of instances such as LGBT Space - Unit I (João Pessoa - Paraíba), arises from this scenario.

Linked to the Secretariat for Women and Human Diversity (SEMDH-PB)[1], also created in 2011, the LGBT Space – Unit I integrates another of the structures of Paraiba for assistance of this population, which also has the Comprehensive Health Outpatient Clinic for Transvestites and Transsexuals of Paraíba - Outpatient Clinic TT, the Coordination of Women's Rights, Sexual Diversity and Human Rights of the Public Defender's Office of the State and the Specialized Police Station against LGBTfóbicos, Racial crimes and Religious Intolerance - DECHRADI/PB.

The institutional mission propagated by the LGBT Space Unit I is to be an instantiation that advocates the citizenship and human rights of LGBTQIA+, as well as, coping with LGBTphobia, discrimination by sexual orientation and gender identity.

It also proposes to articulate the services and social actors, governmental and non-governmental, to form a network of protection and guarantee of the rights of LGBT+ people, which qualifies the care of this population and develops strategies of intersectoral actions to combat LGBTphobia and all forms of violations of rights of this public. (PARAÍBA, SEMDH, 2009).

II. METHODOLOGY

This study has a qualitative approach and adopted bibliographic, documentary and field research by methods. It should be highlighted that most of the information collected was obtained directly at the LGBT Space - Unit I, located at Street Princes Izabel, 164, João Pessoa/PB, which allowed direct consultation of the agency's records, which constituted, as a result, primary sources of research.

III. THEORETICAL FRAMEWORK

According to Soares and Schultz (2019), Espaço LGBT (João Pessoa) was the first public equipment and assistance to the segment created by the state of Paraíba. Specifically regarding Unit I, the authors say that their actions unfold beyond the capital, reaching other municipalities in the interior of the state where LGBT+ people are in a situation of discrimination and violence. In addition to legal and psychosocial support, the instantiation aims to facilitate the segment's access to citizenship. In addition, SEMDH/PB (2019, not paged) highlights:

> The LGBT Space is one of promoting the citizenship and human rights of LGBTQIA+, as well as coping with LGBTphobia, discrimination by sexual orientation and gender identity. One of its actions is to articulate the services and social actors, governmental and non-governmental, to a network of protection and guarantee of LGBTQIA+ rights. The network aims to qualify the care of the population and develop strategies of intersectoral actions to combat LGBTphobia and all forms of violations of law.

Melo (2020, p. 180), citing Soares and Schultz (2019), mentions how some of the actions promoted by Espaço LGBT:

> the monitoring of cases in various areas of law, such as the criminal and civil sphere, cases of adoption by LGBT+ people, access to social security benefits, psychological follow-up, including for family members of LGBT+ people, as well as focus groups for transvestites and transsexuals, assistance in obtaining basic documentation, referral to health services, among others.

It should be highlighted that, according to Melo (2020) some of the services provided by Espaço LGBT also reach family members and friends of LGBT+ people, since many of the situations of vulnerability and discrimination affect people who are not part of this population, but who are associated with it, either by the degree of kinship or by other social ties.

According to the disclosure carried out on the institutional website of the state of Paraíba (2019), the services offered by Espaço LGBT are of a legal nature, psychological support, social service and human rights, besides having an LGBTQI+ library open to the public.

According to Azevedo et al, (2019), the services provided by Espaço LGBT (João Pessoa) allow access to the meeting space and exchanges of experience between family members who are experiencing the transition and preparatory processes for performing sexual reassignment surgery.

In addition to the attendances mentioned, it should be emphasized that the agency also conducts lectures, workshops, seminars and dialogue scans with a view to promoting and strengthening LGBT+ citizenship.

The relevance of its performance is affirmed from the analysis of the reality of the segment, which is historically the victim of violence, prejudice, discrimination and exclusion, commonly also affected by low schooling (NASCIMENTO and FRANCH, 2018).

The reality of the state of Paraíba, which statistically stands out in the national and regional scenario as one of the states with the highest rates of deaths of LGBT+ people, as well as complaints about the practice of discriminatory acts against this population (MELO, 2020) cannot be observed.

One of the strategies used by Espaço LGBT, as Silva (2019) points out, is the interaction and dissemination of services through social networks, such as Facebook and Twitter.

In this sense, at the time of its inauguration was held a virtual poll for the choice of the mascot of the organ, having been elected a multicolored chameleon named Iguaraíba, in a direct reference to the main international symbol of LGBT struggle, the rainbow flag.

Fig. 1: Chameleon Iguaraíba (mascot of LGBT Space - João Pessoa)

Source: LGBT Space Profile on *facebook* (2020)[1]

According to Côrtes *et al.* (2019, p. 428), the LGBT Space (João Pessoa):

> (...) promotes access to services of the Judiciary to rectify the first name of transvestites and transsexuals in the civil registry, with psychological advice, guidance on the process, issuance of negative certificates and guidance after the process yoked and granted" in its legal sector.

In addition, the predominant profile of users of the LGBT Space, verified from the analyses of Nascimento and Franch (2018), has female gender identity (lesbian, bisexual, transvestite and transsexual), black race/ethnicity, age between 18 (eighteen) and 29 (twenty-nine) years, schooling up to high school and income less than or equal to a minimum wage.

IV. ANALYSES AND DISCUSSIONS

From the data collected from the LGBT Space – João Pessoa, as well as with the bibliography and available documents, it was found that until October 2019 the LGBT Space, performed 22,901 (twenty-two thousand) visits and registered 1,501 users, mostly from the younger population, from 18 to 29 years and with female gender identity.

It should be highlighted that the main provoking facts of the agency's performance are linked to the non-framing of users of the LGBT Space to a normative sexuality, that is, heterosexual and cisgender, which often makes them targets of episodes of discrimination, physical, psychological, verbal or symbolic violence, omissions and intolerance.

It is observed that the physical and psychological violence practiced by the victims' own relatives is the main complaint of care, followed by the reports of institutional LGBTphobia.

It was found that in addition to guidance and direct interventions carried out by the LGBT Space (João Pessoa), as indicated for each case, the agency also promotes educational and sensitizing actions, in addition to events for the dissemination of services and reach of the target population (PARAÍBA, 2020)[2].

V. CONCLUSION

The present study allowed a brief description of the institutionalization and performance of one of the most important governmental institutions for the assistance of the LGBT+ population in Paraíba, the LGBT Space, located in the capital of Paraiba.

It is verified that the implementation of the agency is not the result of mere state initiative, but of the action of a strong local militancy, aligned with movements of national character, especially in the last two decades.

The LGBT Space (João Pessoa), currently one of the main articulating instances of public policies aimed at the LGBT+ segment in Paraíba, with technical staff and material that throughout its almost 10 years of existence, has allowed the realization of a relevant amount of care for the reception and direction of the demands of people vulnerable due to LGBTphobia.

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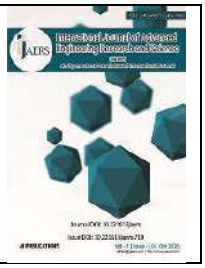

Environmental and Geography Effects of Health Arising from the Sugar Alcohol Sector in the municipalities of Nova Glória, Ipiranga de Goiás and Rubiataba, Goiás state

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***Keywords*— Environmental effects, geography effects, health, sugar alcohol sector.**

Abstract *— The present study refers to a parallel to be evaluated, which is the correlation between the activities of the sugar and alcohol plants and the sugarcane plantations, environmental damage and the local health population in the municipalities of Nova Glória, Ipiranga and Rubiataba, Goiás state, in other words, if there were changes in the aspects related to collective health and that may directly or indirectly be related to this environmental aspect. and, in a specific character, to characterize the level of environmental diagnosis in the sugarcane plantations in the municipalities of Nova Glória, Ipiranga and Rubiataba that serve the Cooper Rubi plant; analyze the Environmental Management System (EMS) with Cooper Rubi, with emphasis on preventive actions that are developed in order to reduce damage to the environment; and finally, to analyze health statistics referring to diseases of respiratory diseases and its correlation with the sugar industry in this region.*

I. INTRODUCTION

The choice for the Microregion of Ceres -GO was due to the fact that, through this study, we sought to ascertain the impacts that the sugarcane agribusiness has represented in environmental and health terms for the municipalities of Nova Glória, Ipiranga de Goiás and Rubiataba. It is important to reiterate that the State of Goiás according to data from [1] is the second largest producer of sugar cane in Brazil, with estimates for this year of 2018, production of 71.14 million tons. With this, the state of Goiás has shown its representativeness in the national scenario of the sugarcane culture, this due to the favoring that the tropical climate presents and suitable to the culture, in addition to the fact that the topography relief collaborate together with mechanization due to low costs and low environmental impact. The planted area presented in 2017 0.2% lower, this due to the lack of provision for expansion areas, but this did not diminish the character of productivity, since it is expected to reach 0.9% more in 2018.

In view of this scenario, it can be observed that the sugarcane agribusiness is representative of socioeconomic development, however, the focus of this study is to assess direct and indirect impacts on the environment, as well as the population's health. According to estimates, the cerrado biome by the year 2035 should lose more than 6 thousand hectares to the sugarcane crop in the process of deforestation. In addition to that areas destined to agriculture, pastures and reforestation are converted into sugarcane plantation areas. What has been observed is that the cerrado biome has been occupied quietly, where the economic interest has outweighed the environmental, and this has caused a gradual imbalance in this environment [2]. In the case of the sugarcane agribusiness, the

production of sugarcane has represented an important economic aspect, including in the micro-region of Ceres - GO [3]

Due to the more comprehensive and holistic perspective of geography and health, the need arises to write this study and thereby demonstrate how geography and, more recently, geoprocessing, as a subarea of knowledge - has been gaining importance when applied to the area of health. In recent years, the number of books dedicated to geoprocessing and public health or epidemiology has been increasing, however, there are still very few that end up available to academics, technicians or the general population [4].

Thus, a mapping process was carried out with the municipalities of Nova Glória, Ipiranga and Rubiataba, which is fundamental for a more global analysis, that is, the map is a tool that demonstrates the special distribution of a particular phenomenon, in the case highlighted plantations and installations of sugarcane plants, with greater precision than the merely descriptive, as well as its determinants [4]. Monitoring for losses and alteration of natural resources is essential for a country with a large territorial extension such as Brazil.

II. METHODOLOGY

The methodology used was of a documental character with a descriptive and quali-quantitative approach, having as a source of data the Municipal Secretaries of Environment and Water Resources of the municipalities of Ipiranga de Goiás; Nova Gloria and Rubiataba, and, still use of monitoring the deforestation of Brazilian biomes by Satellite. We also sought data from epidemiological analyzes regarding the health of the population in the three municipalities, comparing changes that occurred in the last ten years and on-site observations of the municipalities under study.

2.1 Study Area

The present study has as analysis area the municipalities of Nova Glória, Ipiranga de Goiás and Rubiataba located in the State of Goiás, in the Ceres –GO microregion, as shown in fig. 1 and 2:

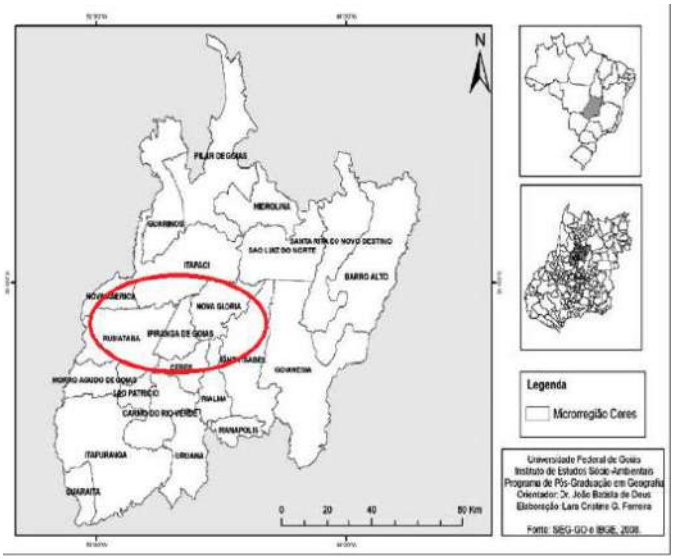

Fig.1: Ceres - Micro region Location - Study area[5]

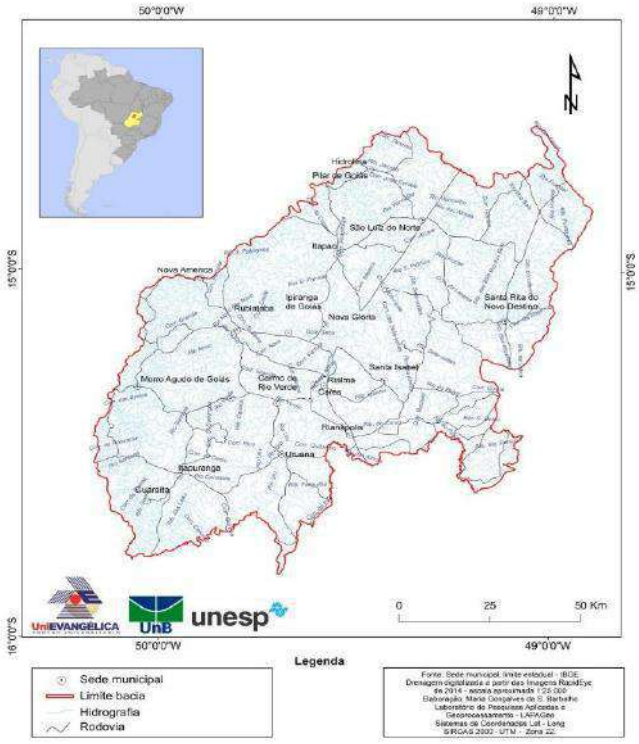

Fig.2: Ceres/GO Microregion Geographic Location [6]

In this area there are more than 223,000 inhabitants, which are distributed in an area of approximately 13,224 km2, representing a demographic density of 16.87 inhabitants / km2, and, therefore, the fifth most populated in the state of Goiás, presenting broad growth and urbanization.

The municipality of Nova Glória has an area of 412,975 km2, and, according to the 2010 IBGE Census, it has a population of 8,514. It is located in the São Patrício Goiano Valley, in the Midwest Region. It is located 185 km from the capital of the state of Goiás, and 35 km from

the city of Ceres-GO. The emancipation of the municipality occurred through Decree Law no. 6,882 on February 19, 1941, a driving factor being the creation of the National Agricultural Colony of Goiás (CANG). The founder of the municipality was João Schettine, who gave the name to the municipality in honor of his homeland. However, its emancipation and dismemberment of Ceres-GO, dates from July 1, 1983.

The municipality of Ipiranga de Goiás has an area of 241.3 km2, according to the IBGE Census (2010) 2,884 inhabitants. It is located 174km from the capital Goiânia and 18km from the municipality of Ceres -GO. The origin of the municipality was also due to the creation of CANG, in the 40s, and, only on July 21, 1997 through Law no. 13,137 sanctioned by the governor of the time Maguito Vilella is that the municipality was emancipated.

Rubiataba is a larger municipality when compared to Nova Glória and Ipiranga de Goiás, with an area of 748.3 km2 and a population of 19,747 according to IBGE data. It is located 27 km from the municipality of Ceres-GO, in the São Patrício Valley region and 220 km from the capital of the State of Goiás, Goiânia. The origin of the municipality also happened in the 40s due to the desire to create the agricultural colony, but its emancipation was only on October 12, 1953, by the then governor of the State Pedro Ludovico Teixeira, according to Law no. 807/1953.

2.2 Cooper Rubi Plant

The Cooper Rubi plant is located on Highway GO-434, Km 24, s / n in Rubiataba, and its business is the production of sugar and alcohol. The company has 1700 direct employees and 600 indirect employees. It was founded in 1983 with 70 members in that period. It currently belongs to Japungu Agroindustrial, in Paraíba and processes around one million tons of sugarcane per year, planted on about 17 thousand hectares, which are located in Rubiataba and in neighboring municipalities, as can be seen in the Figs. 3 and 4 below:

Fig.3: Cooper Rubi Panoramic view, Rubiataba, Goiás state. [7]

Fig.4: Rubiataba –GO alcohol industry (satellite image) (2018). [8]

The planting areas are located in the three municipalities and also on leased land from family farmers, who are designated as partners. In the area located near the Cooper Rubi plant, devastation of the cerrado can be seen, as can be seen in Fig. 5.

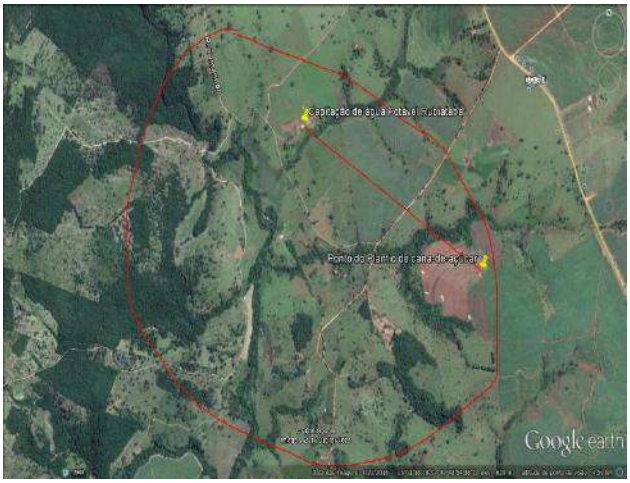

Fig.5: Sugarcane planting point located in Rubiataba, GO. [8]

III. RESULTS AND DISCUSSION

3.1 Sugarcane Plantation Area in the Municipalities of Nova Glória, Ipiranga de Goiás and Rubiataba

In the area of Nova Glória, Ipiranga de Goiás and Rubiataba it is no different. The area of sugar cane showed a considerable increase, according to data from [9], which carries out annual monitoring on the cultivation of sugar cane, as shown in the table below:

Table 1: Sugarcane area in Nova Glória, Ipiranga de Goiás and Rubiataba between the years2003/04 a 2013/14. [9]

IBGE Code	City	Available for harvest (ha)[1]			Total (a+b+c)	Under reformation (d) (ha)	Total Cultivated (e) (ha)
		Soca(a)	Reformed(b)	Expansion (c)			
Sugarcane area in the state of Goiás – Crop year 2003/04							
5214861	Nova Glória	2.783			2.783		2.783
5218904	Rubiataba	3.230			3.230		3.230
5210158	Ipiranga de Goiás	1.965			1.965		1.965
Sugarcane area in the state of Goiás - Cropyear 2013/14							
5214861	Nova Glória	10.990	621	338	11.950	2.271	14.221
5218904	Rubiataba	5.045	586	151	5.782	810	6.591
5210158	Ipiranga de Goiás	5.042	158	139	5.339	273	5.612

a) Soca: is the class of sugarcane crops that have already undergone more than one cut, that is, it is the cane that has sprouted from a plant or from a soca;
(b) Reformed: this is the class of one-and-a-half plant cane crops that were reformed in the previous crop year and are available for harvest in the current crop;

According to the data shown in the table, it can be seen that the municipality of Nova Glória was the one that had the greatest expansion of sugarcane planting, and as you can also see in Fig. 5, which shows the municipality's data for 2013 .

According to Fig. 6, it can be observed that the municipality of Nova Glória has a large plantation of sugar cane, this because the area planted in that municipality also serves the Vale Verde de Itapaci distillery and Cooper Rubi, from Rubiataba, and more characteristic is the shape of the clog, with a bit of representativeness also from that under renovation.

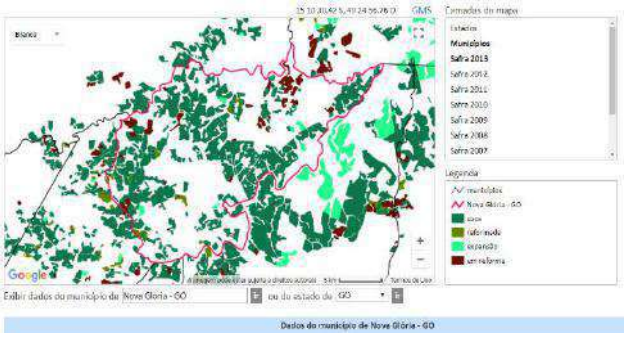

Fig.6: Sugarcane planting areas and profile in the municipality of Nova Glória -GO. [9]

In Fig. 7 below, it already represents the municipality of Ipiranga de Goiás, which compared to the municipality of Nova Glória is presented in a smaller number.

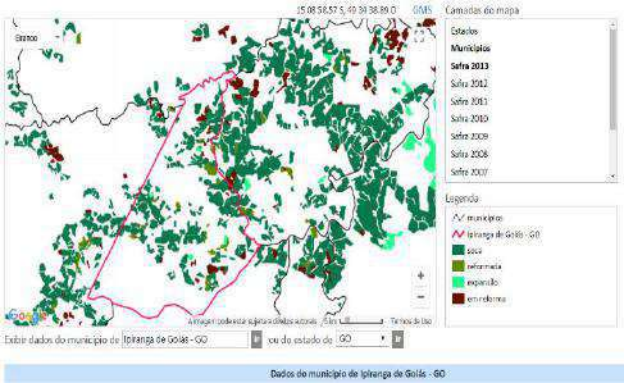

Fig.7: Sugarcane planting areas and profile in the municipality of Ipiranga –Goiás [9]

And, finally, there is the municipality of Rubiataba, state of Goiás, in which if the plant, its plantation area is much smaller compared to the other two municipalities

(c) Expansion: is the class of sugarcane crops that are available for harvesting for the first time;
(d) Under reform: it is the class of sugarcane crops that will not be harvested due to the reform with a year-and-a-half cane plant or because they are destined for another use. (a + b + c) Total available for harvest; (a + b + c + d) Total cultivated.
(Nova Glória and Ipiranga de Goiás), as can be seen in Fig. 8 below:

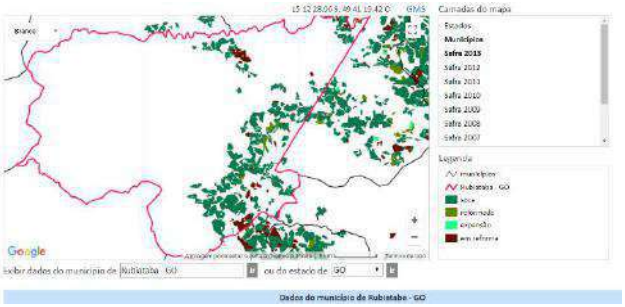

Fig.8: Sugarcane planting areas and profile in the municipality of Rubiataba, GO. [9]

Such data can also be seen in Fig. 9 below, which shows the distribution of sugar cane production throughout the territory of Goiás, it appears that the cultivation is more widespread in the regions of the southwest and northeast of Goiás. In the Ceres –GO microregion region, where the municipalities of Nova Glória, Ipiranga de Goiás and Rubiataba are located, the last two are still the most representative, being in the parameter of 553,360.01 to 1,121,120.00t. And, Rubiataba presenting production of up to 553,360.01t.

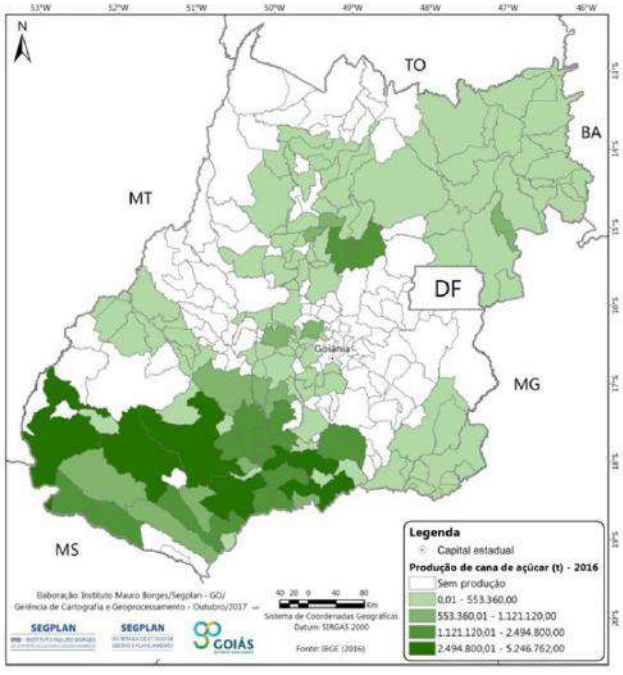

Fig.9: Sugarcane production throughout the state of Goiás [10]

In conducting the research with the company, it was observed that it does not have an Environmental Management System (SGA), which refers to a program focused on environmental issues. However, according to the person in charge of the company, there is a concern on the part of the company regarding issues of water, soil and environment, where risk management is carried out before activities and operational processes, which include harvesting and transporting raw materials, to the area. industrial processing. There is also concern about riparian forests, with a view to the preservation of water resources and biodiversity, in addition to the planting of sugarcane crops, the organization respects the permanent preservation areas (APPs) in which the riparian forests are located.

In addition, there is evidence suggesting that the intensification of activities related to sugarcane farming is severely damaging some areas of remnants of the cerrado region of the South Goiana mesoregion, sharply fragmenting the extensions of legal reserves and permanent preservation such as forests. ciliary [11].

In the current context, the discussion of a new environmental awareness is presented through sustainable development, with an emphasis on rules to seek to understand and reflect on the preservation of nature. Environmental problems are present in organizational decisions, the concern for a pleasant and clean environment is no longer just for environmentalists. Therefore, the environmental issue goes beyond geographical, economic, social and political limits, making it more visible and affecting all areas of human activity.

The most recent concern on the part of the company is the search to reduce atmospheric emissions, both in the transport process, as in production and fires. This is because the burning of sugarcane straw causes the emission of gases in the atmosphere, which would be reduced through mechanized harvesting, which occurs in 50% of the harvest. However, the company has the intention of completely replacing manual cutting with mechanical cutting in 2018. To reduce environmental impacts, the company is still recovering the banks of rivers, and has a team working on reforestation.

As pointed out [12] the expansion of sugarcane cultivation presents serious environmental problems and occupation of Cerrado domains, which are pastures and agriculture, and this expansion impacts fauna, flora and water resources. The burning of sugarcane straw causes air pollution, decreasing air quality, in addition to causing significant deaths of wild animals in the Cerrado biome, as shown in Fig. 10 below:

Fig.10: Burning of sugar cane straw, Rubiataba, state of Goiás. [7]

Another observed factor refers to the transformations of the landscapes, where the sugarcane plantations have occupied a considerable part of the rural areas of the municipalities of the micro region, contrasting in some moments even with the urban borders. This impacts on the relationship between countryside / city.

The plant aimed at recovering and reducing the damage caused to the environment has a project for a nursery that has an annual production of 40,000 seedlings of pro-cerrado plants that are distributed to the population of the municipalities surrounding Rubiataba, and also distributes to schools during the school year, with lectures on the importance of preserving the environment.

At the plant, the company has also developed actions aimed at reducing damage to the environment, such as gas washing, which consists of a system where the gases resulting from the burning of biomass are filtered before being released into the atmosphere. In the long term, the implementation of the Sugarcane Research Unit has been sought in partnership with the Federal Institute of Education of Goiás.

Among the harms to the environment in relation to the sugarcane production process is the burning of sugarcane, which is included in Law n. 11.241 of 2002 a control and planning need for this process, being that legislation foresees that the substitution until 2021 by the mechanizable process. Currently, the elimination of 80% of the fires is recommended, and must also respect some factors, that is, burning is prohibited one kilometer from the urban perimeter or from reserves / places occupied by indigenous people; 100 meters of electric power substation domain locations; it is also not allowed to carry out fires at 50 meters from reserves, ecological parks and conservation units; 25 meters of areas of telecommunication stations; and 15 meters from electric power transmission and distribution lines and from areas occupied by highways and railways. However, it is observed that the fires still happen irregularly, as can be seen in the Fig. below:

Fig.11: Fires carried out irregularly in the city of Rubiataba –GO[14]

There are then aggravations to the environment due to the burning process, triggering respiratory diseases among workers and the local population. It is observed that in the initial years of implantation of the plant, compared to the last years, there were more rates of diseases resulting from exposure to smoke, fire and flames (X00-X09) in the municipalities of Ipiranga de Goiás, Nova Glória and Rubiataba , as can be seen in the tables below.

Table 2: SUS Hospital Morbidity due to External Causes - Causes: X00-X09 Exposure to smoke, fire and flames) in the municipalities of Ipiranga de Goiás, Nova Glória and Rubiataba from 1999 to 2007[14]

Municipalities	1999	2000	2001	2002	2003	2005	2006	2007	Total
521486 Nova Glória	1	1	3	1	-	-	-	-	6
521890 Rubiataba	-	1	10	3	1	2	1	2	20
Total	1	2	13	4	1	2	1	2	26

Table 3: SUS Hospital Morbidity due to External Causes - Causes: X00-X09 Exposure to smoke, fire and flames) in the municipalities of Ipiranga de Goiás, Nova Glória and Rubiataba from 2008 to 2017 [14]

Municipalities	2008	2010	2013	2014	2015	2017	Total
521486 Nova Glória	-	-	-	-	1	3	4
521890 Rubiataba	1	1	5	1	1	2	11
Total	1	1	5	1	2	5	15

According to the study and data collection performed, it was observed that the labor of the Cooper Rubi plant is largely coming from the municipality of Rubiataba, Ipiranga, Nova Glória and Itapaci. Between Rubiataba and the municipality of Nova Glória, there is a prevalence of sugarcane plantations, however, being intensive from the municipality of Ipiranga.

The cerrado biome, despite being one of the richest and most diversified ecosystems in the world, has been transformed on a large scale where several species of native animals and several species of plants can disappear, if serious and concrete measures aimed at the conservation of this biome are not taken.

The fact is that the Cerrado is being deforested in its virgin areas, replacing agriculture, anthropized, destroyed, as large agricultural properties are taking over the territory for grain monoculture.

As described [15]:

This decrease in incidence is perhaps justified by the mechanization implantation process that the plant has presented in recent years, as can be seen in the report below:

> Cooper-Rubi is gradually mechanizing the cutting of cane. According to his representative, the number of workers in the harvest will soon be reduced from 800 to 300. This radical reduction occurs in all producing states, with greater speed in the flat regions, especially favoring the mechanization of cane cutting . This and other questions about the conditions of sugarcane workers are addressed later in the case study on São Paulo. There is nothing better for sugarcane, for cane fields, than cutting cane by hand. It doesn't waste anything, it doesn't have the problem of soil compaction. However, there is the problem of worker fatigue, of burning cane. Now mechanization is a must (Cooper-Rubi's administrative-financial manager).

Thus, this result may be a consequence of the control that Cooper Rubi has shown regarding the decrease in the aggravations of its production process, as well as a decrease in the practice of burning by mechanization in the harvest.

> Deforestation and the urban and agricultural uses of water in the hydrographic basins of this Region are reducing the level of groundwater, which has been affecting natural ecosystems even when they are in Conservation Units. The decrease in the depth of the water table directly influences the structure of the plant communities in the Wetlands of the Cerrado.

Studies address the issue of deforestation in the Cerrado. The first carried out by IBGE made an environmental diagnosis of the basin in the stretch between Barra do Garça (MT) and Luís Alves (GO). Regarding the situation and use of land in the area, this reveals a high degree of compromise of the natural environment in relation to the effects of anthropic action. Only 8.95% of the land was conserved. The 91.05% was used for

agriculture, urban centers as well as uses of plant and mineral extraction. Of this total, 62% were classified as areas under alert, due to the high rate of deforestation in disregard for environmental legislation, due to the inappropriate use of its agroecological potential and / or use with impactful intensive agriculture [6;16]

As represented by Fig. 12 below, which describes the distribution of deforestation in cerrado regions.

Fig.12: Distribution of deforestation in 2008 in the Cerrado[17]

As for deforestation, it has grown over the years and with the arrival of sugarcane monoculture the situation has worsened. This deforestation causes the loss of biodiversity, soil, water resources and opens the region to the expansion of the fires caused.

In addition to severe climatic changes in the region, river springs are affected by pollution and others are even diverted or dried up; the local stream dries up in September and deforestation causes a serious ecological imbalance and the destruction of local biodiversity, as shown in the Fig. below:

Fig.13: Devastation near the source [18]

The farms are completely taken over by the sugarcane monoculture and the cases have been destroyed. [18] also emphasizes the monoculture exploitation, being that it has characterized greater expansion of the plantation of sugar cane, thus having a predominance of one culture over the others. Intensive monoculture causes an imbalance in the soil and micronutrient deficiencies, as plants with unbalanced nutrition are sensitive to pests and diseases making the use of pesticides much more intense with constant applications.

The increase in social and environmental problems caused especially by human action on nature is today a notable lack in everyone. Another factor that can be described is the burning, common in the Cerrado Region. Fire is one of the determinants of the vegetation of the Cerrado, along with the seasonality of the rains and the soil poor in nutrients. Changes in these factors can result in severe damage to the structure and dynamics of vegetation.

Was also described that the expansion of sugar-energy agribusiness has favored a series of impacts, which highlights land concentration, overexploitation of the workforce and territorial disputes between sugarcane and food crops. [19]

In particular, with regard to the State of Goiás, it was possible to verify the expansion of sugarcane cultivation in pasture and grain areas with strong impacts on the Cerrado's biodiversity. On the one hand, there was the replacement of soybean, corn, cotton, subsistence agriculture, and on the other, the occupation of areas considered priority for the conservation of biological diversity in an area of native vegetation [20].

Currently, sugarcane crops have been occupying the cerrado areas with the predominance of sugar

cultivation. This process has impacted vast areas of the state of Goiás, with an expected increase in these agricultural activities with greater expansion of sugar cane. This, although producing alternative energy, renewable, less polluting, has generated intense processes of deforestation, substituting family production for monoculture, damaging the quality due and interurban, rural / urban migration processes internal and external to the state of São Paulo. Goiás [21]

It can be said that the instruments for implementing the principles of prevention and precaution, as is the case with the Environmental Impact Study and its report, are not intended to prevent the development of economic and social activities. Therefore, close monitoring of the new sugarcane expansion areas is necessary, as well as the restoration of areas of permanent preservation and legal reserve in the areas occupied by sugarcane.

In view of these factors, it is important to develop research aimed at the characterization, conservation, recovery and sustainable development of the Cerrado, being important the domain of knowledge about the ecological processes that govern the structuring and functioning of biotic and abiotic relations in the biome. In the modern world, society needs to recover the concept of sustainability and taking care of the environment is not part of our will, it is the duty of every citizen who occupies space on this great planet called Earth.

It is thus observed that even with the lack of an Environmental Management System (SGA), the company has guidelines and policies aimed at preserving the environment and the cerrado biome. However, deforestation and fires still occur, which directly impact the plant's physiognomy, as it is possible to observe soil compaction through heavy machinery traffic, during planting, and also in the harvesting process, in addition to observing reduction of biodiversity, caused by deforestation and also due to the implantation of sugarcane monoculture. Another note that deserves an approach is the intensive use of pesticides in the production of sugarcane that cause pollution in groundwater and CO2 emissions into the atmosphere, however, this aspect still does not have much approach and preventive policies.

Cities suffer practically throughout the year from the occurrence of fires in the cane fields. And this has an impact on the health of the population and workers, which can cause respiratory diseases mainly due to exposure to smoke, fire and flames. There should be an increase in hospitalizations for Respiratory Diseases in the period of burning of sugarcane. And, even in the face of such evidence, there are inefficiencies of public policies regarding the assessment of risks that directly affect human health.

It is concluded, then, that the sugarcane agribusiness has representativeness in terms of socioeconomic development, however, it has caused direct and indirect impacts on the environment, as well as the population's health with an increase in respiratory diseases.

Burning sugarcane residues is a widespread practice in the world, especially in developing countries, but not exclusively in them. This type of burning contributes significantly to pollution in southeastern Louisiana, in the United States, where the practice has suffered increasing objections from the population [22], State law allows such a practice, claiming that there is no scientific evidence of negative impacts. To provide information on possible health effects, a study was carried out based on hospital visits of 6,498 patients diagnosed with asthma, during the years 1998-1999, in a hospital in the city of Houma, in the same North American state.

Temporal analysis and a control table with three standard deviation limits were used to analyze existing observations. For two years, the monthly average of hospitalizations for asthma was 270.8. Women made up 56.9% of patients and babies had the highest rates, with 1,639 visits, followed by the group of children between five and ten years old. The months with the highest number of hospitalizations were October to December (33.06% of hospitalizations), indicating an increase in the trend of hospitalization for asthma in the months of burning cane straw.[22]

In another study carried out in Piracicaba, SP, daily hospital admissions for respiratory diseases were quantified, in children and adolescents (below 13 years of age) and in elderly people over 65 years old, using data from the Department of Informatics of the Unified System of Health (Datasus). The analyzes indicated that biomass burning and resuspension of soil eroded material are responsible for 80% of the fine particulate material (PM 2.5). Relative risk of hospital admissions for respiratory diseases in children and adolescents was significantly associated with the interquartile variation of PM 10, PM 2.5, aluminum black carbon, silicon, manganese, potassium and sulfur. An increase of 10 µg / m3 in PM was associated with a 21% increase in hospitalizations. In the elderly, the relative risk of hospitalizations for respiratory diseases was associated with the interquartile range of PM10, black carbon and potassium. The burning period had 3.5 times more hospitalizations than the one without burning [23]. However, the author warns of confounding factors such as air temperature and precipitation, since much of the burning period coincides with winter and drought, which were not controlled in the study.

Was analyzed spatial correlations when aggregating in a geographic information system: fires, areas in sugarcane and hospital admissions for respiratory diseases registered by Datasus, from 2000 to 2004, in the state of São Paulo and in regional scale in Bauru. On both scales, it was possible to verify a higher incidence of hospitalizations for respiratory diseases in areas where there is burning in sugarcane. [24]

Other studies have made measurements of atmospheric emissions of different pollutants from the sugarcane burning process, without pointing out health effects. However, due to its results, possible risks to human health can be inferred. Despite being restricted and presenting cautious conclusions, the studies analyzed indicate health risks, in adverse atmospheric conditions, caused by the burning of sugarcane straw.

These risks can be greater for children, the elderly and asthmatics and have the consequence of a greater demand for healthcare services. Until recently, studies with sugarcane were mainly concerned with workers in the production process, as observed with sugarcane cutters who are at higher risk of lung cancer as a result of burning foliage [22]

With the worsening and greater awareness of the planetary environmental crisis, especially of changes in the climate due to polluting human activities, there is an increase in the production of biofuels. Among biofuels, sugarcane is the one that has shown the greatest growth. However, its burning has been receiving growing opposition from public opinion that alleges its environmental impacts and the health of the population in its surroundings, despite the still tenuous performance of Brazilian health agencies in this discussion. In the state of São Paulo, due to pressure from environmentalists, in 2002, a law was passed that provides for the gradual elimination of the use of fire, as a facilitator of cutting cane, until 2021 for mechanizable areas and until 2031 for non-mechanized areas [25].

The few studies on the effects of sugarcane burning give some indication of its impact on the health of the general population, but still leave many questions. On the other hand, research on the effects of burning biomass on health, especially on uncontrolled forest fires, [26] can assist in the definition of health policy for the theme and guide future research.

Was concluded that individuals exposed to biomass smoke experienced greater difficulty in daily activities, but that the effects on general and respiratory health were more difficult to interpret. [24]

IV. CONCLUSION

The agricultural residues burning, since it is an old practice and very widespread in countries with tropical climates to control pests and eliminate crop residues, there are public health issues that need to be better studied at this moment when expanding the production of biofuels.

In addition, future studies on the problem need to focus, in addition to diseases and symptoms of respiratory diseases, especially exacerbation of asthma cases, other effects and risks, such as neoplasms, cardiovascular diseases, impacts on the daily activities of affected people, re-hospitalization of elderly and biological risks.

The substitution of burning by the harvester will certainly benefit the health conditions of people living in the sugar cane areas. However, in order to guarantee the improvement of the health of the cutters, programs for their re-qualification and absorption must be developed and applied urgently.

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Reflective Groups: Viable and Necessary Environmental Penal Alternative

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Keywords *— **Environmental Law, Human Rights, Environmental Criminal Alternatives, Environmental Education, Reflective Groups.***

Abstract— *This article aims to present the evolution of environmental criminal law in the Brazilian legal system, consequently of the Criminal Alternatives, in face of the connection of Human Rights with Environmental Law and the new world perspectives of protection of the environment, through a thorough literature review. According to a philosophical context about environmental problems and the evolution of norms that protect nature, due to the ineffectiveness of environmental penal alternatives, it is possible to understand that a punitive measure of an educational and socially useful character is necessary, since everything that involves man and the environment must be seen according to a metaphysical-ontological construction, since they cannot be separated, due to the fact that it composes nature itself. Thus, it concludes that it is possible to include the Reflective Groups as a more viable criminal alternative to the educational context when committing environmental crimes, whether by individuals or legal entities. Although not included in specific legislation, it is certain that this is the most viable alternative because it provides the person in prison with the opportunity to promote environmental awareness and education.*

I. INTRODUCION

Environmental crimes have taken on alarming proportions, which make it necessary for the Judiciary to act effectively in the application of environmental protection rules - in particular the Environmental Crimes Law No. 9,605, of 02/12/1998 - according to the precepts of the Constitution of 1988, it is still not widespread in the legal environment, according to Antunes (2014).

To the violator of the ambient laws must be applied a punitive measure of an educational and socially useful nature, so as not to depart from society and especially from the family the perpetrator of the offense when the penalty imposed is served. The sanctions imposed on the individual who committed such crimes should be alternative measures that make the environmental offending aware that the environment is a universal and indispensable good to human beings, as authorized by the Environmental Crimes Act and Law No. 9,795 of 27/04/1999 - which establishes the National Environmental Education Policy - and defends Takada and Ruschel (2012).

The present study aims to present the evolution of Environmental Criminal Law in the Brazilian legal system, specifically of Environmental Criminal Alternatives through the possibility of including Reflective Groups as a more viable criminal alternative to the educational context when the practice of environmental crimes, by individuals or legal. This claim stems from the fact that, not infrequently, the measures adopted in these cases do not achieve the objective of educating and preventing in line with the new global perspectives for protecting the environment, which connect Human Rights and Environmental Law.

II. METHOD

The adopted approach was the quantitative method, with a "thorough review of the literature", which refers to environmental sciences and, more specifically, measures and criminal alternatives applied to crimes against the environment, in order to seek updated and diversified information, to know the universe that surrounds the problem researched, as directed by Almeida, Francesconi and Fernandes (2019, p. 56).

The bibliographic study aims to prove that, in the case of environmental crimes, the insertion of the person in compliance with an environmental criminal measure or alternative in Reflective Groups with environmental themes is the best way, regarding the educational character of the imposed penalty / alternative criminal to the offender.

The research was based on the practice of insertion in reflective groups of offenders of other criminal types, such as crimes related to Maria da Penha Law No. 11,340/2006, as regulated by the National Council of Justice, through Resolution No. 288/2019.

III. RESULT AND DISCUSSION

3.1 Constitutional Protection of the Environment

The environment has reached an important space in the Brazilian legal system. It is in the 1988 Constitution, in its art. 255, which in an unprecedented way the right to it is guaranteed in the following terms: “Everyone has the right to an ecologically balanced environment, a good for the common use of the people and essential to the healthy quality of life, imposing itself on public power and the community duty to defend it” (Brasil, Constituição da República Federativa, 1988).

It is worth emphasizing the principle brought by the Magna Carta, in its Art. 170, Item VI, when it provides for the Brazilian economic order by clarifying that its development must respect the environment: "The economic order, founded on the valorization of human work and free initiative, aims to assure everyone a dignified existence, according to the dictates of social justice, observed the following principles: VI - defense of the environment" (BRASIL, 1988).

According to Takada and Ruschel (2012), the 1988 Constitution guarantees the defense of the environment and, for this reason, all environmental crimes must be tried and penalties must be carried out in order to preserve and restore this property, when damaged by human action. Therefore, it is imperative to point out that only conviction for criminal practice does not solve the real problem that is hidden in the offending conduct of environmental crimes. As provided in the Brazilian Constitutional Charter, in its Article 225, § 1 VI, it is necessary “to promote environmental education at all levels of education and public awareness for the preservation of the environment”.

Supported by the Federal Constitution of 1988, the public authorities - when applying and monitoring the criminal measure or alternative - have a duty to ensure environmental education in cases of crimes against the environment and provide a reflection on the person whose conduct was harmful, so that it brings to its social environment the awareness that environmental balance is fundamental to the life of this and “future generations”.

In this sense, Diniz (2017, p. 157) states that environmental education “must be emancipatory, must give critical awareness to the individual, must be able to transform common sense in the sense of seeking to effect environmental preservation and maintain life on Earth”.

Thus, it can be concluded that providing the individual in compliance with a criminal alternative means to an environmental education is a way to free him from the thought of debiting environmental protection for an uncertain future, since he is given the opportunity to an environmental ethics based on preservationist values, which can be multiplied in the society where they live.

3.2 Environment and Human Rights

The environment has been seen as an essential part for achieving human rights, according to the lessons of Antunes (2014), since the right to life is closely linked to an ecologically balanced environment. Both are necessary to achieve a dignified life with a quality common to all.

According to this perspective, Fernandes (2014, p. 112) highlights the relationship between environment and human rights, stressing that “the position that defends that the degradation of the environment affects the quality of human life and the exercise of its potential”.

Based on these propositions, it is correct to say that when the Universal Declaration of Human Rights states that "every human being has the right to life", it is referring to quality life, which presupposes the right to an ecologically balanced environment. Since it is impossible for human beings to live outside nature, protecting it is the basis of Human Rights. The studies carried out by Takada and Ruschel (2012) are in line with this understanding when they affirm that Human Rights protect man and nature, so that both cannot be separated. Thus, when the State-Judge obliges man to protect nature, he does so for the benefit of man himself, which is why this protection must have an eminently educational character.

However, it is important to emphasize - based on Fernandes (2014, p. 112) - that only the Stockholm Declaration of 1972 expressly predicted in its first principle the "relationship between human rights and the environment". The author even defends that the protection of other human rights is only possible if there is protection of the environment, according to the Stockholm Declaration.

> Man has the fundamental right to freedom, equality and to enjoy adequate living conditions, in an environment of such quality that allows him to lead a dignified life, enjoy well-being and is a solemn bearer of the obligation to protect and improve the environment, for present and future generations (Fernandes, 2014, p. 113).

Fernandes (2014, p. 113) also presents the content of Principle 1 of the 1992 Rio Declaration: "Human beings are at the center of concerns about sustainable development. They have the right to a healthy and productive life, in harmony with nature ".

Although this principle appears in both the Stockholm Declaration (1972) and the Rio Declaration (1992), the author (FERNANDES, p. 114-116) states that none "defines a clear duty to protect the environment, as a right autonomous human ", that is, within the scope of the International Court the" protection of the environment, the construction of the right to a healthy environment, as a human right, is eminently jurisprudential "; therefore, there is a clear relationship "between the environment and different human rights".

Although this imbroglio of environmental protection is not an autonomous human right - still according to Fernandes (2014, p. 120) - all international courts have already admitted that "environmental degradation can mean violation of human rights, especially when the right to life , health, property, privacy and family life and self-determination are disrespected ". For this reason, human rights cannot be dissociated from environmental protection, since life is closely linked to the environment and it is impossible to separate from it.

Despite the international advances inherent in global environmental protection, national protection policies have been lacking. Many internal actions taken by the States and considered lawful are absurdly harmful to the environment, even with global consequences. Fernandes (2014, p. 120) highlights that "the very format of international environmental law is insufficient to meet the challenges presented by environmental degradation". Thus, environmental damage that is not "cross-border" is addressed only by the actions of the Human Rights Courts that work in specific cases of degradation of nature, when it has a direct relationship with disrespect for other human rights.

When, at the international level, there is no effective collection and inspection, States leave something to be desired. Although many indoctrinators understand that Brazil is an innovative country - because environmental protection is included in our country's Constitution - the ineffectiveness of Brazilian environmental laws must be noted. The State must turn to the broad protection of human rights, the environment cannot, under any circumstances, be excluded from these objectives, since it is not possible to provide human beings with the realization of economic, social and cultural rights, without taking into account consideration the environment where he lives, whether natural, artificial or labor.

Perhaps, the lack of effective protection of human rights linked to the environment by Brazil, has generated enormous discredit by society, precisely because of this inefficiency in protecting man as part of nature. Although Brazil is a signatory to the American Convention on Human Rights (Pact of San José of Costa Rica) - as promulgated by Decree No. 678, of 11/06/1992 - very little has been done. Although the expression contained in art. 4, 1 - which determines: "everyone has the right to have their life respected" - when there is no effective protection of nature, life will be disrespected, which is widely protected in this legal institute.

3.3 Brazilian Criminal Law

The penalty, in the early days, completely disrespected the principles brought by the current American Convention on Human Rights, since it was drastically severe. If we resort to studies aimed at understanding its functioning, it is clear that private revenge was in force as a reprimand for the practice of crimes. Such punishment could even extend to the whole family, which today is unacceptable in the Brazilian legal system.

> In the early days, punishment for a crime was restricted to private revenge. It watches over the

> law of the strongest, the one with the greatest power, who found no limits to the scope or form of execution of the reprimand that he understood to apply, including death, slavery, banishment, when it did not affect the entire family of the offender (Martins, 2008, p. 15).

The private revenge has come a long way in the history of mankind, according to the teaching of Martins (2008). Despite the Talion Law brought by the Hamurabi Code, in the 1980s a. C. to have softened the barbarities practiced in the name of a punishment, incomparable absurdities were also committed, including with a subsequent divine vengeance, when the punishments were given in the name of gods - in order to appease their wrath - which is totally rejected today.

After this phase in which the man punished the crime of blood with blood, it emerged the called public revenge, in which the State assumed the role of responsible for punishments. Therefore, there was no decrease in the cruelty of the penalties imposed, since the State should prove to be strong, owner of undisputed power, according to Martins (2008,p. 16-17).

Martins' lessons (2008, p. 19) also teach that dissatisfaction about the cruel nature of feathers took strength among scholars from the second half of the 17th century to the end of the 18th century, rising into opposing currents. Itis worth mentioning that of "Cesarre Bonesana, Marquis of Beccaria, who edited a work that consisted of the symbol of the liberal reaction to the *inhumane criminal panorama then in force",* whose principles served as the basis for the "Declaration of Man and Citizen". It is at the beginning of the 19th century, however – with the advent of the so-called scientific movement – that a new look was cast at the way the state applied the penalties. However, this new view was refuted, since it conferred on criminal law "a purely clinical function", not attributing the true value of the penalty, which is to establish "value judgments, whose content is ethical and relates to the fact that it violates the norm of conduct".

It was in the 18th century that the prison sentence was consolidated as a definitive sentence, when it replaced the other reprimands that were too cruel. Although there was already a concern at that time with the recovery of the person serving a sentence - and with their reintegration into society - the sentences did not have an awareness and reflexive character about the conduct practiced.

Especially if we talk about the Afonsinas, Manuelinas and Philippines Ordinances, we can see that the penalties have not undergone important changes, since cruel punishments continued to be practiced. However, as presented by Martins (2008, p. 20-21), from 1830 onwards the Law "privileged the imprisonment of the criminal as the most usual form of punishment, although sometimes it was accompanied by the obligation to exercise work in the enclosure. of prisons ". Even the Brazilian Law of December 16, 1839 - which "orders the Penal Code to be enforced" - contained cruel penalties; its Art. 38 admitted the death penalty by the gallows. It is worth mentioning the public humiliation to which the defendant was obliged to submit. As an example, Art. 40 determined that the "defendant in his ordinary dress, and imprisoned", should be "led through the most public streets to the gallows, accompanied by the Criminal Judge of the place, wherever he is, with his Registrar, and military force, if required" (CRIMINAL CODE OF THE EMPIRE OF BRAZIL, of December 6, 1830).

Duarte (1999) points out the evolution of Brazilian Criminal Law, remembering that on October 11, 1890, the Criminal Code of the Republic was sanctioned, which abolished the death penalty. However, it included prison sentences, banning, interdiction or suspension of political rights, as well as suspension and loss of public employment and a fine. In 1932, with Decree nº 22.213, of December 14 of the same year, several extravagant laws were consolidated, giving rise to the so-called Consolidation of the Criminal Laws of Piragibe, whose prevailing penalty was imprisonment. In December 1940 the Penal Code was created, which came into force only on January 1, 1942, coinciding with the validity of the Penal Procedure Code, whose main penalties were listed in its art. 28 and were confinement, detention and a fine. In the same vein, as the author explains, on October 21, 1969, the new Penal Code was consolidated through Decree-Law No. 1004, which presented important changes. Among them, Laws 6,016 / 1973 and 6,5778 / 1978 stand out.

This evolution of criminal legislation, both internally and internally, was due to the widespread understanding that the cruel nature of penalties was not the best solution as a reprimand. Finally, it was concluded that the prison sentence was also not the best alternative, as it is counterproductive in terms of the social reintegration of the convict. It turned out that in 1984 - through Law No. 7,209 - unprecedented modalities were adopted: deprivation of liberty, restrictive rights and a fine, as taught by Martins (2008, p. 26-27).

The ideals of banning the cruel character of sentences presented by the indoctrinators of the second half of the 17th century, took shape in Brazil with the promulgation of the Penal Code of 1984. This was the milestone from which the humanitarian and re socializing character of the penalty had its start. It is important to highlight the important innovation with regard to restrictive penalties of law, as seen in Art. 43, items I, II and III, in this order: 1)

Provision of services to the community, 2) Temporary interdiction of rights and 3) Limitation weekend, which can be combined with the fine prescribed in Art. 49, which will be addressed again later (Brasil, Lei 7.209, de 11 de julho de 1984, 1984).

From the promulgation of the referred Code, other laws were created, giving greater attention to the person of the condemned person, in order to recover him and reinsert him in society, abstracting from the penalties not only the repressive character, but educational, respecting the dignity of the individual , their fundamental rights prescribed in the Universal Declaration of Human Rights and consolidated in the Federal Constitution.

3.4 Brief history of Brazilian Environmental Criminal Law

Environmental penal protection in Brazil had strong influences from international norms, which led the national legislator to include in the constitutional text, precisely in Art. 225, a fundamental right to the "ecologically balanced environment" for the "present and future generations" and in § 3 of the same article the punishment for "conduct and activities considered harmful to the environment", which "will subject violators, individuals or legal entities, to criminal and administrative sanctions, regardless of the obligation to repair the damage caused". (Brazil. *Constitution of the Federative Republic of Brazil, October 5, 1988)*

The Costa's lessons (2013) make it clear that the first penal protection of the environment in Brazil occurred with Law No. 3,311, of 10/15/1886 that criminalized the practice of fire, which was later inserted in the United States Penal Code of Brazil in the year 1890. Therefore, a great advance came with the first Brazilian Forest Code, approved by Decree nº 23.793 of January 23, 1934, which "divided the infractions into crimes and misdemeanors". This Code is considered a milestone in Brazilian legislation, since it served as a basis for the production of other legislative acts such as Decree-Law nº 5.894 of 10/20/1943, which approved the Hunting Code that contained feathers pecuniary benefits, which could be converted into prison.

In 1965, Law No. 4,771, of September 15, introduced the new Forest Code which, in addition to explaining various criminal practices against the environment, contained in its Article 26 a list of criminal offenses. Also the Fauna Protection Law, as well as the Fishing Code, both of 1967. But, according to the magisterium of the same author, it was the fauna protection law nº 7.653, of 02/12/1988 that caused more controversy at the time , as a result of the non-trustworthiness of the crimes provided for therein.

After the tangle of laws, Law No. 9,605 was issued on 12/02/1988, called the Environmental Crimes Law, organizing the criminal protection of the environment in a single document, which "brought considerable innovations to its core", in regarding the criminal liability of collective entities (Costa, 2013, p. 58)

Despite the fervent debate raised around the Environmental Crimes Law, it will not be discussed at this time. However, it is imperative to highlight the great novelty brought about by this, through Article 8, which deals with restrictive penalties of law, also known for good doctrine as penalties or alternative measures.

Finally, it is imperative to highlight that, given the repressive nature of the Environmental Crimes Law, which seeks to protect environmental quality, the mere conduct capable of causing damage, it is already possible to hold the agent, individual or legal entity liable. This protection of environmental quality must be concerned with keeping the environment healthy and sustainable, seeking alternatives in order to guarantee an ecologically balanced system for current and future generations, as Takada and Ruschel (2012) very well point out.

3.5 Environmental Criminal Alternatives, guaranteeing human rights

The criminal alternatives must have a socio-educational bias, since only punishing the perpetrator of environmental crimes will not achieve a desired result, which is the protection and recovery of the damaged environment, as advocated by Salibá (2009). Thus, this socio-educational character is in line with what Law No. 9,795 of 27/04/1999 intends, in its art. 1st, which is to promote the construction of "social values, knowledge, skills, attitudes, behaviors and competences aimed at the conservation of the environment", as well as the implementation of the ideals that sustainable development is possible.

Furthermore, even in the same article of the referred law, it is clear that all processes aimed at educating the individual and the community in the construction of a culture aimed at environmental preservation are understood as "environmental education". Thus, environmental criminal alternatives occupy a prominent place within the criminal process, as they are supported by Law No. 9,795 of 4/27/1999.

Nevertheless, the applicability of criminal alternatives, especially environmental ones, brings great advantages to the Judiciary, to the Institutions and to the beneficiary, it is so certain that the National Council of Justice edited Resolution nº 288, on 06/25/2019, which defines the institutional policy of the Judiciary to promote

the application of criminal alternatives, with a restorative focus, replacing deprivation of liberty.

This recognition brought by the CNJ, despite not being expressed in the referred resolution, is due to the fact that the criminal alternatives unburden, in the Judiciary, the traditional ways that are already exhausted, becoming a more effective and fair punitive means, besides to end impunity for crimes considered to be of low or medium offensive potential, not to mention the low cost to public coffers, the execution of these, as well as the reduction of the prison population, a major problem faced by the public authorities. The low cost mentioned above is due to the partnerships that the Judiciary enters into with institutions that monitor the beneficiaries without any burden for the former.

The person in compliance is also benefited, in addition to numerous other advantages, by the fact that he / she remains in the social and family environment, he / she is led to reflect on the crime committed, educating himself / herself about the values and conduct of good living in society. In the case of environmental crimes, criminal alternatives are given greater prominence, since they also provide a change in the ethical and moral standards related to environmental preservation, an opportunity in which the compliant has the opportunity to reflect on the value that should be given to nature. , which is a good to be preserved for this and future generations.

In cases involving environmental crimes, fines are often imposed on the offender without any follow-up in order to develop a reflection, with a consequent change in conduct. In addition, the alternatives brought by Law No. 9,605, of 02/12/1998, art. 8, in no way contributes to an effective environmental education, unless we see: “Art. 8th The restrictive penalties of right are: I - provision of services to the community; II - temporary interdiction of rights; III - partial or total suspension of activities; IV - cash benefit; V - home collection ”.

Therefore, it is necessary that the applicator of the environmental standard promotes the true educational character now implicit in it. Any environmental criminal alternative, regardless of the rules of its concession, must enable the person in compliance with a reflection and change in the conduct practiced, as well as providing opportunities for a transformation, with the consequent multiplication of environmental education and the dissemination of acquired knowledge.

3.6 Reflective Groups, an alternative for cases of crimes against the environment

The reflective character of environmental criminal alternatives, as advocated elsewhere, could be the alternative for the enforcer of the law, since it will be providing the punisher with true access to justice, to the dignity of the human person, as defended by the Declaration of Human Rights and Citizen. In this sense, from the perspective of ontological interpretation, aiming to achieve the true meaning of the environmental penal norm, with regard to criminal alternatives, the creation of reflective groups in cases of crimes against the environment is urgent.

It is true that there is no express authorization in the criminal environmental legislation for the creation of reflective groups as authorized by Resolution No. 288, of 06/25/2019 to other criminal types. However, nothing prevents its applicability in cases of environmental crimes. In fact, Article 4 of the aforementioned resolution states that

> The organs of the Judiciary Branch must establish means of cooperation with the Executive Branch to structure services for monitoring criminal alternatives, in order to constitute flows and methodologies for the application and execution of measures, contribute to their effectiveness and enable the social inclusion of law enforcement officers. , based on the specificities of each case (Brasil C. , Resolução nº 288, 2019).

It´s understood that it is possible to create reflective groups, as provided by Resolution No. 288, of 06/25/2019, for cases of crimes against nature, not only when applying environmental criminal alternatives, but in any other type of criminal conviction environmental. Furthermore, it corroborates this understanding with the instructions brought by the Management Manual for Alternatives Penas (2020), also authored by CNJ, regarding the crimes laid down in the Maria da Penha Law, nº 11.340 / 2006, where the creation of reflective groups is made more flexible in cases of domestic crimes.

Thus, nothing prevents the creation of reflective groups when executing the sentence, in cases of crimes against the environment, since this is the best alternative, since it aims to educate the offender in the environment where he lives, providing him with the opportunity not to repeat the environmental offense, but to contribute to the protection of the environment where he lives and the understanding that his actions can generate a series of consequences for current and future generations. In addition, it will be possible for the doer to have the opportunity of non-recurrence, as well as being a multiplier of environmental education.

It is worth mentioning what is contained in the Arts. 5 to 7 of the aforementioned Resolution No. 288, dated 06/25/2019, which defends direct communication between the Judiciary and the Executive, which is primarily

responsible for the enforcement of the penalties applied, in the preparation of management plans aimed at monitoring the criminal alternatives, as well as the promotion of these, aiming to attend to the applicability of the rules brought by the international human rights treaties, to which Brazil is a signatory. It also makes it clear that this whole management process in the monitoring of criminal alternatives must have participation in addition to the organs of the Executive Branch and the justice system, of organized civil society.

Thus, in view of what was established in said resolution, in order to create the reflective groups as proposed, the body responsible for criminal execution should promote broad partnerships, especially with local educational institutions, through a specific project for this purpose. In view of the educational character of the reflective groups, as well as the technical / pedagogical capacity of these Educational Institutions, they should be responsible for providing courses and lectures to people in compliance with penalties or alternative environmental measures.

In this tuning fork, it is important to emphasize that, within the reflective groups, the penalties and alternative measures should be directed to the awareness of the offender, to the development of resilience, as instruments of social restoration, and mainly of environmental education, that is, an opportunity must be given the person serving the sentence or imposed measure, to direct his conduct to a model in harmony with nature, as well as the awakening of new ethical values about environmental preservation, including non-recurrence and the multiplication of continuous and permanent educational practices, which are few and lack multipliers. In addition, the person's participation in serving an alternative or sentence in the reflective groups may be a condition applied by the Magistrate or proposed by the Public Prosecutor's Office, as a way of serving the sentence and / or imposed measure, regardless of being the repeat offender.

Finally, it remains to be clarified how the participation of legal entities that practice environmental crimes in reflective groups can take place. Well, Law No. 9,605, of 02/12/1998, in its art. 21, Item III, establishes, among the penalties applied to legal entities, the “provision of services to the community”. Already in its art. 23 and Item I provides that “the provision of services to the community by the legal entity will consist of: I - funding of environmental programs and projects”. Thus, when there is no disregard for the personality, the participation of the legal entity in the reflective groups is fully applicable through the cost of the project intended to install it.

IV. CONCLUSION

The application of penalties or environmental alternatives with only a repressive character, in addition to not achieving the repair or compensation of the damage that is often impossible, does not achieve the primary objective of educating for a change of posture, for a new preservationist and conservative environmental ethics. What is certain is that the adoption of simple reprimand in cases of environmental crimes disregards the possibility that alternatives have to democratize the Judiciary and guarantee genuine access to Criminal Justice, since it disregards the awareness and educational bias. This justifies the pressing need to create reflective groups to assist people in the execution of sentences and / or alternative environmental measures.

In order for the Reflective Groups to achieve the desired results, it is important to create an integrated circuit with partnerships involving Executive Branch Bodies focused on environmental protection, the Judiciary Branch and organized civil society, as well as the participation of Higher Education Institutions that deal with environmental issues, with education professionals. In this sense, the principles of institutional and professional interdisciplinarity must be taken into account, so that the knowledge used in a unison way reach the result that is environmental education.

The help of sciences other than law - such as psychology and pedagogy - is of fundamental importance in order to achieve the objective that criminal alternatives can provide (measures of a preservative socio-educational nature). The valuable contribution of environmental sciences, such as ecological sciences, soil sciences, forest engineering, etc. cannot be dismissed. They will be able to assist in the creation of projects aimed at preservation, repair and environmental education within the criminal process.

The creation of reflective groups as an alternative measure to cases of environmental crimes - even if not included in specific legislation - is an important opportunity to promote environmental awareness and education, as it prioritizes transforming criminal measures and alternatives into opportunities for transforming values, changing posture and conduct, as well as a new vision aimed at preserving and recovering the environment and minimizing the damage caused to nature.

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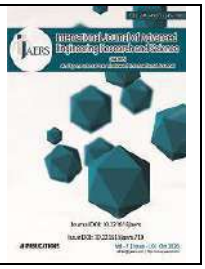

Robot Navigation through the Deep Q-Learning Algorithm

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***Keywords*— Deep Q-learning, robot, training, navigation**

***Abstract*—** *The paper aims to present the results of an assessment of adherence to the Deep Q-learning algorithm, applied to a vehicular navigation robot. The robot's job was to transport parts through an environment, for this purpose, a decision system was built based on the Deep Q-learning algorithm, with the aid of an artificial neural network that received data from the sensors as input and allowed autonomous navigation in an environment. For the experiments, the mobile robot-maintained communication via the network with other robotic components present in the environment through the MQTT protocol.*

I. INTRODUCTION

Technological advances have driven a dramatic increase in industrial productivity since the beginning of industrialization, not only to meet high demands but to guarantee the satisfaction and comfort of its consumers [1]. The great technological leaps in this sector characterize marked changes that today are called Industrial revolutions.

With the fourth industrial revolution, also called industry 4.0, smart factories are becoming a reality in many countries. They use the latest discoveries of informatics to make their factories context-sensitive, so they can deal with production turbulence in time real, using decentralized information and communication structures, for the optimized management of processes [2].

For factories to make their processes more intelligent and dynamic, the most recent and significant advances in technology that form the basis of industry 4.0 must be incorporated, among them the use of autonomous mobile robots that perform activities within production. In this scenario, according to authors Xia and Kamel [3], mobile robots must have the ability to autonomously navigate on the shop floor, needing to find a collision-free path from a starting point to a target point.

So, to make these robots independent by changing the manufacturing processes, an algorithm was applied that uses positive and negative rewards in continuous learning that reinforces the robot's experience of the submitted environment. Then, with an increase in positive rewards, the agent becomes able to locate itself through the situation in a completely autonomous way.

The algorithm that was applied is called Deep Q-learning, as it is a form of deep machine learning and relies on the use of an artificial neural network that processes the input data of the environment through sensors making it more intelligent every time. According to Faceli [4], the artificial neural network can be compared with the form of

information processing carried out in the human brain that acquires experience with each new interaction with the environment through the senses found in the human body.

II. BACKGROUND

In this work, a bibliographic review was carried out to find works related to the use of reinforcement machine learning with application in mobile robots, which is the main theme of this paper. In this case, we compile 1,108 works that were collected that were related to the keywords of this article. However, after a selection that sought a more direct relationship, 15 papers were selected. Then of these, 5 researches were identified with significant results in the implementation of the method in real robots.

The authors Sasaki and colleagues [5] presented the Deep Q-network technique that derives from Deep Q-learning. The authors applied the technique to a robot that navigated in an environment using visual markings. These markings were processed by a camera allowing an intelligent agent to learn the route avoiding collision with walls. This training applied by the authors in the mobile robot, allowed to reinforce the behavior every time he got it right.

However, in this technique, the robot followed only the instructions marked on the central line, not being able to make any decision if an obstacle blocked the visual information. Another limitation of the technique in this work is the need for a robust processor to interpret the input data, as they result from the execution of a secondary convolutional neural network for image processing.

The paper of Ruan and colleagues [6] was applied a technique called Dueling Double DQN, also derived from Deep Q-learning, which uses images in depth, extracting RGB information in a Yesulated environment. However, in this experiment, the learning was based only on the processing of single visual information obtained from the images in depth. Moreover, it was carried out exclusively in a Yesulated environment, not taking into account other factors that could hinder navigation and could be detected by secondary sensors.

Saravanan and colleagues [7], it was proposed to build a mobile robot that navigated in an environment delimited by a matrix, after receiving a command via the Internet of Things. Navigation followed a system based on the classic Q-learning algorithm to reach an arbitrary object, recognizing it through a CNN (Neural Convolutional Network), and capturing it to receive the reward. Despite this work being successful in robot navigation, the environment was previously demarcated using coordinates mirrored to a fixed-size matrix, so this experiment makes it impossible for the robot to navigate in an unknown and previously unmarked environment. However, the work could contribute to the way of sending commands to the robot, using protocols for the internet of things.

According to Han and colleagues [8], the authors observed the use of a mobile navigation robot that used laser sensors autonomously using the Deep Q-learning algorithm. The robot was able to navigate in random 3D Yesulation environments. But the experiment proved to be limited due to the use of a single type of sensor. In addition, the experiment was not tested in a real environment, which could lead to the need for more input parameters for learning.

Finally, in the work of Song and colleagues [9], a Deep Q-learning technique was identified based on a memristive neural network. A model was developed to define rewards to be applied to the agent during the execution of the actions, storing the good policies on a memristive chip that has great non-volatile memory potential. However, for the application of this technique, it was necessary a specific robot that had a memristive chip for storing policies, thus making it impossible to replicate the method in common robots.

The works presented previously have very efficient results for the proposed scenarios. Still, they transform the robots into an isolated cell that does not communicate with other components present in the environment. In this work, besides the autonomous navigation mediated by Deep Q-learning with different input data, the agent was able to communicate with another robot. This robotic claw positions the parts in it after being removed from the conveyor, thus Yesulating a production environment of a factory, and despite not using any computer vision technique, the data collected by the sensors were sufficient to guide the agent in the proposed scenarios.

The comparison among the papers can be seen in TABLE I, the points taken into consideration were, autonomous navigation, use of deep reinforcement learning, use of CV (Computational Vision) techniques, experiments in a real environment, the proposed approach, and the use of communication between robots.

III. MATERIALS AND METHODS

A. Materials used

To build the prototypes used in the experiment, the educational robotics kit Lego Mindstorms in the NXT and EV3 versions were used, which made it possible to build a navigation robot represented by the car 1, a manipulator (robotic arm) 2 and a treadmill 3, according to Fig.1.

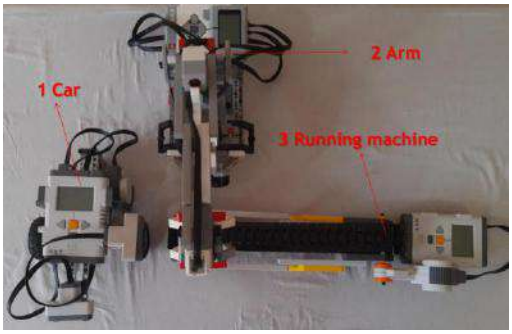

Fig. 1. Robotic prototypes used in the experiments

Table.1: Comparison between the papers and this works

Paper	Navigation Autonomous	DQN	CV	Real environment	Approach	Agents Communication
Sasaki (2017)	Yes	Yes	Yes	Yes	Navigation through visual markings identified by a camera and processed by a secondary CNN.	No
Ruan (2019)	Yes	Yes	Yes	No	Navigation through in-depth images and analysis of RGB information in a Simulated environment.	No
Saravanan (2019)	Yes	No	Yes	Yes	Navigation by mirrored coordinates in a fixed-size matrix processed by classical Q-learning.	No
Han (2018)	Yes	Yes	No	No	Autonomous navigation in 3D simulation based on laser sensors as an entry to Deep Q-learning.	No
Song (2018)	Yes	Yes	No	Yes	Learning based on a memristive neural network, with a model for defining rewards and storing good policies on a memristive chip.	No
This paper	Yes	Yes	No	Yes	Learning using Deep Q-learning for autonomous navigation based on ultrasonic and RGB sensors as input to neural network, being viable for applications in common robots. Navigation is only started after communication between agents.	Yes

B. System Architecture

The system architecture is composed by the blocks that represent the integral parts of the intelligent system, indicating its components, forms of communication, and behaviors, as shown in Fig. 2.

The mobile robot is responsible for transporting the parts that leave a starting point represented by the production line and take it to a target point designated by the dispatch of the factory. So that it could navigate to its target point, the Deep Q-learning algorithm was used, which makes the agent more efficient according to his experience on the environment, enabling autonomous navigation, choosing a collision-free path.

The communication between the two robots took place through a local wireless network that allows the message to be forwarded through the MQTT (Message Queue Telemetry Transport) protocol that is specific for M2M (machine to machine) communication and for the internet of things. The message reaches an MQTT broker that plays the role of FOG, in analogy to a local Cloud present on the intranet, being accessed regularly by the robots. As the LEGO NXT robot only allows connections via Bluetooth networks, a data exchange feature was used between the robot and the server via the Bluetooth socket. This procedure allows a communication bridge between the slave robot with the broker and the master robot that makes direct access via the Wi-Fi network.

When establishing a connection with a broker, robots can perform actions to publish to write a message and subscribe to read the message received.

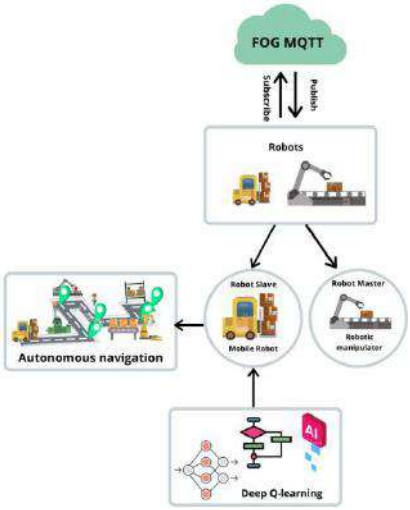

Fig. 2 Experiment architecture

C. Deep Q-learning algorithm

The formal definition of reinforcement learning is given by the Bellman equation, where:

- ***V(s)*** : Present value of a state ***s***;
- ***R (s,a)***: Reward related to action a in state ***s***;
- ***V(s')***: Future value in future state ***s'***;
- ***a:*** Action taken by the agent;
- ***s:*** Current agent state
- ***γ:*** Discount factor.

The discount factor γ notifies the agent when he is close to his destination, according to (1) [10].

$$V(s) = max_a\big(R(s,a) + \gamma V(s')\big) \qquad (1)$$

For the Bellman equation to be applied to Q-learning, the formula undergoes some modifications so that it can calculate the quality of the actions for each agent state in current time (t) and in an earlier time (t-1), according to (2).

From the Q-learning equation (2), the construction of the Deep Q-learning algorithm was started, which makes Q values available according to the agent's state, so that actions can be taken.

To calculate the Q values in the state of the agent, a dense artificial neural network was used with four input. The values were captured by sensors, a hidden layer with 30 artificial neurons that perform the Q-learning calculation, as output from the network four values are presented for Q, as shown in the network diagram in Fig. 3.

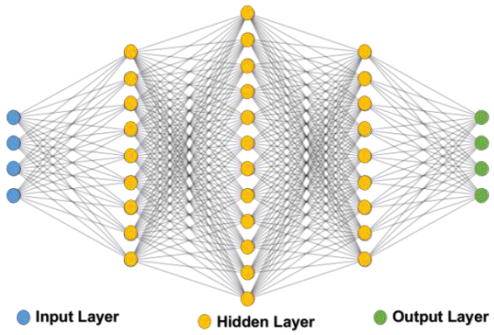

Fig. 3. Neural network used in the learning algorithm.

For the final action of the agent to be taken, a mathematical equation called SoftMax, see in equation (3), was used, which calculated which response was most likely to be chosen based on the Q weights processed by the network. After making a decision, when the agent made a good decision, he received a positive reward, when the opposite occurred, he received a negative reward.

$$SoftMax = \frac{e_Q}{\sum e_Q} \qquad (3)$$

Deep Q-learning becomes more and more efficient with each interaction. To guarantee this statement, a technique called replay experience was used, acting on the agent to remember the last decisions made in the state he is in. Hence, he sends these values again for the entrance of the network, being able to maintain the same decision if he was positively rewarded in the last interaction or choose a different action if he was punished.

```
Deep Q-Learning Algorithm (DQN)

initialize replay memory D
initialize action-value function Q with random weights
observe initial state s

repeat
    select an action a
        with probability & select a random action
        otherwise select a = SoftMaxa Q(s, a)
    carry out action a
    observe reward r and new state s'
    store experience <s, a, r, s'> in replay memory D

    sample random transitions <ss, aa, rr, ss'> from replay memory D
    calculate target for  each minibatch transition
        if ss' is terminal state then tt = rr
        otherwise tt = rr + ymax Q(ss', aa')
    train the Q network using (tt - Q(ss, aa)) as loss

    S = S'

until terminated
```

Fig.4. Deep Q-learning algorithm

Source: Adapted from AILEPHANT

The algorithm can be implemented in any programming language and applied to a virtual or real agent. For this work, the algorithm was written in the python programming language, as it allowed greater flexibility in

the code syntax and the access of the robot resources. The pseudo-code in Fig. 4 shows the basic writing of the Deep Q-learning algorithm used in the experiment.

IV. EXPERIMENTS AND RESULTS

For this work, two scenarios were developed, one free of obstacles and the other with obstacles.

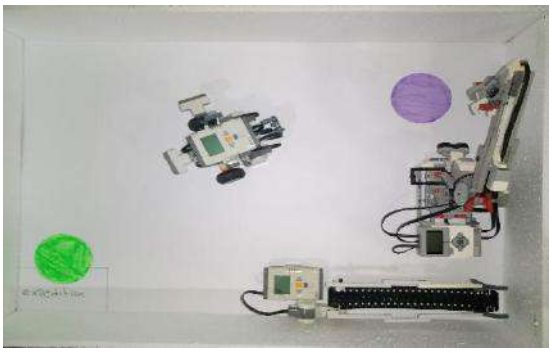

Fig. 5. Navigation Scenario Template one

In this scenario, the robot could navigate freely through the environment only having to complete its objective in the shortest time. Without approaching the walls of the scenario, the rewards received +0.01 if the agent reached his goal, if he touched the wall his sensors a bad action, receiving a penalty of approximately -0.01 and increased if the agent remained in error. The rewards were recalculated for each new state and action pair represented by R (s, a).

Learning success was measured using the graph of the score of rewards received by the agent, given by the average rewards, and the score values were generated for every 1000 rewards generated (4).

$$Score = \frac{\Sigma_i^n (R(s,a))}{n} \quad (4)$$

The rewards started with negative values in the first interactions due to the punishments received, as the agent tried to reach his goal by sailing very close to the walls and started to collide several times. However, as the number of interactions increased, the agent began to navigate a shorter and collision-free path, thus receiving positive rewards. At the end of the test, the agent found a diagonal way that took him more quickly to his target with a hit rate of 91.2% obtained by the percentage of the score of good deeds concerning the total number of interactions and neglecting bad deeds, with this, the learning success was verified, which can be seen by the approximation of the linearity of the positive rewards of the agent marked by the green line, as shown in the graph of Fig. 6.

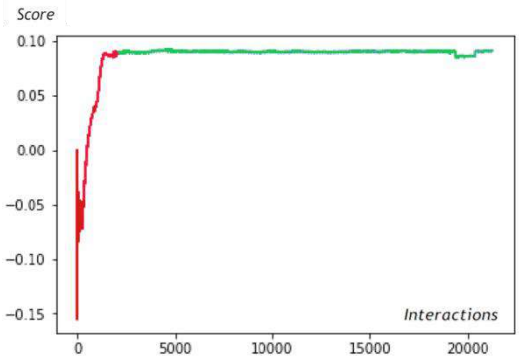

Fig. 6. Graph of agent rewards in scenario one

The second experiment was carried out in a scenario with a higher degree of difficulty, where the agent started from the starting point marked by a purple circle and should reach the target point with the green mark. However, in this scenario the agent could only start navigation from the command sent by the robotic manipulator, indicating that the parts could already be transported. When starting the navigation, the robot was able to use two navigation options, followed a mark on the ground using its RGB sensor that successively shines red, green and blue light on the way, the reflected light is collected by a light sensor sensitive to the entire length wave, differentiating the dark trail from the rest of the environment, indicating the path to be taken, however, losing track, managed to verify through its ultrasonic sensors possible obstacles present in the route, these sensors were able to detect an object and measure its proximity in distances of less than 10 centimeters, avoiding the obstacle and maintaining navigation until finding the mark again or reaching the target point. The model for this scenario can be seen in Fig.7.

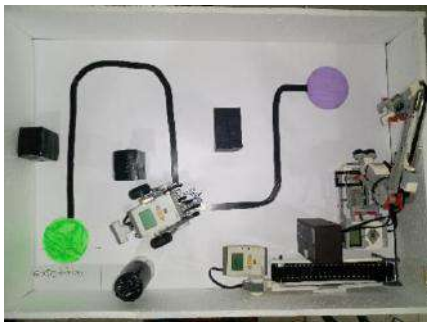

Fig. 7. Navigation Scenario 2 Template

To measure the quality of learning in the second scenario, policies similar to those used in the first scenario were used but adding reward for the agent's proximity to his goal and additional punishments if the agent collided with other components of the environment or lost his track.

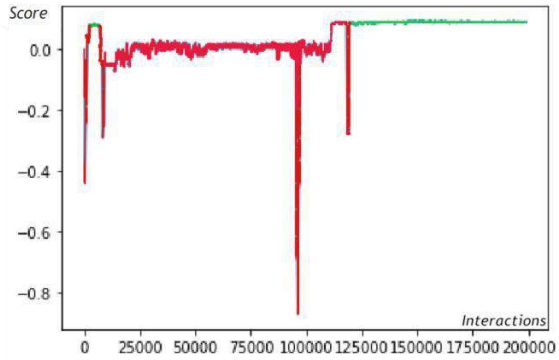

Fig. 8. Graph of agent rewards in scenario 2

In Fig. 8, the agent's rewards graph for the second scenario presented a large number of variations, mixing the learning between mistakes and successes in the initial interactions due to the number of punishments received when colliding with other elements of the environment, losing their track or crash into the wall. However, after approximately 125,000 interactions, the agent started to navigate in an expected way, following the marked and collision-free path, receiving the positive reward and maintaining its linearity of positive actions marked in green, indicating the good adherence of the algorithm to the robot. Navigation as an 87.5% hit rate, very good considering the complexity of the test environment, in addition to other factors that influenced learning in the real scenario, for example, the response time of sensors when obstacles were already in a very short distance from the agent.

V. CONCLUSION

Therefore, through experiments, we arrived at an intelligence model that can be applied as part of the automated production process in factories, as it was possible to transport parts from one place to another using an autonomous mobile robot. It was also verified the efficiency of the communication system between the robots through Fog MQTT, as it presented a practically instantaneous time in sending and receiving messages. Thus, it is expected that this work will contribute to the incorporation of Deep Q-learning in robots. Collaborative activities that carry out activities within real factories, strengthening the concepts of industry 4.0.

As future work, improvements will be made to the algorithm to perform more complex tests with dynamic environments. It is also intended to apply Deep Q-learning to a real industrial robot to prove the feasibility of its use in a real factory, as the research was limited to the use of educational robots.

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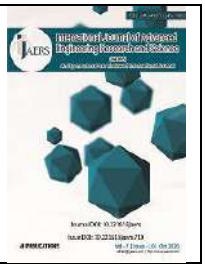

A Study on Grid-Size and Time-Step Calculation using the Taylor Series in Time Series Water Wave Modeling

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Keywords— ***Sinusoidal function, Taylor series***

Abstract— *This paper presents the time-step and grid-size calculation methods for solving time series wave differential equations using the Finite Difference Method.*

The methods are formulated using the Taylor series, assuming that at a very small time-step and grid-size, the number of terms in the Taylor series starting with 2nd order with the highest order is much smaller than the order 1.

I. INTRODUCTION

The formulation of basic hydrodynamic equations, both the continuity equation and the momentum equation, is developed using the Taylor series to one derivative (Dean (1991)). It is argued that in which the time-step$\delta t$and grid size $(\delta x, \delta z)$ is very small, calculation on the Taylor series can be done up to one order$O(\delta^1)$.

The solution of the governing equations numerically is by using the discrete method, both the Finite Difference Method (FDM) and the Finite Element Method (FEM) by dividing the domains into grid-points. The grid-point formation requires a small grid-size under the formulation conditions, assuming the time-step$\delta t$and grid size $(\delta x, \delta z)$are very small.

In FDM, the equations of FDM are formulated by truncating the Taylor series, using only the first or second-order (Smith, G.D (1985)). Therefore, the application of the equations isrequired to use a very small time-step and grid-size where the Taylor series can be used in order 1 and order 2 only.

Thus, it takes a small time-step and grid-size following the formulation of governing equations as well as in the formulation of the FDM equation in which FDM is used in the solving governing-equations.

The accuracy of the Taylor series is determined not only by the length of the terms used but also by the grid-size used, where the smaller the grid size, the better the accuracy. At very small time-steps and grid-sizes, the number of terms of order 2 and greater is much smaller than terms of order 1. This, this condition is the basis for the development of the grid-size calculation method in this study.

The grid-size study is carried out using the sinusoidal function, where the water wave equationsare the result of an analytical solution to the Laplace's equation by using the variable separation method is a sinusoidal function in time and space.

II. THE SETTING OF TIME STEPδtAND GRID SIZE δx

The water wave equations are obtained analytically, by solving Laplace's equation with the variable separation method in the form of multiplication between the sinusoidal function and the hyperbolic function (Dean (1991)). The horizontal axis-*x* and time-*t* form a sinusoidal function while the vertical axis-*z* form a

hyperbolic function. By substituting the water wave equations into the Taylor series, the equations for the time-step p $\delta t$and grid-size δxandδz were obtained.

The formulation is carried out by two methods. The first method isa separate method where the time-step$\delta t$is calculated first and then inputδt, grid-size $\delta x$and$\delta z$are calculated. The second method is to substitute the relation between$\delta x, \delta z$, and the time step δtin the Taylor series to obtain the equation forδt. Then, δxandδzarecalculated using the relation between$\delta x$and$\delta z$with the obtained δt.

2.1. Separate Calculation

a. δt Calculation

The Taylor series form (Thomas, George B., Finney, Ross L.(1996)) for a function of time-t is,

$$f(t+\delta t) = f(t) + \delta t\frac{df}{dt} + \frac{\delta t^2}{2}\frac{d^2f}{dt^2} + \frac{\delta t^3}{6}\frac{d^3f}{dt^3} + \frac{\delta t^4}{24}\frac{d^4f}{dt^4}.$$

.... (1)

To enable Taylor series can be used up to one derivative only, then

$$\left|\frac{\frac{\delta t^2}{2}\frac{d^2f}{dt^2} + \frac{\delta t^3}{6}\frac{d^3f}{dt^3} + \frac{\delta t^4}{24}\frac{d^4f}{dt^4}}{\delta t\frac{df}{dt}}\right| \leq \varepsilon$$

δtin numerator and denominator cancel each other out,

$$\left|\frac{\frac{\delta t d^2f}{2\,dt^2} + \frac{\delta t^2 d^3f}{6\,dt^3} + \frac{\delta t^3 d^4f}{24\,dt^4}}{\frac{df}{dt}}\right| \leq \varepsilon \text{..... (2)}$$

Used

$f(t) = A\cos\sigma t$.... (3)

$\sigma = \frac{2\pi}{T}$:Angular frequency, T: period

Substitution (3) to (2) where the amplitude A on the numerator and denominator cancel each other out is done at the characteristic point and is done at the characteristic point, $\cos\sigma t = \sin\sigma t$, in which the terms $\cos\sigma t$and$\sin\sigma t$in the numerator and denominator also cancel each other out.

$$\left|-\frac{\delta t}{2}\sigma - \frac{\delta t^2}{6}\sigma^2 + \frac{\delta t^3}{24}\sigma^3\right| \leq \varepsilon$$

Since the term in the absolute sign | | is negative, then the positive value of the equation becomes,

$$\frac{\delta t}{2}\sigma + \frac{\delta t^2}{6}\sigma^2 - \frac{\delta t^3}{24}\sigma^3 \leq \varepsilon$$

By taking the equal sign,

$$\frac{\delta t}{2}\sigma + \frac{\delta t^2}{6}\sigma^2 - \frac{\delta t^3}{24}\sigma^3 = \varepsilon \text{..... (4)}$$

Equation (4) can be solved by the Newton-Raphson method (Allen, Myron B.; Isaacson, Eli L.(1998)). The results of the calculation of δtusing equation (4), for several wave periods, are presented in Table (2.1), with an accuracy level of$\varepsilon = 0.001$. Meanwhile, Table (2.2) presents the calculation result of δt for the wave period is 8 sec. with several levels of accuracy.

*Table.2.1: The value of δt for several$T$values with*ε 0.001

T (sec.)	δt (sec.)	$\frac{\delta t}{T}$
6	0,00191	0,00032
7	0,00223	0,00032
8	0,00254	0,00032
9	0,00286	0,00032
10	0,00318	0,00032
11	0,0035	0,00032
12	0,00382	0,00032
13	0,00414	0,00032
14	0,00445	0,00032
15	0,00477	0,00032

*Table.2.2: The value of δtat several values of*ε, $T = 8$ *sec.*

ε	δt (sec.)	$\frac{\delta t}{T}$
0,1	0,23899	0,02987
0,01	0,0253	0,00316
0,001	0,00254	0,00032
0,0001	0,00025	0,00003

Table (2.1) shows that $\frac{\delta t}{T}$ is constant for all periods of T for a given level of accuracyε. Meanwhile, Table (2.2) shows the change in δt along with the change in the level of accuracyε.

b. δx Calculation

The calculation of δx on the function $f(x,t)$is done using δt as the input obtained by the calculation method as discussed in the previous section. In this section, the Taylor Series is only used up to the 3rd differential or$O(\delta^3)$, considering that theδtvalue obtained is quite accurate, and to facilitate writing. Taylor's series up to the third derivative for a function$f(x,t)$is,

$$f(x+\delta x, t+\delta t) = f(x,t) + s_1 + s_2 + s_3 \text{..... (5)}$$

Where,

$$s_1 = \delta t\frac{\partial f}{\partial t} + \delta x\frac{\partial f}{\partial x} \text{..... (6)}$$

$$s_2 = \frac{\delta t^2}{2}\frac{\partial^2 f}{\partial t^2} + \delta t\delta x\frac{\partial^2 f}{\partial t\partial x} + \frac{\delta x^2}{2}\frac{\partial^2 f}{\partial x^2} \text{..... (7)}$$

$$s_3 = \frac{\delta t^3}{6}\frac{\partial^3 f}{\partial t^3} + \frac{\delta t^2}{2}\delta x\frac{\partial^3 f}{\partial t^2\partial x}$$

$$+\delta t\frac{\delta x^2}{2}\frac{\partial^3 f}{\partial t\partial x^2}+\frac{\delta x^3}{6}\frac{\partial^3 f}{\partial x^3}$$

... (8)

To enable the Taylor series used with only one derivative, then

$\left|\frac{s_2+s_3}{s_1}\right| \leq \varepsilon$..... (9)

The function below is used,

$f(x,t) = A\cos kx\ \cos\sigma t$..... (10)

By using the relation (6) and (7),

$$\frac{s_2}{s_1}=\frac{\frac{\delta t^2}{2}\frac{\partial^2 f}{\partial t^2}+\delta t\delta x\frac{\partial^2 f}{\partial t\partial x}+\frac{\delta x^2}{2}\frac{\partial^2 f}{\partial x^2}}{\delta t\frac{\partial f}{\partial t}+\delta x\frac{\partial f}{\partial x}}$$

Substitute $f(x,t)$ done at a characteristic point where $sin\sigma t = cos\sigma t = sinkx = coskx$,

$\frac{s_2}{s_1}=\frac{\frac{\delta t^2}{2}\sigma^2-\delta t\delta x\sigma k+\frac{\delta x^2}{2}k^2}{\delta t\sigma+\delta xk}$..... (11)

In the same way, it was obtained

$\frac{s_3}{s_1}=\frac{-\frac{\delta t^3}{6}\sigma^3-\frac{\delta t^2}{2}\delta x\sigma^2 k-\delta t\frac{\delta x^2}{2}\sigma k^2-\frac{\delta x^3}{6}k^3}{\delta t\sigma+\delta xk}$..... (12)

Intuitively, it can be estimated that (11) is positive, while (12) is negative. However, considering that (11) is greater than (12), the sum of the two equations will be positive.

Substituting the two equations to (9) and assuming that the term in the absolute sign is positive, the equation is obtained.

$$-\left(\delta t\sigma\varepsilon-\frac{\delta t^2}{2}\sigma^2+\frac{\delta t^3}{6}\sigma^3\right)$$
$$-\left(\delta t\sigma+\frac{\delta t^2}{2}\sigma^2+\varepsilon\right)k\delta x$$
$$+(1+\delta t\sigma)\frac{k^2}{2}\delta x^2-\frac{k^3}{6}\delta x^3=0$$

...(13)

δx can be calculated by (13) with δt as the input, where δt is obtained from the previous procedure.

Table (2.3) presents the calculation results of δx for several T wave periods, at a water depth of 10m. The wavelength is calculated using the dispersion equation from the linear wave theory according to Dean (1991).The level of accuracy used is $\varepsilon = 0.001$.

Table.2.3: δx Calculation

T (sec.)	δt (sec.)	δx (m)	L (m)	$\frac{\delta x}{L}$
6	0,00191	0,04643	48,4062	0,00096
7	0,00223	0,05738	59,8212	0,00096
8	0,00254	0,068	70,8984	0,00096
9	0,00286	0,07839	81,7267	0,00096
10	0,00318	0,0886	92,3739	0,00096
11	0,0035	0,09868	102,887	0,00096
12	0,00382	0,10867	113,299	0,00096
13	0,00414	0,11858	123,633	0,00096
14	0,00445	0,12843	133,905	0,00096
15	0,00477	0,13824	144,128	0,00096

The calculation results show that the value of δx obtained is quite small compared to the wavelength L, which shows that the value is quite relevant to use. Since the value of $\frac{\delta x}{L}$ might be too small, the comparison between the wave phase velocity is reviewed, $C = \frac{L}{T}$, and $\frac{\delta x}{\delta t}$ (Table (2.4)).

Table.2.4: Comparison between $\frac{\delta x}{\delta t}$ and C

T (sec.)	$\frac{\delta x}{\delta t}$ (m/sec.)	C (m/sec)	$\frac{\delta x/\delta t}{C}$
6	24,3257	8,0677	3,01519
7	25,7675	8,54589	3,01519
8	26,7215	8,86229	3,01519
9	27,3802	9,08074	3,01519
10	27,8525	9,23739	3,01519
11	28,2022	9,35337	3,01519
12	28,4682	9,44158	3,01519
13	28,6751	9,51022	3,01519
14	28,8392	9,56465	3,01519
15	28,9716	9,60854	3,01519

Table (2.4) shows that $\frac{\delta x}{\delta t}$ is much greater than C there the ratio $\frac{\delta x/\delta t}{C} = 3.01519$ or $\delta x = 3.01519\ C\ \delta t$. This is following with the Courant criteria, $\delta x = 3.0\ C\ \delta t$ (Courant (2928)).

2.2. δt calculation by substituting δx.

In this section δt and $\delta x$are processed using the same procedure as the previous one where $\delta x$is substituted withδt, in which

$\delta x = \gamma C \delta t = \gamma \frac{\sigma}{k} \delta t$ ..... (14)

$C = \frac{L}{T}$is wave celerity

$L = \frac{2\pi}{k}$Wavelength

γ:Coefficient (when used the results in Table (2.4.),$\gamma = 3.01519$)

Furthermore, using the relation (6) and (7), where$\delta x$is substituted by (14) to obtain:

$\frac{s_2}{s_1} = \left(\frac{1/2 - \gamma + \frac{\gamma^2}{2}}{1+\gamma}\right)\sigma\delta t$ .....(15)

By using the relations (6) and (8) and by substitutingδx with (14),

$\frac{s_3}{s_1} = -\left(\frac{1/6 + \frac{\gamma}{2} + \frac{\gamma^2}{2} + \frac{\gamma^3}{6}}{1+\gamma}\right)\sigma^2\delta t^2$.... (16)

Substitute (15) and (16) into (9) and taking a value equal to,

$$-\left(\frac{1/6 + \frac{\gamma}{2} + \frac{\gamma^2}{2} + \frac{\gamma^3}{6}}{1+\gamma}\right)\sigma^2\delta t^2 + \left(\frac{1/2 - \gamma + \frac{\gamma^2}{2}}{1+\gamma}\right)\sigma\delta t - \varepsilon = 0$$

..... (17)

By inputtingσ, ε andγ, δtcan be calculated with (14). Meanwhile, γ can be obtained using the previous calculation results,$\gamma = 3.01519$.

The calculation of δx in the table (2.5) is done in the water depth $h = 10$ m, while the wave number $k$is calculated using the dispersion equation of the linear wave theory (Dean (1991)). It shows that δt and δx in Table (2.5) are more or less the same as the calculation results in Table (2.3). However, the calculation of δt and (17) was preferable considering that there is a clear interaction between δt andδx.

Table.2.5: The results of the calculation of δt and δx with (17), for $\gamma = 3.01519$.

T (sec)	δt (sec)	δx (m)	$\frac{\delta x}{L}$
6	0,00191	0,04619	0,00095
7	0,00223	0,05709	0,00095
8	0,00255	0,06766	0,00095
9	0,00286	0,07799	0,00095
10	0,00318	0,08815	0,00095
11	0,0035	0,09819	0,00095
12	0,00382	0,10812	0,00095
13	0,00414	0,11798	0,00095
14	0,00445	0,12779	0,00095
15	0,00477	0,13754	0,00095

2.3. δz calculation in the function$f(x,z,t)$

This section formulates the calculation method δz for a function $f(x,z,t)$. The calculation method is as discussed in the previous section, where δt and $\delta x$are the inputs obtained from the previous procedure on a sinusoidal function $f(x,t)$.

Taylor series for a function $f(x,z,t)$ is,

$$f(x+\delta x, z+\delta z, t+\delta t) = f(x,z,t) + s_1 + s_2 + s_3$$

.... (19)

$s_1 = \delta t\frac{\partial f}{\partial t} + \delta x\frac{\partial f}{\partial x} + \delta z\frac{\partial f}{\partial z}$.... (20)

$$s_2 = \frac{\delta t^2}{2}\frac{\partial^2 f}{\partial t^2} + \delta t\delta x\frac{\partial^2 f}{\partial x\partial t} + \frac{\delta x^2}{2}\frac{\partial^2 f}{\partial x^2} + \delta t\delta z\frac{\partial^2 f}{\partial z\partial t} + \delta x\delta z\frac{\partial^2 f}{\partial x\partial z} + \frac{\delta z^2}{2}\frac{\partial^2 f}{\partial z^2}$$

..... (21)

$$s_3 = \frac{\delta t^3}{6}\frac{\partial^3 f}{\partial t^3} + \frac{\delta t^2}{2}\delta x\frac{\partial^3 f}{\partial x\partial t^2} + \frac{\delta t^2}{2}\delta z\frac{\partial^3 f}{\partial z\partial t^2} + \delta t\frac{\delta x^2}{2}\frac{\partial^3 f}{\partial x^2\partial t} + \delta t\frac{\delta z^2}{2}\frac{\partial^3 f}{\partial z^2\partial t} + \delta t\delta x\delta z\frac{\partial^3 f}{\partial x\partial z\partial t} + \frac{\delta x^3}{6}\frac{\partial^3 f}{\partial x^3} + \frac{\delta z^3}{6}\frac{\partial^3 f}{\partial z^3}$$

..... (22)

δzwill be calculated using equation (9).

As a function$f(x,z,t)$, the following form of function is used

$f(x,z,t) = coshk(h+z)coskxcos\sigma t$.... (23)

At the characteristic point, the sinusoidal terms in the numerator and denominator might cancel each other out. The equation is done at$z = \eta$, where$\eta$is water surface elevation and is done in deep water where $tanhk(h+\eta) = 1$or$sinhk(h+\eta) = coshk(h+\eta)$. Thus, the hyperbolic function of the numerator and the denominators might eliminate each other.By using the wave-number

conservation law (Hutahaean (2020)), the relation$tank(h+\eta)=1$remains valid in shallow waters.

After removing the sinusoidal and hyperbolic elements, the equations of s_1, s_2 and s_3 are,

$$s_1 = -\delta t\sigma - \delta xk + \delta zk \ldots (24)$$

$$s_2 = -\frac{\delta t^2}{2}\sigma^2 + \delta t\delta x\sigma k - \frac{\delta x^2}{2}k^2 - \delta t\delta z\sigma k - \delta x\delta zk^2 + \frac{\delta z^2}{2}k^2 \quad \ldots..(25)$$

$$s_3 = \frac{\delta t^3}{6}\sigma^3 + \frac{\delta t^2}{2}\delta x\sigma^2 k - \frac{\delta t^2}{2}\delta z\sigma^2 k + \delta t\frac{\delta x^2}{2}\sigma k^2 - \delta t\frac{\delta z^2}{2}\sigma k^2 - \delta t\frac{\delta z^2}{2}\sigma k^2 + \delta t\delta x\delta z\sigma k^2 + \frac{\delta x^3}{6}k^3 + \frac{\delta z^3}{6}k^3 \quad \ldots..(26)$$

Substitutingss_1, s_2, and$s_3$to (9) assuming that$\frac{s_2+s_3}{s_1}$is positive and using the equal sign, the equation for$\delta z$is in the form of a 3-degree polynomial.

The results of the calculation of δz where δt and $\delta x$are calculated using the procedure in sub-chapter (2.2) are presented in Table (2.6), where the calculation at a water depth of 10m using the accuracy level$\varepsilon = 0.001$.

Table.2.6: δz Calculation

T (sec)	δt (sec)	δx (m)	δz (m)	$\frac{\delta z}{\delta x}$
6	0,00191	0,04619	0,13859	3,00012
7	0,00223	0,05709	0,17127	3,00012
8	0,00255	0,06766	0,20298	3,00012
9	0,00286	0,07799	0,23398	3,00012
10	0,00318	0,08815	0,26447	3,00012
11	0,0035	0,09819	0,29457	3,00012
12	0,00382	0,10812	0,32438	3,00012
13	0,00414	0,11798	0,35396	3,00012
14	0,00445	0,12779	0,38337	3,00012
15	0,00477	0,13754	0,41264	3,00012

Something is interesting enough to note that the value of $\frac{\delta z}{\delta x} = 3.00012$isconstat for allwave periods. Thus, it can be assumed that:

$$\delta z = \frac{\gamma^2\sigma}{k}\delta t = \gamma^2 C\delta t \ldots. (27)$$

Where $\gamma = 3$ can be used.

Hence, a calculation method might be formulated where δx and δzaresubstituted by δt using the relations in (14) and (27) to (24), (25), and (26).

$$s_1 = (-1-\gamma+\gamma^2)\sigma\delta t \ldots (28)$$

$$s_2 = \left(-\tfrac{1}{2}+\gamma-\tfrac{3}{2}\gamma^2-\gamma^3+\tfrac{1}{2}\gamma^4\right)\sigma^2\delta t^2 \ldots. (29)$$

$$s_3 = \left(\tfrac{1}{6}+\tfrac{1}{2}\gamma+\tfrac{7}{6}\gamma^3-\tfrac{1}{2}\gamma^4+\tfrac{1}{6}\gamma^6\right)\sigma^3\delta t^3 \ldots. (30)$$

Substituting (28), (29), and (30) to (9) and assuming that the term in the absolute sign is positive, the quadratic equation of $\delta t$is obtained as follows,

$$a\,\delta t^2 + b\,\delta t + c = 0 \ldots.. (31)$$

$$a = \left(\tfrac{1}{6}+\tfrac{1}{2}\gamma+\tfrac{7}{6}\gamma^3-\tfrac{1}{2}\gamma^4+\tfrac{1}{6}\gamma^6\right)\sigma^2 \ldots.. (32)$$

$$b = \left(-\tfrac{1}{2}+\gamma-\tfrac{3}{2}\gamma^2-\gamma^3+\tfrac{1}{2}\gamma^4\right)\sigma \ldots. (33)$$

$$c = -(-1-\gamma+\gamma^2)\varepsilon \ldots (34)$$

The results of the calculation of δt with (31) for several wave periods, at a water depth of 10m with an accuracy level of$\varepsilon = 0.001$, while$\gamma = 3.00012$are presented in Table (2.7).

Table.2.7: Calculation results of δt, δx and δz with (31)

T (sec)	δt (sec)	δx (m)	δz (m)
6	0,00176	0,04261	0,12782
7	0,00205	0,05265	0,15797
8	0,00235	0,0624	0,18722
9	0,00264	0,07193	0,21581
10	0,00293	0,08131	0,24392
11	0,00323	0,09056	0,27169
12	0,00352	0,09972	0,29918
13	0,00381	0,10882	0,32647
14	0,00411	0,11786	0,35359
15	0,0044	0,12686	0,38059

There is a relatively small difference between the results in Table (2.7) and the results in Table (2.6). It can be said that with (31) simultaneous calculations onδt, δxandδz,

the results of calculation with (31), in Table (2.7) will be more reliable than the results of calculations in (2.6).

It is important to note that $\frac{\delta x}{\delta t}$ and $\frac{\delta z}{\delta t}$correlate with the velocity of the *C* wave phase, in equations (14) and (27), in interpreting these two parameters.

III. AIRY'S LONG WAVE EQUATION COMPLETION

In this section, Airy's Long Wave Equation or also known as the Shallow Water Equation is resolved. The equationis actually for small amplitude and longwave. To be used for short and high amplitude waves, a modification of the equation might be used. The formulation is not presented in this study considering that this study does not aim to develop a water wave model, but only to test the reliability of the time-step and grid-size produced in the previous sections.

Governing equations consists of two equations, namely

a. Water surface equation

$$\frac{\partial \eta}{\partial t} = -\frac{1}{0.5\pi}\frac{\partial Uh}{\partial x} - 0.025U\frac{\partial \eta}{\partial x} \text{.... (35)}$$

b. Momentum equation

$$\frac{\partial U}{\partial t} = -\frac{1}{9}\left(\frac{3}{2}\frac{\partial UU}{\partial x} + g\frac{\partial \eta}{\partial x}\right) \text{..... (36)}$$

η: water surface elevation
U: depth average particle velocity
h: still water depth
g: gravitation acceleration

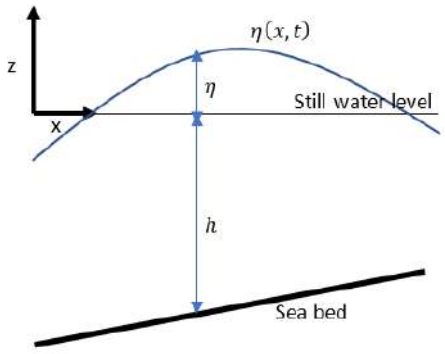

Fig.1: The axes system and variables in SWE

Both equations are solved by modifying MacCormack's predictor-corrector method (Anderson, J.D. Jr.(1994)). The original predictor-connector method is a combination of the forward difference with the backward difference in solving the time differential (Anderson, J.D. Jr.(1994)). In this study, a combination of central and backward differences was used.

The simulation results for waves with a period of 9 sec., at constant still water depth h =10 m, wave amplitude 0.8 m on execution for 10 times the wave period or 80 sec., are presented in Fig. (2). Time-step$\delta t$and grid-size $\delta x$are generated using the accuracy level of$\varepsilon = 0.001$.

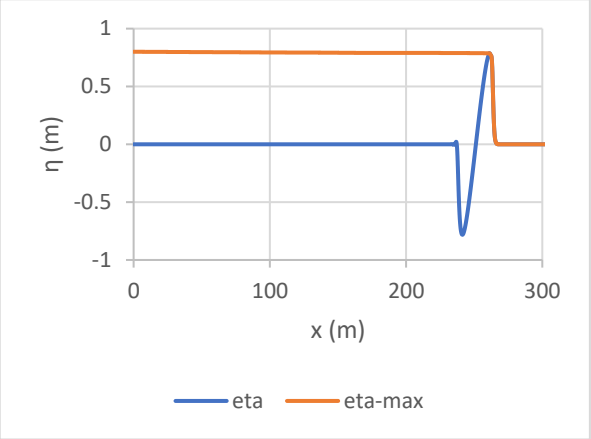

Fig.2: Model results in constant water depth,$h = 10$ m.

Fig. (2) shows that the wave curve is stable at execution for 80 sec. Thus, the wave crest elevation η_{max} was stable. This shows the stability of the model, the numerical method used, as well as the good time-step and grid-size. In case the time-step and grid-size are not correct, for example, the grid-size is too large, and then a reduction in waveamplitude or wave height might occur.

Given the wavelength of the model is shorter than the wavelength of the linear wave theory, the calculation of the grid-size δx used the following dispersion equation to obtain the appropriate grid-size:

$\sigma^2 = gk\ tanh(kh)$..... (37)

However, this study does not propose a new dispersion equation, but only the calculation of the grid-size.

Furthermore, the model is worked on the sloping bottom where the initial still water depth is 10m, while the final still water depth is 1m. The bottom slope is $\frac{9}{300}$ with a channel length of 300m. The wave period is 8 sec, with a wave amplitude of 0.8 m. The model results are presented in Fig (3).

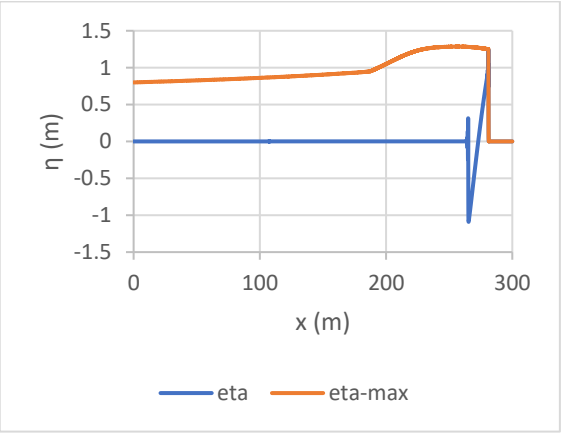

Fig.3: Results of model execution at the sloping bottom.

Fig (3) visualizes the occurrence of shoaling. Meanwhile, in the very shallow waters, there is a large increase in wave crest which possibly breaking the model. The concern, in this case, is the stability of the model in unstable wave conditions, at the time of breaking, which also shows that the time-step and grid-size used are quite good.

IV. CONCLUSION

By using the right time-step and grid-size, the Taylor series can be cut using only one derivative (order 1). Thus, the equations in FDM are exact.

Moreover, the use of the right time-size and grid-size, the solution of the governing equations of the hydrodynamic equations is under the conditions of the formulation, where generally the governing-equations are formulated by cutting the Taylor series in order 1 only.

It is important to note that the results of this study are that the grid-size onthe Taylor series in a sinusoidal function is correlated with the phase velocity instead of the particle velocity or the current velocity. This should be considered in formulating the governing equations of the wave model, especially in the formulation of the momentum equation.

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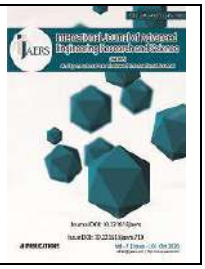

Signs in Libras for inorganic compounds as a translator of scientific concepts: a prospection in bibliographic databases

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***Keywords*— chemistry, libras, scientific terminologies, signs, teaching materials.**

***Abstract*—** *We live in a technological society whose development is directly linked to advances in scientific knowledge. Thus, learning science at school today is of fundamental importance for students to be able to understand its concepts, as well as to apply them. However, due to the lack of methodologies as regards Teaching Chemistry to deaf alumni and the scarcity of scientific terminologies in this area, which impact on the learning of this science, many authors point out the need for research involving chemical signs in Libras. In this sense, this article aims to make a mapping to know if there are Signs in Libras for inorganic compounds in audiovisual format, as material to aid the translation of scientific concepts. The methodology was based upon a qualitative approach of exploratory nature, with data collection via bibliographical research. The prospecting was accomplished on CAPES portal, Google Scholar and SciELO, there resulting in 6,476 documents. After filtering strategies, we found that none was identical to the desired product. We therefore identified that there are no articles, dissertations and theses, up to this research date, addressing to the theme of Libras for inorganic compounds and that their creation is of fundamental need for understanding the chemical concepts and, consequently, as a tool to support the chemistry teaching-learning process.*

I. INTRODUCTION

Chemistry is present in our lives from the most elementary to the most complex things like medicines. And when it comes to education, it is essential to reflect on the relevance of teaching science today, especially the Teaching of Chemistry, as we live in a technological society, the growth of which is directly linked to advances in scientific knowledge and vice versa. It is then necessary to scientifically train up literate citizens.

When considering the importance of learning Chemistry, one has to keep in mind that it studies matter and its transformations, having two distinct concerns: one focused on contents and scientific concepts, the other focused on the education of the citizen (Krasilchik, & Marandino, 2007). On the other hand, the scientific language of Chemistry uses terms such as functions, reactions, bonds, atoms, ions, among others, which are symbolic and abstract, sometimes transforming the learning in this area of knowledge into a complex task for any student, either normal or deaf, making them unmotivated (Lucena, Benite & Benite, 2008; Pereira, Benite & Benite, 2011).

When one thinks of the Teaching of Chemistry at school, he takes into account that education is everyone's right - according to the article 205 Federative Republic

Constitution of the Federative of Brazil (1988). However, despite the Constitution establishing this right, the access to knowledge is not guaranteed to all students on equal basis. Although there has been an evolution of legislation to guarantee the improvement of the teaching-learning process of the deaf, in practice these educational proposals are not satisfactory. And due to a series of restrictions and gaps in structural, methodological and pedagogical orders, these students have more learning difficulties in Chemistry than those who can hear.

Thus, in the perspective of a quality scientific education that includes deaf students, some pedagogical measures need to be adopted. That is why many authors point to the need for more research involving scientific concepts in Libras and its dissemination to education professionals. Because, in addition to the lack of methodologies in the teaching of Science for the deaf, there is a shortage of specific terminologies in this area (Carvalho, 2017; Fernandes, 2016; Ferreira, Nascimento, & Pitanga, 2014; Gomes, Souza, & Soares, 2015; Oliveira, 2014; Quadros, & Karnopp, 2004; Saldanha, 2011; Sousa, & Silveira, 2011). About this, Barral, Pinto-Silva and Rumjanek (2012) understand that a vicious circle has been created, *i. e.*, there are no scientific signs, teachers have difficulty in teaching Science, interpreters have difficulty in conceptualizing and deaf students are increasingly excluded as regards Science.

In this context, this article aims to make a mapping to know if there are already Signs in Libras for inorganic compounds, in audiovisual format, as material to aid the translation of scientific concepts.

II. CHEMISTRY AND THE DIFFICULTIES IN LEARNING SCIENTIFIC CONCEPTS

Chemistry is an investigative science that lives in a continuous process of construction. We understand that its learning allows the student to be able to interpret scientific concepts and articulate them with practical applications because,

> it is a question of training the student-citizen to survive and act in a responsible and committed manner in this techno-scientific society, in which chemistry appears as a relevant instrument of investigation, production of goods and socio-economic growth, interfering directly in the daily lives of people (Martins, Santa Maria, & Aguiar, 2003, page 18).

In contrast, learning this Science is a complex task for any student, be him deaf or hearing. According to Gabel (1998), the problems to understand Chemistry can be due to two factors: the difficulties in interpreting the chemical phenomena that happen at macroscopic and/or microscopic levels, and the lack of relationship between these two levels of the subject (*Apud* Furió, & Furió, 2000).

When thinking about Teaching Chemistry at school, one – in accordance with to the article 205 Federative Republic Constitution of Brazil (1988) – must take into account that education is a right for all. Speaking especially of the deaf, it is important to understand how the teaching-learning process of this Science takes place in this community. For, they are individuals with their own culture and, therefore, knowing their aspects is of great value to substantiate the problem of this study.

We emphasize that the education of the deaf in Brazil has gained some initiatives with the objective of providing the full development of their abilities, like the Law that establishes the Guidelines and Bases of National Education (LDB) – Law nr. 9,394/1996, which won a chapter on Special Education for disabled students and recommends that it be offered in the regular school system; of the Law on the Brazilian Sign Language - Libras and other measures – Law nr. 10,436/2002, which recognized Libras as the legal means of communication for the deaf and the Decree that regulates Law nr. 10,436 of April 24th, 2002, which provides for the Brazilian Sign Language – Libras, plus article 18 of the Law nr. 10,098 dated December 19th, 2000 – Decree nr. 5,626/2005, which proposes bilingual education as well.

Although this has been an evolution to guarantee the improvement of the teaching-learning process of the deaf, in practice, these educational proposals are not satisfactory. Furthermore, some researches denounce the specific terminologies of Chemistry with a scarcity of words in Libras, as well as the few teaching materials available to assist in the translation of these terms into sign language (COSTA, 2014; Ferreira *et al.*, 2014; Quadros, & Karnopp, 2004; Sousa, & Silveira, 2011). Therefore, due to a series of methodological and pedagogical gaps and restrictions, students with deafness have more difficulty in learning Chemistry than those who can listen.

Faced with these adversities, Feltrini (2009) points out that the linguistic specificities of the deaf make their education a very complex situation, with several difficulties that decisively interfere in the construction of scientific concepts. So, in the perspective of a quality scientific education to include deaf students, some pedagogical measures need to be adopted.

A first point to be considered in the learning of students with deafness associated with chemical contents concerns Law nr. 9,394/96, in which, in its Article 58,

establishes that Special Education for disabled *alumni* be offered in the regular school system. This school model, however, does not consider that deaf and hearing people have different learning needs, and the regular school follows the common education pattern through which classes are taught in the oral language, without the option of Libras. Under this scenario, Queiroz, Silva, Macedo and Benite (2010) point out that when teachers use only oral speech and writing in the teaching-learning process of scientific knowledge, it appears that the deaf do not learn or do it poorly.

A second gap concerns the lack of clarity of the Law nr. 10,436/02, and its regulating Decree nr. 5,626/05, which contemplates the inclusion of a bilingual proposal. There is a lack of understanding of Art. 3rd, §2, when Libras becomes an optional subject for most higher and professional oral education courses. Thus, a Chemistry teacher, who should have specific training and knowledge in Libras, is only trained in his area. As for the referred article, Ferreira *et al*. (2014) claim that there is no clear definition of what the bilingual education is – within the subjects – mainly as regards the training of teachers toward understanding the scientific concepts. Therefore, according to Sousa and Silveira (2011),

> science teachers, particularly those of chemistry, who do not have the training to work with the hearing impaired, have great difficulties in dealing with the construction of scientific concepts for this particular group, which, in turn, generates exclusion and distance from deaf students in classes with this content (Sousa, & Silveira, 2011, page 38).

Still in the perspective of bilingual education, in the absence a teacher of Chemistry who has knowledge in Libras, the Libras Translator and Interpreter (TILs) will translate the contents. Under Art. 17th of the afore mentioned Decree, the formation of TILs will take place through a higher degree in Translation and Interpretation, with qualification in Libras-Portuguese language. Thus, in a translation of the chemical contents for the deaf, the interpreters have their difficulties with regard to chemical symbology, using signs of their own understanding of the contents (Sousa, & Silveira, 2011). In view of the above, Quadros (2004) recalls that, historically, the education of the deaf has always been focused on linguistic issues, specifically on the teaching of the oral Portuguese language and the use of Libras, with little being discussed in the teaching of other areas of knowledge.

As a third constraint, some researches – including those of the authors Costa (2014) and Sousa and Silveira (2011) – signal the specific terminologies of chemistry without correspondence with Libras. These studies report that, as this Science uses specific symbols to represent functions, reactions, bongs, atoms etc., which do not have vocabulary in Libras, there is a difficulty in explaining the chemical phenomena on the part of teachers and understanding by deaf students, which can lead these students into school failure.

As a fourth point, we mention the works of Ferreira *et al.* (2014), Costa (2014), Sousa and Silveira (2011), and Quadros and Karnopp (2004) that reveal the few materials available to assist in the translation of specific terms from Chemistry to Libras. These studies point out that the shortage of these materials is usually considered one of the main problems in the learning of chemical contents by the deaf.

Therefore, in circumstances in which there is a difficulty in learning the chemical contents and consequently the investigative knowledge, recreating didactic materials and disseminating them in various educational contexts – such as the Signs to translate the technical-scientific language to Libras – is of fundamental importance to support the teaching of that Science.

III. SIGNS IN LIBRAS AS SUPPORT MATERIAL FOR TEACHING CHEMISTRY

As seen, deaf students have difficulty learning chemical concepts and, consequently, building their specific practical applications. This is due to several factors that range from methodological-pedagogical restrictions and gaps, passing through specific chemistry terminologies and, finally, the few materials available to assist in the translation of these terms to Libras. As for this difficulty, Quadros and Karnopp (2004) claim that the lack of these materials interferes in the negotiation of meanings of scientific concepts by teachers, students and interpreters, making science teaching and learning difficult.

With the advancement of Information and Communication Technologies (ICTs), the insertion of technological digital resources and the use of new media in schools become increasingly necessary; because the facilities of digital technologies have popularized access to knowledge, leaving traditional practices outdated. In view of this reality, for Silva (2013),

> science education is becoming more and more outside school walls, getting installed in spaces such as magazines, newspapers, videos on the internet, for example, reflecting a popularization and diffusion of science previously restricted to academic institutions. Hence the relevance of the

> creation of cultural artifacts of communication and information as pedagogical instances, being able to produce meanings, values and behaviors in different contexts – beyond school spaces (Silva, 2013, page 57).

Good experiences have emerged in Brazil, there involving the deaf and didactic material that uses digital technologies on the Web. For these students, these tools represent an inclusive, visibly attractive and very easy to understand medium, through which they learn by interacting and communicating, then leading Rosa and Cruz (2001) and Souza, Aguiar and Pinto (2003) to point out that

> the use of the *Internet* constitutes another tool that enhances the deaf in their relationship with the world as it has presented positive points such as – for instance – cognitive changes favored by technologies, incentive to search and acquire knowledge, establishing affective relationships while allowing the deaf to demonstrate their feelings and emotions without being excluded, and social through interaction and relationship with other people, deaf or hearing (Rosa, & Cruz, 2001; Souza, Aguiar, & Pinto, 2003).

As deaf students need visual memory, the utilization of means that use vision as a channel of communication has contributed greatly to their educational progress. When preparing this type of material, therefore, the work – based on visual pedagogy, as a field for learning – must be taken into account, since these students apprehend information through vision (Ribeiro, & Silva, 2017; Ferreira *et al*., 2014).

In addition, according to Rosa (2013, page 61) "sign language has a *visuospatial* modality because it is articulated in space and is apprehended visually, *i. e.*, linguistic information is received by the eyes and produced by the hands." In view of this statement, the following parameters should be used in the construction of signs: hand configuration (HC), articulation point (AP), movement (M), hand orientation (Or), facial and body expressions (FBE) (Vargas, & Gobara, 2015). It is noteworthy that these combined patterns form the signals. Figure 1 exemplifies the elaboration of signs taking into account the parameters described above.

(AP)and (M) (FBE) (HC)

Fig. 1: Examples of parameters of Libras

Fonte: De "Desenvolvimento de sinais em Libras para o ensino de química orgânica: um estudo de caso de uma escola de Linhares/ES" (Dissertação de mestrado), de A. B. Pontara, 2017, *Centro Universitário do Norte do Espírito Santo*, p. 78.

In Chemistry as a whole, it should be noted that some research have been developed to assist the teacher when the student is deaf, as are the case of the Brazilian Sign Language by Capovilla and Raphael (2001), the Chemistry Sign Book of the Phala Institute (2013) and the Scientific Signs by Costa (2014). According to Costa (2014)

> the production of these signs is of fundamental importance to solve difficulties in the teaching and learning process and to minimize educational barriers such as chemistry, which has a and complex vocabulary in Portuguese, but is not included in the sign language (Costa, 2014, page 26).

Stumpf (2005, page 36) conceptualizes *Sinalários* as "a set of expressions that make the lexicon of a given language". According to this definition, Libras Signs can be used as teaching material. Because being a bridge between the student and knowledge, they are a visual experience that helps to explain scientific concepts. This type of resource can be an efficient didactic strategy to meet the learning needs of deaf students, especially with regard to teaching Chemistry.

Furthermore, as the main support media for the *Sinalários* (signs) are the video-sharing sites on the Web, they establish themselves as excellent means of popularizing science. Thus, "the audiovisual language allows the formation of new concepts by these students, causing the interest and internalization of concepts that – if expressed with the formalism of scientific definitions – would be incomprehensible" (Silva, Santana and Silva, Tudury, & Barros, 2009, page 2).

Given the above, it appears that the Signs in Libras are appropriate products to assist in the teaching and learning of Chemistry in various educational contexts,

through which the deaf can learn scientific concepts and use them in practical experiments.

IV. METHODOLOGY

The methodology adopted in this research was based on a qualitative approach to the treatment and analysis of information, since it aims to explore the meaning of the chemical terms translated to Libras. The type of research used can be classified as exploratory, due to the few records of scientific term in Libras in Brazil. As for data collection, the procedure was via bibliographic research, supported by search for precedence.

a. Data collection – search for precedence

The researched universe had Academic Bases, as a scope. The sample, on the other hand, was based on information contained in documents of the afore mentioned Bases, referring to chemical Signs in Libras.

Academic Bases (Google Scholar, SciELO and Capes – articles, dissertations and theses) – As a criterion for gathering information and search strategies, we used keywords: Glossary AND Libras; Glossary AND Libras AND Chemistry; Glossary AND Libras AND inorganic reagents, in which we tried to make various combinations. Instead of the word *Sinalário* (signs), Glossary was used as this is a more comprehensive synonym. As the aid tool, we used the *Boolean* operator AND in order to restrict the number of documents. Bearing in mind that the *Sinalário* we intend to develop in this work refers to an intellectual property, we – for this reason – searched only on academic bases platforms.

From the mapping of the information contained in the Academic Bases, we started with the data collection in the months of April/May 2020. Signs of inorganic compounds translated into Libras and displayed in articles, dissertations and theses were used as instrument for the qualitative analysis of the data.

V. RESULTS AND DISCUSSION

After collecting data, the presentation and analysis from the Academic Bases took place as per Table 1, basing on the chemical terms translated into Libras. Each base is divided into two fields: quantity of documents found (F) and quantity of documents identical (I) to the *Sinalários* in Libras.

Table 1 – Search result of Sinalários in Libras

	G. Scholar		**SciELO**		**Capes**		**Total**
Keywords	F	I	F	I	F	I	
Glossary AND Libras	4,970	_	_	_	24	_	4,994
Glossary AND Libras AND Chemistry	1,310	_	_	_	3	_	1,313
Glossary AND Libras AND inorg. reagents	169	_	_	_	_	_	169
Total	6,449	_	_	_	27	_	6,476

Taking a look at Table 1, we can see that a total of 6,476 documents containing articles, dissertations and theses were found; 6,449 of them in Google Scholar, 27 in Capes and none in SciELO. In the first search, using the keyword **Glossary AND Libras**, 4,994 records were found; of these, 4,970 were in Google Scholar, 24 in Capes and none in SciELO. In a second search as a filter strategy, we used **Glossary AND Libras AND Chemistry**, finding 1,313 records; of theses, 1,310 were in Google Scholar, 3 in Capes and none in SciELO. And as a last filtering criterion, **Glossary AND Libra AND inorganic reagents** were adopted, obtaining 169 documents, all available in Google Scholar.

The combination of keywords that index more articles, dissertations and theses is Glossary-Libras; 4,970 for Google Scholar and 24 for Capes. This happens because this association of words is more generic, covering all areas of knowledge for Glossary in Libras. For the Glossary-Libras-inorganic compounds combination, the list of documents is small. There are 169 records, and only for Google Scholar. This is due to the fact that inorganic functions are from a specific technical area of chemistry, in which there are very rare sign-terms in Libras. Therefore, the few documents found in the literature show his term arranged throughout the text; yet, unrelated to signs in Libras for inorganic compounds.

On realizing that, for all combinations of keywords, the titles were repeated, we then took – for research – **Glossary AND Libras AND Chemistry**, since this filtering strategy contemplates more specific documents of interest for the research, while excluding the

generics. As the objective of the research was to find out which documents had sign-terms for inorganic compounds, all the titles of the 1.313 records found were analyzed. As a criterion of exclusion, only the documents that contained words in the title referring to the research objective, such as: Libras, signs, chemistry, glossary, scientific, concepts, *Sinalários*, among others remained. Thus, of the 1,313 found in Google Scholar, 28 remain; while of the 3 Capes records, two remained. Finally, the abstracts of the articles, dissertations and theses were selected, reaching 17records for final analysis; 16 in Google Scholar and 1 in Capes.

For a amore specific analysis, we present below, in Chart 1, the list of 17 titles of the articles and theses of the final analysis and their consequences.

Chart 1: Final analysis records – Google Scholar and Capes

Platforms	TITLES
Google Scholar	1. Development of signs in Libras for teaching organic Chemistry: a case study in a school in Linhares/ES, 2017, Amanda Bobbio Pontara.
	2. New signs for science: development of scientific glossary in Libras, 2011, Julia Barral Dodd Rumjanek.
	3. Construction of a glossary of signs-terms used in the teaching of chemistry, 2017, Regina de Fátima Freire Valentim Monteiro; Layce Alicy CunhaAlves Pontes.
	4. Construction of glossary on glass to give support to disabled students, 2017, Raquel Teixeira; Yuri Freitas Mastroiano; Amelia Rota Borges de Bastos.
	5. Elaboration of a glossary to support the learning of chemical concepts for deaf students, 2017, Thalita Gabriela Comar Charallo.
	6.The contribution of *sinalários* for scientific divulgation in Libras, 2018, Vilma Malacarne; Verônica Rosemary deOliveira.
	7. Libras glossary for chemistry: innovation in teaching the deaf, 2017, Nielson Firmino de Oliveira.
	8. Libras signs for experimental chemistry: building communication between teachers and deaf students, 2018, Expedito Barbosa Lages; Jhonison Lima Fernandes de Freitas; Nazaré do Socorro Lemos Silva Vasconcelos.
	9. Creation of a *Sinalário* of technical terms in Libras –Technical Course in Electro-technique, 2017, Ângela Paloma Zelli Wiedemann; Elisete Ponio Aires; Ana Lucia Berno Bonassina; Fabio Cuellar; Gustavo Elias de Brito; Marcella Jenichen Perussolo.
	10. *Sinalário* of Chemistry in the Brazilian Language of Signs (LIBRAS): lexical creation on a periodic table, 2019, Joyce Valeska Oliveira Gonçalves: Bruna Gomes Delanhese; Letícia Jovelina Storto.
	11. Sinalário of Scientific Terms in Libras and its Use at School, 2016, Geano Gustavo Geofre Paz; Bruno Gonçalve Carneiro; Roselba Gomes de Miranda.
	12. Experimentation in chemical education: elaboration of signs in Libras for laboratory practices, 2018, Geilson Rodrigues da Silva; Talina Meirely Nery dos Santos; Griscele Souza de Jesus; Lucas Pereira Gandra.
	13. Teaching of chemistry and the Brazlian language of signs – signwritting system (Libras-SW): intervening monitoring in the production of scientific signs, 2014, Edvaldo da Silva Costa.
	14. Glossary on glass: material of support to the teaching of disabled students, 2, Raquel Lopes Teixeira; Amélia Rota Borges de Bastos; Yuri Freitas Mastroiano.
	15. Production of glossary in Libras for laboratory equipment: option for chemical experimentation and inclusion, 2019, Rogério Pacheco Rodrigues; Fernanda Welter Adams; Cinthia Maria Felício; Maísa Conceição Silva; Jaliane Soares Borges dos Santos; Alessandra Timóteo Cardoso; Simone Machado Goulart.
	16. Chemical terminologies in Libras: use of signs in the learning of deaf students, 2010, Sinval Fernandes de Sousa; Hélder Eterno da Silveira.
Capes	17. Information density, phonological complexity and their implications toward organizing glossaries of technical terms for the Brazilian sign language, 2013, Janine Soares Oliveira; Markus Johannes Weininger.

Chart 1 evidences that there is a similarity in all 17 recorded titles as regards the format of the document, *i. e.*, they all mention the creation of signs in Libras, mainly for Chemistry as a whole. This is due to the fact that the platforms index documents quoting the words Glossary, Libras and Chemistry, which generally refer to the assistance in contents of Chemistry. Some mention the creation of scientific sign-terms in Libras. However, when the download is carried out to allow the reading of the document, what came closest to the intended product in this work was Amanda Bobbio Pontara's master's dissertation, 2017, which proposes the "Development of signs in Libras for the teaching of organic Chemistry: a case study of a school in Linhares/ES".

In general, the product described in the dissertation is similar in form to the *sinalário* intended in this research project – as it refers to the development of signs in Libras and, in this sense, there is a similarity in the general format of the two products. However, it differs in content, since the proposed *sinalário* refers specifically to signals from the area of inorganic chemistry, while that of Pontara (2017) refers to the area or organic chemistry.

VI. FINAL CONSIDERATION

Science and technology have advanced all over the world, making societies more and more dependent upon this knowledge. In view of this reality, it is imperative to form scientifically literate citizens. As seen earlier in this specific case, deaf students have more learning difficulties in Chemistry than hearing ones. And among other reasons, this is due to what authors like Silva and Santana (2011) and Quadros and Karnopp (2004) had already noticed in their studies: the lack of scientific terminologies in Libras and the impact that the lack of these sign-terms cause to the access, the production and exchange of scientific knowledge in the deaf community. In this scenario, research on anteriority is very significant for the inclusive scientific education of the deaf; because, on the one hand, it confirms what the aforementioned researchers had already reported and, on the other hand, it reinforces the need for the development of more studies involving scientific concepts in Libras and their dissemination in different educational contexts.

Regarding data mapping, the search for anteriority resulted in 6,.476 documents containing articles, dissertations and theses: 6,449 in Google Scholar, 27 in Capes and none in SciELO. After strategies for excluding titles, reading abstracts and texts, there was only one document similar to the product intended in this project, authored by Amanda Bobbio Pontara, 2017. However, the *Sinalário* described in the dissertation is similar in form but, differs in content. The *Sinalário* we propose refers specifically to Libras signs in the area of inorganic Chemistry, while that of the researcher Pontara (2017) refers to the area of Organic Chemistry. Thus, there is a lack of specific signs of inorganic Chemistry in Libras.

Therefore, we conclude that – until the date of the search carried out in this research – there were no articles, dissertations or theses in the researched bases that addressed *Sinalários* in Libras for inorganic compounds. This factor indicates the importance of creating this instrument as a didactic material to support the Teaching of Chemistry. Because, it will firstly provide the translation of the scientific concepts in theoretical classes and, later on, their practical application in laboratory experiments, including the deaf in investigative knowledge.

It is important to show that research in Libras, in the area of Sciences, continues, and that signs can be created in order to cut off the lexical gap for a more satisfactory scientific inclusion of this community.

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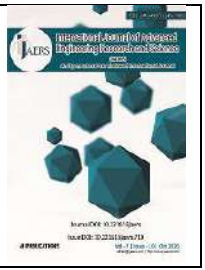

Relationship between the Flooded Area and Cases of Malaria Disease before and after Construction of Jirau Hydroelectric Plant, Madeira River, Brazil

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Abstract *- The operation of the Jirau hydroelectric plant, in the Madeira River near Porto Velho, Brazil started in 2013. Increased flooding areas near Jirau dam periodically reach communities with poor sanitation and can result in health problems, as the propagation of tropical diseases transmitted by aquatic vectors. Thus, we investigated the relationship between flooded areas and cases of malaria in Jirau´s Administrative Regions between 1994 and 2015. The flooded area was determined through spectral data (Landsat-5 and Landsat-8 satellite) and the numbers of malaria cases were extracted from the Epidemiological Surveillance Information System database of the Brazilian Ministry of Health. We verified an average flooded area of 770.3 km² before the dam (1994-2013) and 1370 km² after its operation (2014-2015). With linear regression between malaria cases and flooded areas, we verified a negative correlation during the study interval. Despite greater average flooded area after dam operation, the reduction of cases may be a result of several factors such as the imbalance of the parasitic relationship due to microclimatic changes, application of new substances for biological control (like artemisinin derivatives), little time for vector adaptation into new breeding sites, presence of plasmodium asymptomatic carriers, or even gaps or lack of case records in epidemiological databases. We highlight the importance of continuous monitoring of these variables and social control actions coverage expansion to prevent the risk of epidemic cycle occurrence and guarantee health security concerning this tropical disease and its socio-economic consequences.*

I. INTRODUCTION

The Madeira River is the main tributary of the Amazon River, with an extension of 1.238 km in Brazilian territory and an average flow of 23,000 m³ per second (Silva *et al.* 2013). It is formed by the rivers Guaporé, Mamoré and Beni, originated in the Andean highlands, and

its course is divided into lower and higher Madeira River (ANEEL, 2008).

The Jirau Hydroelectric plants on Madeira River started the operation in 2013, near the municipality of Porto Velho, north of Rondônia. The hydroelectric plant has an installed capacity of power generation around 3,300 MW, however, due to the operation with low water storage capacity in a very small reservoir, the effective production is around 2,184 MW on average (ONS, 2019).

Hydroelectric plants along the Madeira river increased potential risks and vulnerabilities in the Porto Velho region, Rondonia state, Brazil. Among these, we highlight changes in population and socio-economic profile, hydrological cycle, environmental characteristics, biological relationships, and ecological processes (Rodrigues *et al.* 2019).

Another problem is the formation of flooded areas and changes in the natural flooding process. This results in the displacement of the resident population in the area that will be flooded by the reservoir and, consequently land losses. Flooded areas are relevant to health due to their intrinsical relationship with some infectious diseases of water transmission, like malaria. So the extent of flooded areas determines the potential presence of sites for the proliferation of insects and vectors of these diseases.

Several studies had developed methodologies for monitoring flooded areas (Baldassarre, 2009); (Asadzadeh, 2013), mainly through remote sensing techniques, using satellite images that represent important tools for mapping temporal modeling of flood areas (Wardah, 2008; Baki and Gan, 2012;Villar, 2013).

Considering the multiple ecosystem services provided by Amazon ecosystems, the construction of dams cannot be dissociated from studies of its impacts in all knowledge fields, which also includes the possible effects of floods in their coverage areas and its potential influence on public health.

In this context, to understand the processes arising after the installation of the Jirau dam, this study focused on remote sensing as a tool to investigate changes in habitats e and verify the association of water coverage (flooded area) with the number of cases of waterborne diseases, with an emphasis on malaria. Therefore, we traced the temporal water coverage profile of Jirau dam before, during, and after the construction of the hydroelectric plant, located in the coordinates: 9° 15' 52"S and 64° 38' 31"W and obtained the number of infections for each year

This paper addressed the main aspects of the literature of remote sensing as a monitoring tool, impacts of dams on the landscape, and potential relationships between floods and health aspects. Methodological procedures included study area description, steps of geoprocessing for flooded area coverage estimation, acquisition of malaria records in government databases, and linear regression between flooded area and numbers of malaria cases.

II. METHODS

2.1 Study area

The Jirau Hydroelectric Plant, located on Madeira River, is entirely inserted in the municipality of Porto Velho, State of Rondônia, Brazil (Figure 1). Jirau dam is located on Jirau rapids, immediately downstream of Inferno waterfalls and about 130 km upstream of the city of Porto Velho (Costa, 2013). The formed reservoir has an area of 361.6 km2. The flooding area varies between 21 km2 and 207.7 km2 at the geographical coordinates 9° 15' 52"S and 64° 38' 31"Q (Rodrigues, 2019).

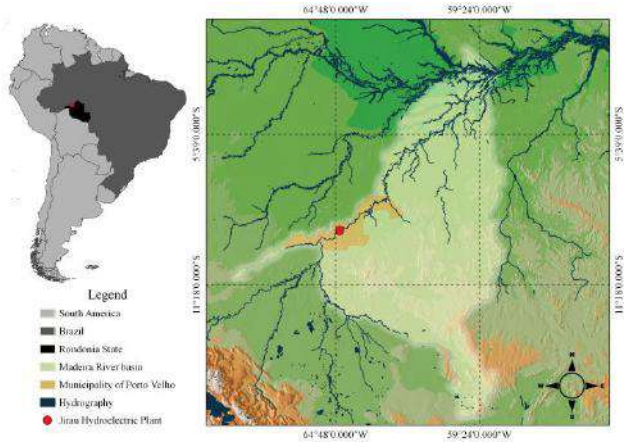

Fig.1: Map of study area showing the location of Porto Velho and areas under the influence of the Jirau Hydroelectric Plant, Rondônia State, Brazil.

2.2 Geoprocessing techniques

Spectral data used in this study were obtained from the Thematic Mapper (TM) sensor of Landsat-5 satellite and Operational Land Imager (OLI) sensor of Landsat-8 satellite. The imagery collection was acquired from the database of the Brazilian National Institute for Space Research (INPE). To calculate the reflectance values of the Earth's surface, scenes 232/66 and 233/66 with a bandwidth of 760 to 900 nm from the years 1994 to July 2015 (Table 1) were manipulated with ENVI software (ENVI, 2005). These scenes have a spatial resolution of 30m and a 16-day temporal resolution.), for both sensors. The bandwidth corresponds to the region of the near-infrared, where water bodies are reflected as dark (i.e.

black) and the vegetation reflection is white (Nascimento*et al.*2014)

Table 1: Date reference of Spectral data of Thematic Mapper Sensor (TM) and Operational Land Imager (OLI)

Orbit/ Point	Thematic Mapper (TM)	Operational Land Imager (OLI)
232/66	Date	Date
	07-08-1994	08-06-2013
	01-07-1998	11-06-2014
	06-07-2000	
	02-06-2005	13-07-2014
	28-07-2007	14-06-2015
	04-06-2009	16-07-2015
	13-08-2011	
233/66	Date	Date
	27-06-1994	01-07-2013
	08-07-1998	02-06-2014
	11-06-2000	
	11-07-2005	14-07-2014
	28-07-2007	
	04-06-2009	05-06-2015
	13-08-2011	07-07-2015

The Jirau reservoir is inserted in two tiles (232/66 and 233/6), so it was necessary to create a mosaic with these images. Images obtained from the TM sensor-Landsat 5 were georeferenced because they don't have a cartographic reference system. Georeferencing process consists of a set of numerical operations that modify or alter its geometry to adjust it to a coordinate system considered as a reference (Weber, 2006).

To perform this procedure, a polynomial equation was used, whose coefficients were calculated from control points. These points were identified in the image to be adjusted and in the desired reference system, and a uniform spatial distribution should be found (Richards, 1995; Mather, 1999). The equation establishes a relationship between the coordinates of the image (line, column) and the defined cartographic reference system. After applying the polynomial function to transform the geometry of an image into a plane and/or geographic coordinate system, errors are generated (Equation 1), where EMQ is the mean square error; pt is the difference between the positions (x and y) of the reference control point of the point in the image after the transformation; and subscripts 1, 2 ... n denote control points.

$$EMQ = \sqrt{\frac{pt_1^2+pt_2^2+pt_{2n}^2}{n}} \quad (1)$$

In the ENVI software (ENVI, 2005) the RMS value, after making 60 control points, must have a maximum of between 0.8 and 0.9 (Weber, 2006), in units of pixels. When the geometric corrections of the images were obtained based on a georeferenced product, different compositions were made with three-band arrangements, in the following sequences: True color R3G2B1, False color R4G3B2, False natural color R5G4B3 (Rosa *et al.* 2011). For the TM sensor images, the false natural color R5G4B3 was chosen because it makes a better distinction between the targets of interest, while for the OLI images the color composition R5G6B4 was chosen, which makes the best distinction between soil and water (Butler, 2013).

2.3 Flooded area coverage estimation

The coverage of flood area was estimated through the Normalized DifferenceVegetation Index (NDVI), which considers the transformation of the reflectance from the TIFF images obtained from the satellite sensors. However, before reaching the reflectance result, is necessary to obtain the terrestrial latitude angle (Φ), where the minutes of degree were converted into decimal fractions of a degree, the hour angle (ω), which is an angular deviation value whose value is null when the local time is half a day, considering that the Earth rotates 15 ° every hour (Campos, 2013). The hour angle is expressed in Equation 2, where T is the solar time h in the considered place and T varies between 0 and 24 hrs.

$$\omega = (12 - T) * 15 \quad (2)$$

According to Campos (2013), there is a seasonal variation of the terrestrial axis inclination of 23º 27' to the normal on the ecliptic plane. The solar declination perceived by an observer at the terrestrial equator, on a given day of the year (J), is given by Equation 3, where is the solar declination value in degrees, and J indicates the order number of Julian days.

$$\delta = 23{,}45°.sen\left[\frac{360*J-80}{365}\right] \quad (3)$$

After obtaining the declination values, we calculated the solar altitude, which is the angle between the direction of the radiation and the projection of this same direction in the horizontal plane. For this, the Equation 4, proposed by Messenger (2010) was used (where α (alpha) is the value of the angle of the solar altitude, given in degrees and is the angle of the terrestrial latitude);

$$\alpha = sen^{-1}(sen\delta.sen\Phi + cos\delta.cos\Phi.cos\omega) \quad (4)$$

The additional steps were to calculate the radiance and the reflectance (Equation 6) for bands 3 and 4 of Landsat 5 / TM. This allowed the conversion of Digital Numbers (DN) into monochromatic reflectance effectively (Neto et al., 2008). For the Landsat 5/TM images, there is a (DN) min and (DN) max of 0 and 255 respectively, since the radiometric resolution is 8 bits. while for Landsat-8/OLI images, the range of (DN) value is between 0 to 65535, since the images have a 16-bit radiometric resolution (Neto et al., 2008).

To calculate radiance (Equation 5), DN is the Digital number of each pixel; (DN) min and (DN) max are the Minimum and maximum value that DN can reach; L min L L max area the Calibration constants for a given sensor; Lλ is Monochromatic spectral radiance (W⁄m.sr.µm).

$$L_\lambda = \left(\frac{L_{máx}-L_{mín}}{DN_{máx}}\right) x(DN) + L_{mín} \quad (5)$$

The monochrome reflectance was obtained with Equation 6, where dr = Inverse of the square of the Earth-Sun distance in astronomical units; z = Zenith solar angle (degrees) at the time of acquisition; Eλ = Average solar irradiance at the top of the atmosphere (mW⁄(cm².Ω.µm));Lλ = Monochromatic spectral radiance (W⁄m.sr.µm); ρλ = Monochromatic reflectance) by:

$$\rho_\lambda = \frac{\pi.L_\lambda}{E_\lambda.cos(z).d_r} \quad (6)$$

We obtained the equation for direct conversion (Equation 7) of the digital number into reflectance substituting Equation 5 in Equation 6.

$$\rho_\lambda = \frac{\pi.\left[\left(\frac{L_{máx}-L_{mín}}{DN_{máx}}\right)x(DN)+L_{mín}\right]}{E_\lambda.cos(z).d_r} \quad (7)$$

After determining the physical values of reflectance of the images, the NDVI was calculated, which according to Rosemback et al. (2005) is given by Equation 8, where ρivp = reflectance value in the near-infrared range; ρv = Value of reflectance in the red band.

$$NDVI = \left(\frac{\rho_{ivp}-\rho_v}{\rho_{ivp}+\rho_v}\right) \quad (8)$$

The NDVI valuesobtained are contained in a scale that ranges from values between -1 to 1 (Neto *et al.* 2008). The delimitation of the flooded surfaces was carried out as described by Sakamoto (2010), which consists of three phases: (i) composition of the bands derived from the calculation of the NDVI, (ii) comparison of these indices to identify and separate the different classes of land use, (iii) generation of classified images for the entire time series, delimiting the water bodies of other land uses. The last phase was defined by four distinct classes: free water (totally floodable regions), floodable vegetation (temporarily flooded regions), non-floodable vegetation (regions covered with vegetation without flooding), and other regions that are not of interest in this study (Santos, 2009). To calculate the areas flooded by the hydroelectric dam, the software Envi 4.5 and Qgis were used to obtain the results of the area flooded in km².

2.4 Acquisition of malaria cases

Data of registered cases of malaria in the studied area were collected from the Ministry of Health, Health Surveillance Secretariat (SVS), Epidemiological Surveillance Information System, and demographic databases from the Brazilian Institute of Geography and Statistics (IBGE). The malaria disease data extracted from the Epidemiological Surveillance Information System - Malaria (SIVEP-Malaria) was from 2004 to 2016.

To verify the relationship between the flooded surface area and the cases of malaria in the entire construction process (beforeand after) the Jirau hydroelectric plant, we followed the work of Viana (2003) who treats this relationship as the main aspect to cause environmental changes and social disruptions. According to this author, big dams generate serious problems for the health of the affected population.

Malaria disease was represented in the analysis by the Annual Parasitic Index (IPA), which has the number of positive malaria tests (codes B50 to B53) per thousand inhabitants, in a given geographical space, in the year considered (RIPSA, 2017).

The risk of the occurrence of malaria was estimated in the population in the region of influence of the Jirau reservoir during period selected for this study, and the respective population exposed to the risk of acquiring the disease.

In Brazil, endemic areas are located in the Legal Amazon Region, with degrees of risk expressed in IPA values ranging from low (0.1 to 9.9), medium (10.0 to 49.9), and high (greater or equal to 50.0).

The use of malaria IPA makes it possible to assess the risk of malaria transmission in a given geographical space, to analyze population, geographic and temporal variations in the distribution of malaria cases. This represents an important piece of the set of epidemiological and environmental surveillance actions for malaria and alsocontributes tosubsidize planning, management, and

evaluation processes of health policies and actions aimed at controlling vector-borne diseases (DATASUS, 2010). The method of calculating the malaria IPA can be expressed in Equation 9, where NPE = number of positive malaria tests; PR = resident population in a given region and time.

$$IPA = 1000x\frac{NPE}{PR} \quad (9)$$

2.5. Relationship between flooded area and health aspects

The relationship between flooded areas and IPA (i.e. health aspects) was verified with linear regression. According to Peternelli (2002), this analysis makes it possible to verify the correlation between two distinct quantitative variables.

III. RESULTS AND DISCUSSION

NDVI values were calculated for all years under study based on data of TM sensor and OLI sensor in a 2-year interval from 1994 to 2015. However, in 2013, the year that the OLI sensor and Jirau Hydroelectric Plant started operation, satellite images were entirely covered by clouds, interfering in the accuracy of the estimation of the flooded surface. To compensate this, NDVI was calculated for the June and July of the years 2014 and 2015.

The values of 1994, 1998, 2000, 2005, 2007, and 2009 were before any intervention on the Madeira River channel in the current location of Jirau reservoir. In 2011 part of the dam was already installed and the course of the Madeira River was deviated, during the construction period. In 2013, the Hydroelectric Plant started operation. The years 2014 and 2015 represented the period after the installation of the dam.

We observed a remarkable increase in flooded areas upstream and downstream of the Jirau dam (Table 2). The average flooded area before the dam, calculated between 1994 and 2009, was 770.3 km², while in 2011 this area increased to more than 867.3 km², and continuously increased after 2013, reaching 335.2 km² in July 2015. According to the inspection report of the Federal Secretariat of Internal Control, Porto Velho - RO (CGU, 2014) the area under influence of the Jirau reservoir was affected in its physical, environmental, and economic aspects.

This scenario was the result of the elevation of the Madeira River up to the historical quota of 19.74 m on March 30, 2014, a measure that corresponds to 3.06 m above the value already considered as overflow quota. We highlight that the quotas registered in the higher historical floods were 17.44 m and 17.50 m in 1984 and 1997 respectively). After the operation of the Jirau Hydroelectric Plant, the most critical level of the flooded area was in 2015.

Table 2: Flooded surface in areas under influence of Jirau Hydroelectric Plant, in Porto Velho, State of Rondonia, Brazil, between 1994 and 2015.

Years	Flooded area(Km²)
1994	747.6147
1998	729.6669
2000	778.3920
2005	831.0465
2007	763.6455
2009	771.4989
2011	867.3948
June 2014	1,335.2877
July 2014	1,319.4351
June 2015	1,376.8002
July 2015	1,370.3085

The influence of the Jirau dam in increasing the flooded area of surrounding territories has the potential to result in socio-environmental and ecological impacts such as habitat fragmentation, native fauna and flora loss, and relocation of residents, mainly upstream of the dam. As more water is available in inhabited areas, the possibility of insect vectors for diseases such as malaria increases.

Porto Velho represented 64.8% of the registered cases of malaria disease in 2014 (BRASIL, 2017), considering all Administrative Regions of Rondônia State. According the Rondonia's State Program for Malaria Control (PECM/AGEVISA-RO, 2017), the municipalities of Alto Paraíso, Candeias do Jamari, Cujubim, Guajará-Mirim, Itapuã do Oeste, Machadinho do Oeste and Porto Velho are in the transmission area of malaria, while Castanheiras, Cerejeiras, Chupinguaia, Colorado do Oeste, Corumbiara, Espigão do Oeste, Minister Mário Andreazza, Mirante da Serra, Novo Horizonte, Nova União, Parecis, Presidente Médici, Primavera de Rondônia, Santa Luzia do

Oeste, São Felipe do Oeste and Vilhena were free of the disease.

Based on the database obtained for governmental sources, we verified that the number of cases of malaria in Porto Velho has substantially decreased between the years evaluated in this study (Table 3).

Table 3. Number of registered cases of malaria disease in Porto Velho, State of Rondonia, Brazil, between 2004 and 2016.

Years	Number of cases (malaria)
2004	33,942
2005	44,464
2006	36,108
2007	32,774
2008	21,994
2009	19,766
2010	22,887
2011	18,247
2012	16,953
2013	8,221
2014	6,409
2015	2,965
2016	1,782

The decreasing behavior observed in Porto Velho, a region under influence of the Jirau reservoir, is in line with the report of the World Health Organization (WHO), which describes that malaria has been showing a reduction in its incidence in all countries, since it went from approximately 500 million cases in 2010 to 198 million cases in 2013, that represents a reduction of 60.4% (WHO, 2015). According to Brazil (2015), in the same period mentioned in the WHO report, Porto Velho presented a 64.1% reduction in the number of malaria cases.

The reduction in the number of malaria cases over the years may have been influenced by climate changes, considering that these changes can modify the conditions of disease transmission (Kovats, 2000). In Porto Velho, another potential factor may be the introduction of a new drug combined with artemisinin derivatives to control the malaria disease vector (BRASIL, 2006).

The linear regression between the number of malaria cases and the flooded area indicated a negative correlation between these variables ($R^2 = 0.5369$, Slope = -18.80 and $p < 0.05$; Figure 2) which leads to the inference that the number of malaria cases in Porto Velho decreased in the years evaluated while the flooded area increased.

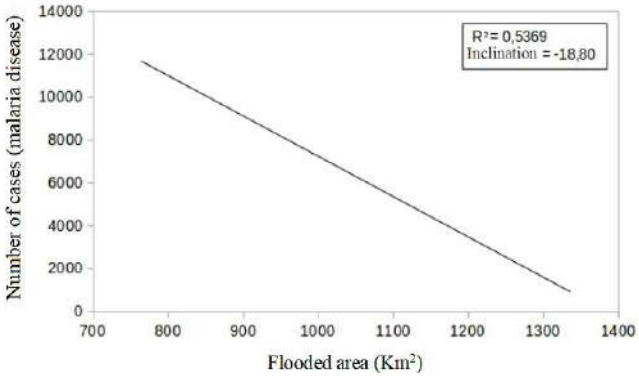

Fig.2: Linear regression between the number of malaria cases and the flooded area in Porto Velho, Rondonia State, Brazil, between 2004 and 2015.

Anopheles darlingi, the main vector of malaria in Amazonian environments shows, in the northern region, greater abundance in anthropized environments (Oliveira and Luz, 1996). Previous studies also carried out in the North region, notably in the state of Rondônia, also demonstrated the synanthropy of these vectors (Klein and Lima, 1990). According to the data analyzed, it can be seen that there has been a significant increase in the population in all ARs since 2010, but the same has not happened with malaria cases, given that there was a decline in all regions during the year. analyzed period.

For malaria disease, in the case of the construction of dams, the number of breeding areas of the vector mosquito may increase and contact with people may be intensified, so there is an expected increase in the risk of infestation and consequently in the number of cases (Tubaki *et al.* 2004).

Lima (2016) raises the possibility that the filling of the Jirau reservoir may have eliminated numerous breeding sites, given the increase in the water mirror, however, the possibility of forming others is not extinguished, as the adaptation of the vector to these new breeding sites is just a matter of time (Lima, 2016). Considering that the presence of asymptomatic patients with plasmodium (Camargo *et al.* 1999; Alves*et al.* 2002;

Lima, 2016), plus the presence of vectors, the risk of future epidemic cycles cannot be overlooked.

Our results show that, in absolute numbers, malaria showed a sharp decline, even with the increase in the flooded area in the area influenced by Jirau reservoir. However, Lima (2016) registered an increase in the detection of malaria disease by *Plasmodium falciparum* (which causes 90% of malaria cases) in the same period in the region studied. So this scenario can be represent a period of adaptation of the vector to the new landscape scenario and ecological patterns, efficiency of the vector control with combined drugs, or deficiency in the system of registration and identification of the cases of malaria in the region by the health and epidemiological service at the local, regional and state levels.

We emphasize that more flooded areas together with the presence of vectors can represent optimal conditions to malaria diseases and the risk of future epidemic cycles cannot be overlooked and must be treated as a priority in public policies.

IV. CONCLUSIONS

In the years 1994 to 2009, there was no substantial change in the flooded area when compared to the years to the increase verified for 2011, 2014, and 2015.

The average flooded area from 1994 to 2009 was 770.3 km². After installing part of the dam in 2011, this area increased to more than 867 km², in the period of June 2014 and July 2014 this flooded area increased to more than 1318 km² and for the same period of 2015, this flooded area increased to more than 1370 km².

Remote sensing techniques can be used for temporal analysis, as well as monitoring flooded areas.It was expected that the incidence of disease would be entirely linked to the increase in the flooded area due to the displacement of workers to the region, however, a negative relationship was found. The linear regression model indicated that the number of cases of malaria decreases with the increase in the flooded area.

Although the data show a decline in the number of malaria cases in the years studied, there is a need to continue the present study to verify whether this correlation can become positive, since due to the adaptation of the vector, it may be that in the course of years there has been an increase in malaria epidemic cycles.

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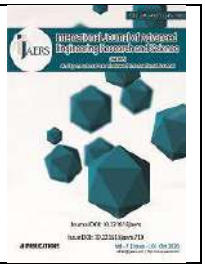

Application of Lean Manufacturing to Reduce Unproductive Times in a Valve Spring Inspection and Packaging Cell

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***Keywords*—Continuous improvement, Lean manufacturing, Packing, Productivity increase, Quality.**

***Abstract*—*Lean Manufacturing (LM) is a philosophy that allows companies to be elevated using their tools and contribute to the improvement of sectors. Therefore, it is necessary to adopt this system in order to continuously improve it, therefore, the general objective of this research was to analyze the feasibility of implementing the lean manufacturing tool in a valve spring inspection and packaging cell. To do this, specify the following specific objective, determine a method capable of increasing production capacity through LM, in order to increase competitiveness and profitability and evaluate the time results provided by LM. An action research was carried out to understand the benefits of applying this study in an inspection and packaging cell through the use of practical activities in company X. The results show that using tools such as the Ishikawa Diagram it is possible to use the cause root of the problems, thus allowing to develop actions to solve the problems. Thus, it was possible to verify that, when discovering the problems, it can increase by about 15% in area 1 and 9% in area 2.*

I. INTRODUCTION

Globalization is a phenomenon that has occurred frequently in recent decades, with this, there has been a great expansion of the market, as well as the increase in the competitiveness of companies, which required the development of new tools and methodologies to improve production processes. In this scenario, it is worth highlighting the productive models, which have changed, that is, the high standardization and mass production gave rise to the production of smaller volumes and has its characteristics constantly adapted to follow the market oscillations and also the demands of consumers [1].

This was necessary because the number of companies that started to offer similar products increased, increasing the competition among them, culminating in the reduction of the prices of these materials. In this way, organizations began to modify their production flow, thus contributing to minimize waste while increasing productivity and reducing production costs [2].In this scenario, the LM emerges, which is a concept aimed at reducing waste and allowing the organization of the production management process. In addition, this philosophy aims to respond to market changes in a more flexible, fast and quality way. This increases organizational competitiveness and reduces existing waste in production activities [3].

It is worth mentioning that the increase in competitiveness among companies has made it necessary to employ systems in order to optimize production chains and an efficient way to do this is with the LM, which has been a methodology widely used in large companies due to the benefits it can bring. Therefore, this work is justified

because, if applied correctly, this tool can reduce unproductive times in the inspection cell and valve packaging. This occurs, since this system relies on the principle of continuous improvement, that is, constantly improving the activities performed so that organizations remain competitive in the market

Thus, the lean manufacturing (LM)philosophy seeks to create a productive model that reduces the existing times between the order (client) and delivery (company) stages in order to meet customer expectations. However, for this methodology to be effective it is necessary that all stakeholders are committed to the process, thus allowing to achieve the projected results. Faced with this, this work sought to study a problem, which is presented in the form of a question, which is, how the LM can be applied in an inspection cell and valve spring packaging to reduce unproductive times?

To answer the question problem it was necessary to determine the objective that served as a basis to guide this work. Thus, the present study started to have as a general objective the analysis of the feasibility of implementing the LM tool in an inspection cell and valve spring packaging, in an auto parts company located in the Vale do Paraíba, in the state of São Paulo (SP).

Due to current business competitiveness, it is necessary to use a management system to improve production processes. Based on the success history of the implementation of the LM, it can be affirmed that this system brings good results when correctly applied in the inspection and packaging cell, especially in this work, which sought to reduce unproductive times.

In order to validate the relevance of the subject, research was conducted in [4] and [5] databases considering the period between 2016 and 2020, using the keywords: continuous improvement. lean manufacturing. packing. productivity increase. quality. In view of this, it is worth mentioning that the LM is considered by scholars in the literature studied a management philosophy that seeks to reduce waste while increasing productivity and quality, being this a theme of relevance at the time.

Through the [5] and [4] databases, a total of 202 publications in the [5] database and 222 documents published in the [4] portal were observed, with the combination of the words: lean manufacturing. continuous improvement. productivity increase. And few or no results when adding the keywords: inspection and packing.

[6]reveal that, through theoretical reviews, it is possible to raise the publications that surround the theme. With this, it is possible to identify what has already been written and by whom, generating a basis for the development of new works that can enrich and contribute even more to the development of this important field.

In order to have the knowledge of the number of journals published and what was written on the LM theme, the consultation was done in the [5] database. In the research conducted with the keyword lean manufacturing obtained returns of 1,957 papers published in the period between 2016 and 2020. Also in the [5] database there were 9,390 citations for the same keyword, as shown in Fig. 2 where it was also noted that there was an increase in the interest of researchers on the subject in the period between 2016 and 2020.

One of the possible explanations for this phenomenon is the fact that there is still much emphasis on the theoretical approach of the LM and its tools. Although the LM is often used in companies, most publications present a theoretical nature fortifying the reason of studying the practical nature of the LM.

II. THEORECTICAL BACKGROUND

Japan, in 1950, after being defeated in the Second World War suffered with a great crisis, and it was necessary to rebuild the country. The economy was collapsing, and most of the companies that were there had enormous financial difficulties, besides suffering to remain in the market. And it was precisely in the midst of this crisis that the Japanese TaiichiOhno and Eiji Toyoda, from Toyota, created a widely spread model that is the Toyota production system [7].

This productive model created by Toyoda and Ohno occurred after these professionals visited the United States, where they came into direct contact with the Ford model. They observed that the Ford model was efficient, however, it had a big problem, which was the enormous waste of resources.

This productive model created by Toyoda and Ohno occurred after the visit of these professionals to the United States, where they came into direct contact with the Ford model. They observed that the Ford model was efficient, however, it had a big problem, which was the huge waste of resources. With this, the basis emerged for the creation of the toyota production system, which adopted quality manufacturing and waste reduction as its guiding principles [8].

With the reduction of waste, the aim was to minimize all activities that added or did not add value to the item produced, while manufacturing with quality was aimed at producing goods free of defects. The creators of the method also stated that there was another key point for the previous characteristics to be met, which was the

involvement of the collaborators, that is, without the participation of these subjects, it would not be possible to achieve the projected results [9].

Shortly after its creation, the Toyota production model began to be used in most Japanese industries. It can be mentioned that the export of Japanese products has made several entrepreneurs around the world show interest in this production system, with this, the toyota method has become popular in Europe and the United States, allowing to obtain items with quality and competitive prices [10].

In view of this, it can be mentioned that after the creation of this model the Toyota company became a reference when the subject is excellence in automobile manufacturing. The company currently has about ten factories around the world and more than thirty thousand employees in North America alone, being one of the main automakers in the world [11].

It is also important to mention that there has been an evolution of the toyota production system, which has culminated in several designations from the improvement of this model. Among these systems one can mention justin - in - time (JIT) (lean/pull production) and the LM that is the focus of this work. It is worth mentioning that initially the LM philosophy appeared, only after some time, with several modifications and evolutions, is that the LM nomenclature appeared, which is a system related to the use of quality, production and management systems that aim to add value to products and eliminate waste [9].

2.1 Lean Manufacturing

The LM is an innovative theory as far as management practices are concerned, since actions are developed that seek to gradually eliminate all sources of waste in the productive system. To this end, several procedures and simple approaches are carried out in order to make the processes perfect, having as guiding principles continuous improvement and constant satisfaction of all those involved in the process. It is important to highlight that in this case time is used as a strategic tool in the processes [3].

Therefore, it is worth pointing out that the LM philosophy aims to create a production without waste and clean, in order to minimize the time between the moment the client places the order and its delivery to the consumer. For this to occur, it is essential to create processes that ensure the quality, flexibility and speed of production flow. Thus, you can mention that this system consists of the integration of tools, operational techniques and principles that have as main objective to ensure perfection in the process of creating value for consumers [12].

In this scenario, it is worth mentioning that the LM philosophy was based on the toyota production system, so it inherited from this model characteristics such as flexibility. Flexibility refers to the ability of organizations to produce their items in small batches in order to meet the demands and market responses from the wide variation of this environment [2].

Thus, the LM consists of a lean production system, which aims to produce on a smaller scale when compared to traditional mass production systems. The reduction in production results in the elimination of existing waste in the production chain, which also allows increasing the efficiency and productivity of the production flow [1].

2.1.1 Benefits of using lean manufacturing

The implementation of the LM generates significant benefits for organizations, including better use of physical space, improved quality management, cost minimization, increased efficiency and waste reduction [13]. There are claims that some organizations that have implemented the LM use different performance measures to evaluate gain after LM implementation. Usually these new measures are not financial, but are useful to generate future financial results [14].

2.2 Seven Lean Manufacturing Wastes

According to [15], companies that adopt the LM philosophy have as their main focus to eliminate the seven existing wastes in the production flow. These wastes are divided into two distinct classes, the hidden and the visible. The hidden wastes are those that are not perceptible, so it is necessary to discover them and eliminate them to avoid their expansion in the process, which can result in several problems for organizations, among which we can highlight:

a) Equipment failures;

b) The execution of unnecessary procedures and activities;

c) Extra costs in deliveries.

For [16], as far as visible waste is concerned, it is worth mentioning that these are those that are easily observed by the team. Thus, it is necessary for the company to develop and stimulate methods to eliminate these problems, which can be:

a) The wastes;

b) The rework;

c) The defects.

For [17], it can be highlighted that waste is an element that integrates the entire production flow and can be observed in several ways, among the most common:

a) The movement of people, equipment and products;

b) The documents;

c) The infrastructures;

d) The utilities;

e) The stocks.

According to [18], waste consists of any activity performed by human beings that results in the absorption of resources without generating added value for the company. [7] and[19] classify waste in seven categories [20] that can be seen in Fig. 1.

Fig. 1: Seven wastes.
Source: [21].

The LM seeks to combat exactly these seven wastes to have a leaner production. In view of this, these elements will be discussed below, pointing out their main impacts on organizations, especially on production flows [22].

2.2.1 Lean Manufacturing

According to [23], the waste associated with the defect is directly related to the manufacture of defective items, which results in rework, because these products need to be corrected, for example. Another problem of this waste is the resources employed in the occurrence of rework or defective products. There are several causes for this, however, the main ones are:

a) The employment of the sector;

b) The lack of clarity, on the part of the client, in the specification of a product;

c) Deficiency in control processes;

d) The hiring of disqualified labor;

e) The purchase of disqualified suppliers;

f) Incapable processes.

It is worth mentioning that producing items without rework is something related to planning and prevention and not to inspections and corrections, because it is only possible to reach these levels when planning and prevention tasks are well executed. Another point that deserves attention is that products with lower quality tend to result in dissatisfied consumers, besides elevating the costs of the company, which needs to replace the products that were defective. In this scenario, it can be highlighted that only with preventive measures and continuous improvements is it possible to minimize waste from defects [24].

2.2.2 Overproduction

For [25], the waste related to overproduction occurs when companies start producing faster than they need or when more is produced than the required demand. This problem can be caused by several issues, among which we can highlight:

a) The use of practices that stimulate incentives or targets per volume of production;

b) The adoption of accounting practices that promote stock increase;

c) The elevation of machinery and equipment capacity;

d) Unbalances in production flow;

e) Deficient production planning.

Thus, overproduction tends to generate an inconvenience for many companies today, which is the high volume of finished items in stock. Moreover, this waste promotes a distorted view of reality, because it is commonly considered that the stock of finished items is an asset of value to the organization. However, this is not true, because these components tend to be outdated, which results in inventory costs until their sale [26].

2.2.3 Waiting

According to [27], waste by waiting comes from idleness by waiting time or from human idleness. There are several causes for this type of waste, the most common of which are:

a) Delays or lack of materials;

b) Large equipment setup times;

c) The absence of equipment scheduling for the production flow;

d) Non-flexible work forces;

e) Incorrect choice of the team;

f) Unbalanced lines or processes.

These problems are most observed when the physical or human resources have to wait due to delays that occur due to lack of information, lack of availability of resources or even delays resulting from the arrival of materials. A very common example of this waste is when the right tools have to be expected to start producing an item or when the signature of a professional responsible for an activity is required to proceed with an activity [28].

2.2.4 By Transport

For [29], waste by transportation is due to unnecessary movements of equipment, tools and materials, and its main causes are:

a) The bad planning of the products route;

b) Suppliers that are located far from the productive centers;

c) The complexity in the flow of materials;

d) Equipment layouts or bad production cells;

e) Disorganized work areas.

The waste due to transportation is directly related to any resources, whether documents, materials, supplies, tools, people or equipment that are transported from one space to another without a need. In view of this, it is worth mentioning that the best way to combat this form of waste is to create a productive layout that is efficient, always aiming at reducing times between operations [30].

2.2.5 By Movement

According to [31], the waste related to movement in operations occurs when it is necessary to promote unnecessary locomotion of all workers, among the main causes of these problems, stand out:

a) The existence of an inefficient flow of materials;

b) Disorganized work cells or stocks;

c) Work instructions not understood or without standard;

d) Unorganized work environments;

e) Inadequate layouts.

This problem is commonly observed when employees need to make unnecessary movements to perform a task, for example, lowering, lifting, walking or searching, which results in the interruption of the activities performed. Therefore, a study should be made of all the movements that the workers perform in order to evaluate their necessity. When it is detected that such a movement is necessary, it is important to study it in order to make it more practical, and the best way to do this is by redesigning the layout of the productive flow or reorganizing the work environment [32].

2.2.6 Due to Over-processing

For Santos and Santos [33], waste due to excessive processing is observed in activities performed by machines or by human beings. The main causes for this type of problem are:

a) The constant changes in the process;

b) Excess quality;

c) Poor preparation of work instructions;

d) The elaboration of incorrect value analyses;

e) The lack of objectivity in the specification by the clients.

In view of this, it can be highlighted that these wastes are related to tasks that do not have the capacity to add value to the item produced. A common example of this problem is the addition of steps in the process that tend to increase the quality of the products or not add value to it, resulting in additional costs that will decrease the profitability of the company. It is important to emphasize that through a thorough analysis it is possible to identify which activities are performed in the production flow and that do not bring any value to the product and that directly impact on operational costs and productivity [34].

2.2.7 By Stock

According to [35], stock-related waste occurs due to the large volume of inputs, raw materials or end products in the company. One of the main causes of this problem can be highlighted:

a) The lack of purchase patterns;

b) Lack of requisition for purchase of materials;

c) High lead time;

d) High rework rates;

e) Large lots;

f) The unbalance of production flow;

g) Excess production.

Thus, the waste in stocks is directly associated with the high volume of purchases or even storage of materials, inputs or any other resources. It is worth mentioning that to avoid the occurrence of this problem it is necessary to create a utilization rate that portrays the reality of consumption of each resource employed in the process, as well as the elaboration of a coherent planning [36].

2.3 Quality Tools

There are several tools that can be used in the LM to provide guidelines that help eliminate the waste that has been generated along the production flow, thus improving the activities related to this important organizational component [37]. The main quality tools that can be used in the LM are presented below.

2.3.1 Total Quality Control (TQC)

Total quality control or total quality is a concept developed by Duran, and this tool is considered to be an evolution of statistical process control (CEP). The difference between these components is that CEP seeks to solve problems related to the production flow, while total quality aims to solve all the objectives of the company in

order to minimize cycles, eliminate waste and raise quality [38].

The main purpose of total quality is to ensure that the processes related to the manufacture of a product are continuously improved. This is done by seeking to act directly or indirectly to promote the reduction of impacts, as well as to anticipate any problems that may occur. This way, the quality of the processes and, consequently, of the final product is increased, resulting in the full satisfaction of final consumers. It is important to emphasize that the use of the term total is to reinforce that the total quality needs to be applied in all phases of the production flow and by all individuals related to it [39].

According to [40], Karou Ishikawa, who was an important management theorist and quality control engineer, in the 1960s created a list suggesting seven basic tools that can be embedded in TQC, both in the industrial and administrative spheres:

a) Dispersion diagrams, which are widely used in the evaluation of data on a horizontal or vertical axis, this being done in order to point out the impact of one variable on another. In this instrument, the data can be observed by a series of points, each of which presents one of the variables. With this, the position on the horizontal axis is responsible for pointing out the value of a variable while the vertical axis points out another one when there are two variables;

b) The control charts consist of a graphical model that is adopted in process monitoring. By means of this tool, it is possible to determine, in a statistical way, the control limits with the help of a middle line, a lower line and an upper line, and all the data, which are outside these limits, are treated as a special cause. It is recommended to use the control charts in order to analyze if the process is controlled, that is, without special causes;

c) Histograms, which are called frequency charts, consist of a bar chart, which is used to point out the frequency at which an item occurs. In this case, each bar acts as a class interval, while the height represents its frequency. It is worth mentioning that this tool aims to understand the behavior of a given activity, thus it acts as an important data distribution indicator;

d) The Pareto diagram consists of a graph in which it is possible to prioritize occurrences according to frequency, which helps to understand which process should be prioritized. The basis of this instrument is the rule that 80% of the consequences come from 20% of all causes, thus it is possible to observe the problems or causes of something easily and quickly. After the survey of the main observed occurrences it is possible to construct a table and its respective absolute frequency;

e) The check sheets consist of forms designed to collect and fill out the data in a concise and easy way. In this instrument, all data of items that need to be verified is recorded, thus helping to perceive the reality of the problem in an immediate way, besides allowing an instantaneous interpretation of adversities, thus contributing to reduce confusion and errors;

f) Ishikawa's diagram, also called herringbone diagram or cause and effect diagram, is a graphic structure that aims to predict and raise the causes of a problem, as well as solve its effects;

g) Flowcharts are graphical, matrix or linear representations of a given work process, and they are used to improve or illustrate the visualization of the production flow and an operational sequence.

2.3.2 Total Productive Maintenance (TPM)

It is important to mention that the total productive maintenance consists of a tool that aims to increase the useful life and performance of equipment and machines in organizations. In this way, this tool can be directly integrated to the LM, since it aims to reduce the waste that exists along the production flow. Therefore, for TPM to be applied correctly, all employees must be involved in the process, thus allowing them to acquire new assignments and responsibility in the organization [40].

For [28] this tool aims to eliminate corrective maintenance in companies, since this task brings with it a series of wastes and losses, among which we can mention:

a) Delays in fulfilling production programs;

b) Refuse;

c) Stopped equipment (which culminates in production delays and increases the company's costs).

This philosophy is based on eight work pillars, as illustrated in Fig. 2. Thus, it is worth pointing out that this division contributes to the creation of improvements in all points of the company in a matrix way, that is, even when acting on distinct issues, all are widely interconnected [34].

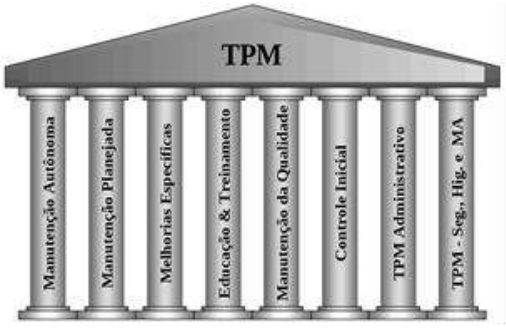

Fig.2: TPM Pillars.
Source: [41].

In this context, TPM seeks to adopt the philosophy of preventive maintenance in the organization. This type of maintenance occurs in a programmed way in machines and equipment, bringing a series of benefits to the company, among which we can mention the increase in productivity, the reduction in downtime of the production flow, the minimization of operating costs and the increase in the useful life of the equipment [10].

2.3.3 Plan, Do, Check, Action (PDCA) Tool

According to [32], the PDCA cycle is a tool created to develop and make the processes related to management execution more agile and clear. With this, this system is divided into four distinct parts, which are:

a) P = plan, which is the planning stage;

b) D = do, which is the execution stage;

c) C = check, which is the control and verification stage;

d) A = action, which refers to the development of preventive actions.

Fig. 3 illustrates the PDCA cycle.

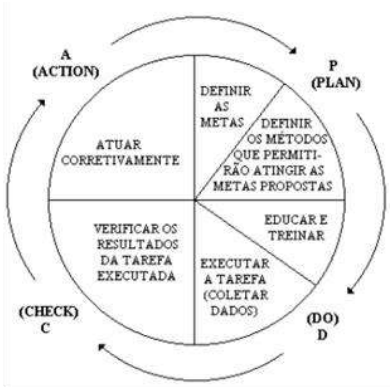

Fig. 3: PDCA cycle.
Source: [42]

PDCA starts through planning and then several actions are generated, which allows them to be executed later. After this process, the tasks performed are checked and compared if they are in accordance with what was planned and repeated several times, and tasks are performed to minimize or eliminate existing defects in processes or products [28].

2.4 LM TOOLS

There are several tools that can be used in the LM to provide guidelines that help eliminate the waste that has been generated along the production flow, thus improving the activities related to this important organizational component [37].

2.4.1 Process Maps or Value Stream

It is essential that before seeking solutions to a company's problems or measuring its performance, it is essential to understand the items it manufactures and delivers to its customers, in this way it is possible to assess whether in fact what the organization adds value to its customers. This means that it is necessary to understand if the organization has accomplished what its customers want [43].

For [44], the concept of value can be defined as the level of benefit that has been obtained due to the use of the product, that is, the perception that consumers and other stakeholders have about the fulfillment and overcoming of their expectations and needs due to the attributes and characteristics of an item. In view of this, companies need to deliver and create their values by balancing values according to the perception of their customers. It is also worth mentioning that the activities that add value to the organization are divided into two groups, the support and the main ones:

a) The support activities refer to those activities that serve as a basis or aid for the execution of the main activities;

b) The main ones consist of tasks that allow for the creation of the product, as well as its subsequent transfer to consumers.

[45]and[46], portray the Value Flow Map (VSM) as an important focus for processes providing efficient identification of where and how to improve. Fig. 4 illustrates an example of VSM.

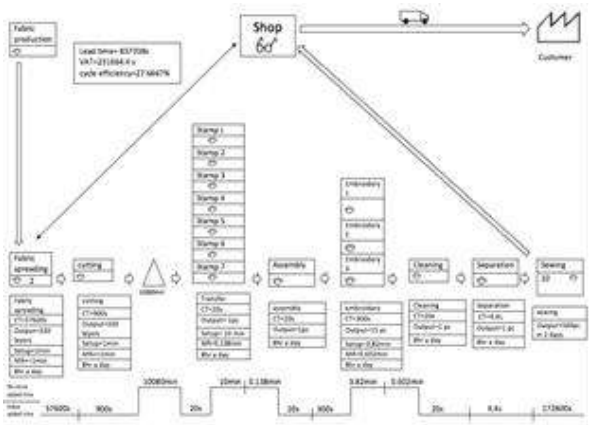

Fig.4: Value Flow Map.
Source: [46].

Observing Fig. 4 it is possible to see a value map, being that the activities present in the upper part refer to those of support and that do not integrate the productive flow, however, they act helping the accomplishment of the main activities. The activities present in the lower part of

the figure are the main ones, being that they are arranged in line and their execution allows the manufacture of the good and its delivery to the consumers. In view of the above, it can be mentioned that through the mapping of a productive system it is possible to evaluate which are the tasks that tend to add value to the productive flow, as well as the process errors [47].

2.4.2 Autonomation or Jidoka

Through automation or jidoka, machine and equipment operators have the autonomy to interrupt the operation of these devices and even the production flow when an abnormality or defect is observed on the line. The principle of this tool is to work in an integrated way the decision of the human being with automation in order to avoid that the parts with defects are passed to the next stages of production. In this scenario, it can be mentioned that for such a tool to integrate the lean concept, it needs to stop performing the inspection of the process, since, this represents a waste, that is, it does not add value to the final product [40].

2.4.3 Poka-yoke

The expression poka-yoke means error-proofing, i.e., using processes that seek to reduce defects arising from errors or human failures, thereby automating or optimizing activities that are assigned to operators in order to reduce possible failures in the process. The main purpose of this tool is to serve as a base for lean production, helping in the decision making processes as well as solving problems [38].

2.4.4 Self-control

For [30] self-control in the production flow is related to activities such as prioritizing, quantifying and identifying what are the solutions to the problems observed at the time when they occur. According to the LM system, in the productive processes that count with self-control it is necessary:

a) Perform the activities without waste;

b) Perform the tasks with cleaning and organization;

c) Perform the activities correctly since the first attempt;

d) Execute the tasks safely;

e) Know how to do the activities.

In face of this, it can be mentioned that the self-control technique brings innumerable benefits to meet the expectations of the final consumer. Among these benefits are the increase in market share, the increase in profit margins, the reduction of waste, the reduction of scrap, the optimization of the work environment, the increase in productivity and the increase in satisfaction of final consumers [31].

2.4.5 Continuous Flow

The continuous flow is a tool used in the LM system, thus, it stands out that through this tool the maintenance of high stocks and the production of large lots is avoided. In this case, the flow takes place through the production of only one part at a time in order to reduce the volume of components available at a workstation [47].

With this, the lean system has as main objective to obtain products with high quality, being that for this, only the quantity of necessary components should be used. Thus, the continuous flow acts as a relevant tool for the production flow, which contributes to raise the productivity of the organization without the need to make investments [43].

2.4.6 5S

The 5S is a tool that aims to promote a cleaner work environment, that is, more pleasant, tidy, organized, clean and hygienic, and the basis of this is to change the organizational culture or the habits of employees. In view of this, it is worth pointing out that 5S serves as a support for several management systems, being this a starting point to develop several improvement and quality activities in organizations [29].

In this sense, it can be mentioned that the acronym 5S can be associated with five techniques that are used in the achievement of the stipulated objectives [31]. These techniques are illustrated in Fig. 5.

Fig. 5: 5S.
Source: [48].

Seiri or sense of use is directly related to the perception about the usefulness of available resources, as well as the separation of the useful from the non useful. Seiton or sense of ordering is the task that seeks to execute activities in the right order and put things in the right place. The Seiso or sense of cleanliness aims to remove garbage, avoid polluting and avoid dirtying the environment. Seiketsu or sense of health aims to have standard practices,

values and behaviors to favor the environmental, mental and physical health of employees. Shitsuke or sense of self-discipline starts from the idea that each person has their own responsibilities, mainly their own responsibility, and this is fundamental to have adaptability with other people and the environment in a sustainable way [47].

2.4.7 Overall Equipment Efficiency (OEE)

The overall efficiency of the equipment or OEE is an indicator that can be employed at TPM. Through this tool, efforts can be directed to achieve several goals, which are to employ visual management techniques, get team employees involved in activities related to continuous improvement, make processes stable and reduce waste [49].

Thus, OEE is responsible for directly measuring the efficiencies of machines and organizational equipment in order to evaluate their performance and develop efforts to achieve the determined goals. This technique is based on three central measures: quality index, performance and availability, responsible for measuring the organization's performance in percentage [50]. Fig. 6 illustrates the OEE.

Fig. 6: OEE.
Source:[51].

Through the indicators present in the OEE it is possible to understand all the efficiency losses existing in machines and equipment. In this context, it is worth highlighting the eight losses that most impact on the efficiency of devices, which are the failures or breaks, adjustments or setups, losses related to engineering (change of tools, for example), drives, small failures, speed reduction, scrap rates and rework or shutdown. Thus, by understanding these issues it is possible to increase the performance of machines and equipment in order to eliminate waste and correct existing failures [49].

2.4.8 Process Standardization

Another tool that can be used in the LM is the process standardization, thus, this tool is used to increase the maximum performance of all the company's employees. This activity consists in documenting and registering all the manufacturing steps, as well as the work instructions in order to predict how the operations are performed, the space required to perform it, what are the parameters to be considered in the process, which machines and equipment are required and also the space required. This way, it is possible to survey which operations do not generate value to the final product, eliminating them [52].

2.4.9 Takt-time

The takt-time is obtained by dividing the daily operation time by the total quantity of parts to be manufactured daily. This parameter is closely linked to the cycle time, which is the time required for a component to be produced, that is, the time spent between the repetition of the start and end of the operation. It is worth mentioning that the cycle time is the element responsible for limiting takt-time, which is pointed out as being the bottleneck resource and not only the rhythm of the production line according to daily demand and available time [30].

It can be highlighted that takt-time is directly related to quality, since work instructions are created so that there is an instant solution for all the defects that exist in the process. If there is a repair time that is longer than the takt-time, it is necessary to remove the product from the production flow so that it can be checked or reworked in another work station so that there is no loss of time in production [35].

2.4.10 Production Leveling

As previously mentioned, the takt-time is used to determine the production rhythm, and it is responsible for determining the cycle time. However, depending on the component to be manufactured, the cycle time may exceed the takt-time, which now requires the leveling of the production flow to produce different parts, but with continuous flow [28].

This way, for the production leveling to occur in the lean system there must be intervals in the manufacturing where different items are produced in an interleaving manner and in small batches. This way, it is possible to meet the requested demand, as well as immediately meet the orders for any part that has already been produced before. In this scenario, it is worth mentioning that the production leveling is responsible for promoting the production flow flexibility and, if there are delays in the manufacturing stage, only some deliveries will be delayed, which would not be easy to achieve in large scale production systems [8].

2.4.11 Quick Changeover and Quick Setup

The setup time needs to be low in order to produce in small batches and without failures, which can also contribute to make the system more flexible and able to

satisfy the needs and demands of consumers. With this, quick tool change and quick setup are tools used in the LM to optimize the production system [43].

Fast tool changes allow a considerable reduction in equipment set-up costs, as well as avoiding large stocks due to higher set-up times. In addition, with this tool it is possible to reduce the adjustment errors that may occur during setup [10].

To understand the setup method employed in companies, it is necessary to perform movement and time evaluations to understand whether the elements are external or internal, and the main objective of this is to turn the internal setup external. The internal ones are those performed only when the machine is stopped, while the external ones are executed with the equipment in operation. To achieve this, it is recommended to train the operators and standardize the parts, thus allowing a multifunctionality in operations [40].

2.4.12 Just-in-time

The just-in-time is a system employed in production management, being responsible for evaluating what needs to be transported, purchased or produced before the exact moment, that is, pointing out what needs to be in the right place and at the right time. This way, the raw material or the product arrives at its place of use only when it is required, for this, it starts from the pulled production system, which is a component responsible for developing through a demand, that is, producing only what the customer wants. Thus, with this tool it is possible to reduce the stock of materials, establish continuous improvement in processes, increase continuous efforts to solve problems and establish a continuous production flow [29].

2.4.13 Kanban

The kanban system uses plates, signs or cards, which are used in material handling processes and production, serving as a basis for controlling orders and activities in order to point out the supply or production need. The kanban tool is visual and its most used component are the cards, which act informing the production flow the need to feed a work station or produce. This methodology works based on three distinct colors, green (operating conditions), red (attention) and red (urgency) [47].

2.4.14 Kaizen

For [53], kaizen or improvement is a tool that values continuous improvement, thus increasing profitability and productivity without requiring high investments, as well as contributing to lower production costs and waste. For this tool to be successfully implemented, it is important that everyone involved in the production flow gets involved with it. This is necessary, because only these subjects are able to point out the points where there is waste, as well as ways to eliminate them. According to [54], the great theorist of kaizen philosophy, Masaaki Imai lists ten principles that should be followed in companies, while [55] mention the ten principles as the ten commandments of kaizen:

1. Waste is enemy number 1. To eliminate it you must get your hands dirty;

2. Gradual improvements made continuously; it is not a punctual break;

3. Everyone in the company has to be involved, from the top and middle managers, to the base staff; the methodology is not elitist;

4. The strategy must be cheap. The productivity increase must be done without significant investments. Astronomical sums should not be applied on technology and consulting;

5. Apply anywhere; not only for the Japanese;

6. It is based on a visual management, on a total transparency of procedures, processes and values; it makes problems and waste visible to the eyes of all;

7. Focuses attention on the place where value is really created ("genba", in Japanese);

8. It focuses on processes;

9. Gives priority to people, to humanware; believes that the main effort for improvement should come from a new mentality and people's work style (personal orientation to quality, team work, cultivation of wisdom, moral elevation, self-discipline, quality circles and practice of individual or group suggestions);

10. The essential motto of organizational learning is learning by doing.

Thus, it can be said that kaizen is a tool of continuous improvement that is guided by actions. This way, teams start to create and implement solutions and also innovate or create processes that already exist in the organization, which contributes to dispense with high investments [11]. Fig. 7 illustrates the phases involved in applying the kaizen tool.

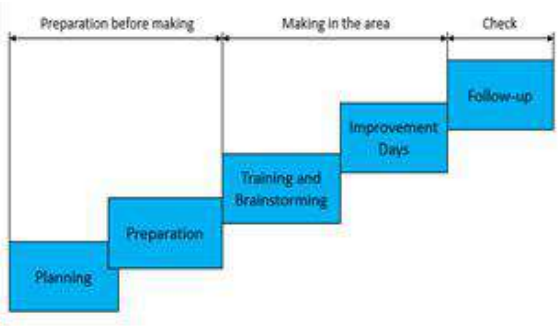

Fig. 7: Kaizen phases.
Source: [54]

2.4.15 GenbaWalk

The genba walk is a tool that has as its principle to make the employees spend more time on the factory floor instead of just in the offices. Going to the factory floor is something necessary, because it is there that the actions actually take place and, being there, the professionals start to understand in a complete and deep way the productive flow. Moreover, going into this environment allows talking to the operators who work directly with the processes, which helps to understand the problems in order to find more creative ways to solve them [47].

III. MATERIAL AND METHODS

When developing a research, one must consider in its methodological trajectory the classification of appropriate techniques for solving the investigated problem. It is necessary, then, to highlight the methods that guided the development of the study in focus, taking into consideration the nature, the objective, the approach and the procedures used in the construction of the research. Based on this thought, this chapter presents the methods selected for the execution of the project that was outlined.

3.1 Research Classification

Attending to the methodological criteria directed to the researches in the Production Engineering area, this study adopts the following types of researches: applied, as for its nature; descriptive, as for its objective; and, by the approach, qualitative, following the method of action research as illustrated in Fig. 8.

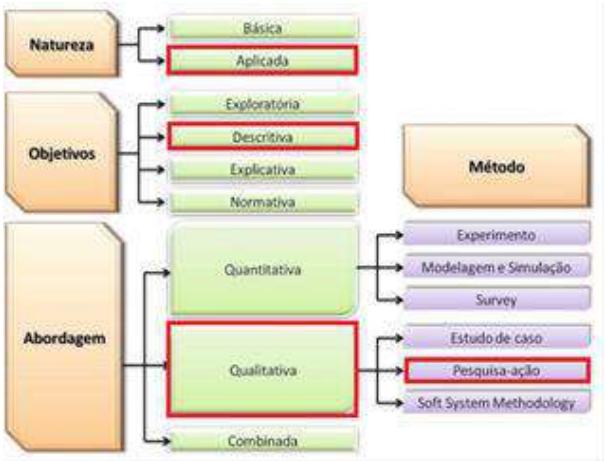

Fig. 8: Classification of scientific research in production engineering.
Source: Adapted from [56].

The software Catia V5 R19 (DassaultSystemes), AutoCad 2013 (Autodesk, Inc.) and Excel 2020 (Microsoft) will be used to perform the simulations and data analysis. To achieve the objectives defined in chapter 1, the approach to the problem followed the principles of action-research, since the procedures recommended by it contemplate the nature of the study in vogue, since it sought to generate knowledge for practical use, related to the solution of a problem identified in an auto parts factory.

It must be taken into account that practical research, as [57], "is characterized by its practical interest, that is, that the results are applied or used immediately to solve problems that occur in reality". In this context, as for the objectives, the research has a descriptive character, since from the knowledge and understanding of the premises of the LM, its tools and techniques, it was possible to use them in the proposed study.

According to [58] studies, there are several definitions about action-research, as well as several procedures for different applications. The best concept for action-research, elected by [58], is "a form of action-research that uses consecrated research techniques to inform the action that is decided to take to improve the practice".

[57]conceptualize action-research as an action or the resolution of a collective problem, and the researcher and participants in the situation or problems are involved in a cooperative or participatory manner. Therefore, this is a qualitative method that generates critical knowledge about the change presented in the system. Still according to [58], it is a variety of action-research, in which research techniques are employed, of sufficient quality to face peer criticism at the university to inform the planning and evaluation of the improvements obtained.

[58]and [57] explain that most improvement processes need this sequence: problem identification, planning, data collection, data analysis and action planning, action implementation, monitoring and evaluation of results. Fig. 9 illustrates the steps of the research-action study.

Fig. 9: Stages of research-action.
Source: Adapted from [56].

The use of the LM in this study was through the use of the seven waste concept of the LM and its techniques. It

also addresses the uses of root cause analysis tools (cause and effect diagram and 5 why) and genba walk. These tools were used to analyze the process flow and to find wastes that affect its flow, create improvements and solutions to be applied to the process, implement the actions created and, finally, evaluate if improvements occurred and in what degree of satisfaction.

3.2 Data Collection

In order to achieve the proposed goals, data was collected for this survey over a period of one month, which means a production of 2,500,000 valve springs. For this, the production line was observed, which is composed by:

- Winding;
- Heat Treatment;
- Rectification;
- Muzzle;
- Blasting;
- Blocking/compression and force adjustment;
- Inspection;
- Packaging.

It is worth mentioning that the research used the procedures and instruments described below to accomplish the data collection:

3.2.1 Observation in Loco - Genba

For [59], the objective of observation is to accurately capture the inherent aspects of a phenomenon in practice. Complementing the concept, [60] inform that it consists in examining facts or phenomena that one wishes to study and not only see and hear.

To identify the problem in the inspection cell and packaging of product X, the concept of the seven wastes of the LM was applied with the objective of evaluating the actions that add value and those that do not add value during the development of the flow. The points observed in the genbaare presented in Fig. 10.

Fig. 10: The Seven Waste of the LM. Source: Authors.

3.2.2 Interview

In order to complement the study with the seven wastes of the LM, semi-structured interviews were conducted with managers and production collaborators to discuss planning, execution, evaluation of effectiveness and monitoring/control. In this way, the researcher followed a script previously established as an instrument of information collection, having the freedom to add new questions during the dialogue.

The interviews aimed to qualify the analysis of the documentary research, since the result presented in the documents, its advances or setbacks are permeated by the human make. In this scenario, [60], affirm that the interview is a meeting of people, with the intention of obtaining information about a certain issue through a dialogue of professional nature, which in this work was to seek improvements to the waste already identified.

3.2.3 Analysis of Documentation

[59]states that "documentary research corresponds to all the information collected, whether oral, written or visualized. According to [61], the documental research carries out the examination of materials of diverse nature that have not yet received an analytical treatment, or that can be reexamined through complementary interpretations. Thus, this type of research allows the study of facts with which it would not be possible to have another form of contact, for temporal reasons or distance. With regard to documental research, the following documents have been read analytically:

a) Production notes, where productivity, scrap and eventual problems during the work shift are mentioned;

b) Production schedule, where it is informed what, when, how much and where it should be produced;

c) Fertigungsvorschrift which is the manufacturing specification defined in the product development.

3.3 Identification of the Field of Study

The study was carried out for the auto parts factory X with headquarters in Germany and branch in Brazil. It is also worth mentioning that the researcher is part of the staff, so this work was the result of a major problem observed by him in the production flow. The company was founded in 1999 and currently manufactures auto parts for the chassis line and engines with direct sales to automakers and systemists. The organization is located in the city of Taubaté, state of São Paulo, being this a privileged location, because it has access to the main highways (Dutra, Carvalho Pinto and AyrtonSenna).

The company occupies ten thousand square meters of built area and a land of forty thousand square meters of total area. The X auto parts factory has a diversified

number of equipment, such as: ovens, computer numerical control (CNC) machine tools, presses, powder painting lines and special processes such as salt bath, mechanical assembly and ring and clamp setting. The factory also has a team of specialized engineers for the development of the products, for this the professionals are using development software according to the needs of the process, such as Catia, Inventor, Siemens NX, AutoCad and Solidworks.

The company's quality assurance sector is based on the certification of standards that manage the entire quality management system and coordinates with extensive experience of its technical staff the releases of products to the customer, counting on a complete set of instruments and measuring machines. Aiming at excellence in its production processes, the auto parts factory X is increasingly implementing LM projects focused on manufacturing, seeking continuous improvement and flexibility in its processes to reduce manufacturing time and product delivery to the customer while meeting the established quality requirements.

3.4 Method Choice

According to [58], action-research constitutes "a one-off approach in which the researcher takes an existing practice from somewhere else and implements it in his or her own sphere of practice to make an improvement. The use of the LM methodology with the 5Why tool is based on the fact that it is a universally accepted technique used in company transformation projects.

The 5 Why is a tool or technique that aims to reach the real root cause of a problem by asking five times the reason for an event. It is simple and can bring interesting answers that before were not perceived by the team, but the results can be even better if combined with other tools, such as the cause and effect diagram, one of the seven quality tools used for quality control management and its composition takes into account that the causes of problems can be classified into six different types of main causes that affect the processes [62,63]:

a) Method - It is a method used to perform the work or a procedure;

b) Raw material - The raw material used in the work that can be the cause of problems;

c) Labor - Hurry, imprudence or even lack of qualification of the labor can be the cause of many problems;

d) Machines - Many problems are due to machine failures. This can be caused by lack of regular maintenance or even if it is inadequately operated;

e) Measurement - Any decision made previously can alter the process and be the cause of the problem;

f) Environment - The environment can favor the occurrence of problems, it is related in this context to pollution, dust, heat, lack of space, etc.

IV. RESULTS AND DISCUSSION

Once the procedures used were defined and based on the method determined for the proposed study, research was conducted in the valve spring process. It is important to emphasize that there was a division into two stages to better meet the objectives defined, the first part being the application of the questionnaire and the second part, more practical was to visit the genba, specifically in the process of inspection and packaging of valve springs where it was identified the problem, flow and working procedures, taking time, repetitive activities that did not add value to the product and cause root, followed by a proposal to reduce activities that did not add value to the product, resulting in increased production capacity.

4.1 The Problem

Fig. 11 illustrates how the process of packing and inspection of valve springs occurred, the process was carried out without a specific standardization, in which one can observe an inadequate use of time and unnecessary movements to perform the activities.

Fig. 11: Packing and inspection.
Source: Authors.

The company counts yet with two packaging areas, which develops the packaging activity for five clients. Fig. 12 illustrates that for each client it was adopted a different packaging procedure, which made this process more complex, especially in the A2 client's work process in which it was necessary three steps before packaging the mechanical component.

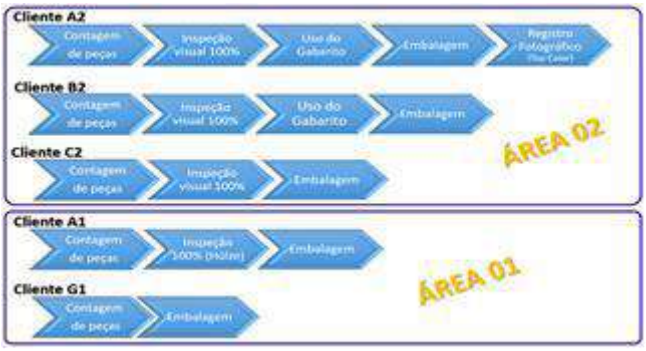

Fig. 12: Procedure performed for the various clients.
Source: Authors.

In view of this, it was chosen to apply the LM in area 2, it is worth mentioning that this process started based on the interview/questionnaire mentioned in item 3.2.2 of this study and through the use of the genba walk tool in which the researcher, who worked in the office of the company under study, walked to the factory floor and identified the problems mentioned above. As pointed out by [47], this tool allows the subjects to experience the reality of the factory floor, in addition to getting in direct contact with the employees who perform the activities. Getting in touch with these individuals is essential to solve possible problems in production.

The researcher also used the three gen's, which is the genba, which is when you visit the site to understand where the problem came from, which in this case, was the area of packaging. After that, the genbutsu was performed, that is, the product with problem was evaluated, which is the place where the activities were carried out, in which several problems were observed, among which, one can mention the excessive movements, irregular layout, among other things. Gingitsuwas also performed, which is a moment in which one seeks to understand the causes of the problems encountered. After that, it was decided to time the times of the executed activities, with that, one hundred experiments were made for each type of spring or client generating the averages presented in Fig. 13.

		Atividades e Tempos									
		Levar a caixa KLT vazia e limpa até o posto de trabalho	Encher as caixas com peças a serem inspecionadas	Levar a caixa até a bancada de inspeção	Efetuar inspeção das peças	Alinhamento das peças (SEM gabarito)	Alinhamento das peças (COM gabarito)	Depositar peças alinhadas com gabarito na embalagem final	Foto do posicionamento e do Top Color	Levar caixa KLT até o palete	TOTAL
PROJETO / CLIENTE											
ÁREA 2	- CLIENTE A2	30s	15s	25s	23 min	N/A	4min 47s	53s	15s	12s	30 min
	- CLIENTE B2	30s	15s	25s	23 min	N/A	4min 47s	53s	N/A	12s	30 min
	- CLIENTE C2	30s	15s	25s	28min 48s	4min	N/A	N/A	N/A	12s	34 min
ÁREA 1	- CLIENTE A1	2s	15s	N/A	60s	N/A	N/A	N/A	N/A	10,9s	1 min 43s
	- CLIENTE G1	2s	15s	N/A	N/A	N/A	N/A	N/A	N/A	10,9S	28s

Fig. 13: Average time spent in the execution of the activities.
Source: Authors.

In fact, area 2 has the longest times and activities, especially in the activity of inspecting the parts with times of 28 minutes and 48 seconds to perform this task for customer C2 and 23 minutes for A2 and B2 customers. These activities contributed to the execution time of all tasks being 34 minutes for client C2 in area 2 and 30 minutes for client A2 and B2 and, for this reason, this area became a priority in this study.

The fastest activity in this sector was to take the kleinladungsträger (KLT) box to the pallet. In area 1, the execution time of the activities was shorter, 1 minute and 43 seconds for client A1 and 28 seconds for client G1. After analyzing all the processes it was observed that some activities did not add value to the product, which increased the execution time of the processes. Among these tasks, one can mention taking the empty and clean box to the work station, filling the boxes with the parts to be inspected, taking the box to the inspection bench and taking the KLT box to the pallet, as shown in Fig. 14.

		Atividade/tempo que não agrega valor ao produto				
		Levar a caixa KLT vazia e limpa até o posto de trabalho	Encher as caixas com peças a serem inspecionadas	Levar a caixa até a bancada de inspeção	Levar caixa KLT até o palete	TOTAL
PROJETO / CLIENTE						
ÁREA 2	- CLIENTE A2	30s	15s	25s	12s	1min 22 s
	- CLIENTE B2	30s	15s	25s	12s	1min 22 s
	- CLIENTE C2	30s	15s	25s	12s	1min 22 s
ÁREA 1	- CLIENTE A1	2s	15s	N/A	10,9s	28 s
	- CLIENTE G1	2s	15s	N/A	10,9S	28 s

Fig. 14: Time of activities that do not add value to the product.
Source: Authors.

The activities shown in Fig.14 consumed about 1 minute and 22 seconds in area 2 and 28 seconds in area 1. This time, at the end of the processes performed in the company were high, so it is noted that it was necessary to work to reduce and/or eliminate these tasks. Fig. 15 illustrates the spaghetti diagram of area 1, in which one can see the layout of the productive flow, as well as the activities executed by the operators.

Fig. 15: Spaghetti diagram and area layout.
Source: Authors.

Fig. 16 illustrates the spaghetti diagram of area 2, in which you can see the layout of the production flow, as well as the activities that were performed by the operators.

Fig. 16: Spaghetti diagram and Layout of area 2. Source: Authors.

Areas 1 and 2 were provisionally given the springs to be inspected in a großladungsträger (GLT) box. An equipment called "elevator" is rented in area 1, in this one the GLT box is introduced, in this way it gradually turned this box with springs into a vibratory chute, which poured them into smaller boxes, model KLT, model adopted by all customers until the present moment.

It is important to highlight that 13 minutes and 24 seconds were spent to change the content of the GLT box (about 8,000 springs) for the KLT boxes, moreover, in this interval the area 1 was stopped, because the freight elevator was stopped due to the filling of the boxes. Another point that deserves attention was that if the springs to be inspected were not in the KLT boxes, the inspection and packing time in area 2 would be longer, because the operator would have to manually fill the KLT boxes, as illustrated in Fig. 17.

Fig. 17: Manual overflow of packaging. Source: Authors.

4.2 In Searchof the Solution to the Problem

After this finding it was possible to develop the Ishikawa diagram to find out what were the main problems in the packaging area. Fig. 18 shows the constructed diagram, with this it was observed that most of the activities were related to the movement, being this the main cause (root cause) of the problem in study.

Fig. 18: Ishikawa diagram for the problem under study. Source: Authors.

After using this tool, it became clear the root cause of the problem, which was the excess of displacement/movement and activities that did not add value to the product and/or process. With this, it was determined with the company's management the goal of increasing the productivity of the sector by about 5% in order to optimize the tasks performed. After several meetings and many brainstormings it was suggested the acquisition of false bottom basket, easel, pantographic pallet, roller conveyor and readjustment of the bench and layout of area 2. Using the software Catia V5 R19 it was possible to illustrate and simulate the process as illustrated in Fig. 19.

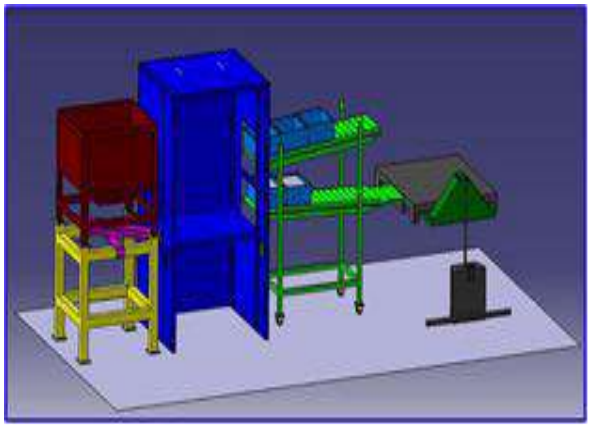

Fig. 19: Design of the new equipment and adaptation of the layout of area 2. Source: Authors.

With this change, it was expected:

a) Reduce the travel costs of the operators;

b) To keep the pallets always at the height of the collaborators' hands;

c) Reduce the physical effort, allowing the springs to be inspected to be near the operator;

d) Create a buffer of inspected parts, reduce the time spent with overflow and decrease the occupation of the elevator 1.

It is worth mentioning that the cost of these modifications was R$ 11,066.67 (in reais), because it was possible to reuse baskets and some materials already existing in the company studied, however, the productivity gains can be much higher with this improvement. Through the payback calculation it was possible to verify that this investment will be paid in 12 months, excluding the productivity gains thus obtaining the approval of the costs before the board of company X. It can be seen in Fig. 20 the new inspection and packing bench already delivered to company X.

Fig. 20: New inspection and packaging bench for line 2.
Source: Authors.

4.3 After Improvement

After receiving the new inspection bench for line 02, the need to review the layout and organization of the area was found, and 5S was used for this. As mentioned in item 2.3.7 of this study, the 5S is a tool that aims to promote a cleaner, tidier and more organized working environment. Fig. 21 shows several pallets allocated in the corridor and little space available for work on the new inspection and packaging bench, because it was using space assigned to the finished products exit area.

Fig. 21: Inspection and packaging area before the 5S.
Source: Authors.

With the application of 5S, the layout was revised, which consisted of reallocating the area of finished products to the area near the bottom wall of the shed. Changes were also made to the position of the old inspection and packaging bench in area 2, which continued in use (dedicated to special operations), reallocation of the inspection and packaging bench to the area next to the central aisle and repainting of the floor and space delimitation strips as shown in Fig. 22.

Fig. 22: Inspection and packing area after 5S improvement and revision.
Source: Authors.

After the installation of the cabin next to the central aisle several changes were observed in the execution of the activities, among which we can mention the reduction in the movement of the operator to collect parts to be inspected, the reduction in the movement to collect empty boxes, the reduction in the movement of boxes with parts inspected to the pallet. With this, the displacement of the employee started to occur every five boxes.

In area 1, after the change of the common pallet box for the pantographic pallet box it was observed that there was a gain of about 3 minutes and 29 seconds. In view of this, it can be mentioned that for the study period, which was the year 2019, 2,218 pallets were made, resulting in a gain of 116 hours after the implementation of the improvement in area 1, which is equivalent to 14.4 days of work with a journey of 8 hours. With this extra time it was possible to inspect and package about 3.12 million pieces, resulting in a productivity gain. Fig. 23 shows the pantographic pallet box in use.

It is worth mentioning that there was a (average) reduction in operator movement resulting in a gain of 170h/year, representing the possibility of increasing production by 294,099 pieces. Thus, the productivity gain in area 1 was 15%, while in area 2 was 9%, exceeding the initial estimates which were 5%.

Fig. 23: Pantographic pallet box in use in area 01. Source: Authors.

Another point that deserves attention is that the overflow time reduced from 13 minutes and 44 seconds to 2 minutes and 40 seconds after the use of the false bottom boxes. Thus, there was a reduction of time per overflow from 10 minutes and 44 seconds, in addition to the reduction of down-time from areas 1 and 2 to 106 hours per year, which allowed to produce about 153 thousand pieces more.

The LM methodology contributes in fact to the reduction of unproductive times in the companies, which in this work was the valve spring packaging sector. There are several tools that can be used to implement the LM philosophy, among which we can mention the 5S, the TPM, the just in time, the Ishikawa diagram, among others. In this work, the Ishikawa diagram was used to find out what was the root cause of the problem observed in the valve spring packaging sector in company X.

After that, it was found that the main cause of this was the unnecessary displacements of the employees, which made the subjects move without needing to. With these displacements, the times for the execution of the activities were increased, mainly the overflow, which was 13 minutes and 44 seconds. After the installation of the improvement this time was reduced to 2 minutes and 40 seconds, that is, by changing a conventional pallet for a removable bottom, a productivity gain of 10 minutes and 44 seconds was achieved.

Another improvement installed was the layout adjustment, with this, the employees started to move less, which resulted in an increase in productivity. Initially, it was estimated an expense of 22 thousand to implement the improvement, however, its final value was 11 thousand, or half of what was projected. In addition, the return or payback time for this investment was 12 months, being relatively fast due to production gains.

It can also be mentioned that initially it was projected an efficiency increase of 5% in the lines, however, at the end of the improvements this value was 15% for line 1 and 9% for line 2. Thus, with the project executed, the company started to produce about 153 thousand more pieces per year, besides and to reduce the risks for the health of the collaborators.

V. CONCLUSION

The automotive industry and other private enterprise industries are continuously seeking to increase production capacity and revenue/profit. For this, employees need to be involved and susceptible to changes and paradigm breaks with the new concepts provided by the LM. Thus, the proposed study had as main objective to make an analysis and prove the feasibility of using the LM tool in a cell of inspection and packaging of valve springs of a German company of auto parts, here called X and located in Taubaté - SP. Thus, scientific articles, specialized books and dissertations on the principles of the LM in private manufacturing processes were researched, which allowed to offer subsidies and suggest improvements that can be adapted in the packaging and inspection sectors.

The interview with the managers and other collaborators of the process together with the analysis of the documents directly in the genba allowed the identification of the waste in the process, using the principles of the LM. The following wastes were found: lack of standardization of the work routine, inadequate or underused equipment/actives, employees with excessive movements or displacements that did not add value to the product. Thus, this waste allowed the preparation of Ishikawa's diagram that showed that the excessive movement of employees was the root cause of the problem, which was broken down in detail in this work.

In the new scenario no lack of standardization of the work routine was found, the equipment/assets were readjusted and reallocated and activities that did not add value were eliminated. Thus, it is possible to conclude that the implementation of the LM tool in an inspection cell and valve spring packaging is totally feasible, showing gains in the process, since the seven wastes of the LM together with the Ishikawa diagram allowed to raise and eliminate the wastes, as evidenced by the results presented in Chapter 4, thus achieving the general objective of this work and dissemination of the LM concepts to the entire university community, scientific and other stakeholders.

The study in question had as practical implications the empirical nature of the researcher who used the experience and experience of eighteen years in company X. It is worth mentioning that another limitation of this work was the time of the research, which was relatively short, being opportune to carry it out in the company considering a longer and empirical period of time of the researcher.

It is recommended as a suggestion for future work the use of simulation/modelling software and the application of a value flow map in the valve spring sector in order to clearly identify the takt-time of each cell/sector and the actual or new 'bottleneck' of the process. It is also suggested to evaluate the impacts provided by the LM in a company that adopts this philosophy, comparing it with a company that does not.

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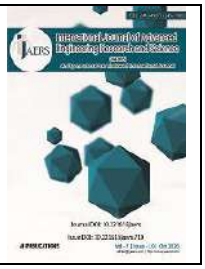

Dental management in hypertensive patients

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***Keywords*— Blood pressure, Hypertension, Oral health.**

***Abstract*—** *Systemic arterial hypertension or high blood pressure is a disease that affects many people in the world and is considered a relevant factor in establishing the cause of death. Arterial hypertension is when the pressure that the blood exerts on the walls of the arteries to move is very strong, being above the values considered normal. In addition, this disease involves hardening of the vascular walls, which makes it difficult for blood flow to pass. Therefore, the general objective of this work is to evaluate the existing literature, in order to verify dental care for hypertensive patients. The methodology used was a review of the integrative literature, which searched material databases that supported the theme addressed here. After this survey, 13 articles made up the research results. It is concluded that in the case of diagnosed and treated hypertension, the dentist should consult the patient's doctor, when starting the treatment plan, to make possible the integration of the medical and dental treatments. These patients can be submitted to non-surgical treatments using normal methods, and in case of simple surgical procedures, complementary sedation should be used.*

I. INTRODUCTION

Hypertension is known as the “silent killer” and affects 80 million adults over the age of 20 in the United States alone and only <1 billion people worldwide. In 2025, the number of patients diagnosed with hypertension is expected to be 1.56 billion. Hypertension is responsible for> 7 million deaths annually and is one of the main risk factors for mortality from cardiovascular diseases. The disease is defined as systolic blood pressure (SBP) of 140 mmHg or diastolic blood pressure (DBP) ≥90 mmHg, or anyone receiving a prescription for antihypertensive medication for the purpose of controlling hypertension. In addition, hypertension is defined as high blood pressure readings on at least two occasions with or without provocation (CALISTRO et al., 2019).

As mentioned by Yugar-Toledo et al. (2020), for those normotensive or prehypertensive patients, providing a complete education is essential for prevention. Explain the risk factors associated with the disease and provide advice on lifestyle changes, such as weight loss, dietary changes (dietary approaches to stop hypertension), decreased sodium intake, increased physical activity and restricted intake of alcohol can prove to save lives in this population.

The dentist is faced daily with cardiovascular pathologies. Inappropriate consideration of such a story can lead to potentially fatal accidents. In relation to the hypertensive subject, the dentist must know how to assess the severity and stability of hypertension. In the case of uncontrolled hypertension, the patient should be referred to the attending physician to adjust the treatment (SOUTHERLAND et al., 2016).

The dentist must be careful not to interrupt the antihypertensive treatment and limit the stress caused by their care, ensuring optimal analgesia, or even prescribing premedication. Local anesthetic solutions with adrenaline are not contraindicated in controlled hypertension. People with heart valve disease are at risk of developing infective endocarditis. Dental care is particularly indicated in these

patients, as the oral cavity represents an important reservoir of germs. Some treatments are contraindicated and antibiotic prophylaxis is sometimes recommended. Finally, the coronary subject must undergo a careful evaluation in collaboration with the cardiologist. High-risk patients should be treated in a hospital structure in case of urgent intervention. Antiplatelet therapy should not be stopped under any circumstances. Local hemostasis should then be treated particularly because of the high risk of bleeding. The patient should be informed of the risk of bleeding and given guidance to limit bleeding. Certain treatments may require postponing treatment. In the event of a cardiovascular accident in the office, the dentist should immediately call the emergency medical service (RODRIGUES et al., 2015; SCHUEROFF et al., 2016; SILVA et al., 2020). Therefore, the following problem arises: What is the importance of a dental care protocol for patients with hypertension?

It is important that the oral health professional is well versed on the challenges involved in prevention, management and treatment options for patients with systemic disorders, as well as on the opportunities available that can improve general patient care and treatment outcomes in the Odontological office. Under such conditions, immediate diagnosis and immediate treatment are mandatory, especially when a patient is clinically compromised. The purpose of such an operation is the prevention, identification and immediate implementation of an adequate dental care protocol (CALISTRO et al., 2019; PRIYANKA et al., 2019).

The present study is justified due to the importance of seeking an adequate dental care protocol for hypertensive patients. New information on these types of patients is published frequently and management is often changed. It is important to implement these new changes to maintain the best quality of care in the treatment. A dental professional must be aware of the disease, know the current therapeutic options and have the ability to educate and provide access to patient care. The recommendation for the management of these patients is based mainly on the judgment of a professional. Before providing assistance to these patients, the professional must be able to assess their health status and make appropriate decisions (NAKANISHI et al., 2017; GUEIROS et al., 2019; LEITE et al., 2020).

Therefore, the general objective of this work is to evaluate the existing literature, in order to verify dental care for hypertensive patients. The specific objectives are: Describe the etiology, classification, epidemiology and risk factors associated with hypertensive patients; Point out the main oral manifestations present in hypertensive patients; Provide an overview of the concerns related to the treatment of hypertensive patients and useful recommendations in managing a wide spectrum of these patients who present themselves at the dental office.

II. HELITERATURE REVIEW

2.1 EPIDEMIOLOGY OF SYSTEMIC ARTERIAL HYPERTENSION

Hypertension is clinically defined as a disorder of elevated blood pressure blood pressure at rest. There are some risk factors that can lead individuals to develop some degree of hypertension, including age, black race, female gender and lifestyle like sedentary lifestyle and obesity. (COSTA et al., 2013)

Hypertension affects more than 30% of the adult population worldwide, that is, more than one billion people. It is the main risk factor for cardiovascular disease, especially coronary heart disease and stroke, but also for chronic kidney disease, heart failure, arrhythmia and dementia (WHO, 2018).

The burden of hypertension is felt disproportionately in low- and middle-income countries, where two-thirds of the cases are largely due to the increase in risk factors in these populations in recent decades. In addition, about half of people living with hypertension are unaware of their condition, which puts them at risk for preventable medical complications and death (BRASIL, 2017).

According to the World Health Organization (WHO), hypertension affects 20 to 40% of the adult population, with the highest prevalence among men and in middle and low income countries (WHO, 2018).

In Brazil, according to data from the National Health Survey (PNS), the prevalence of hypertension in 2013 was 21.4%, with 24.2% among women and 18.3% among men. This prevalence was higher according to age: 20.6% among adults aged 30 to 59 years, 44.4% among elderly people aged 60 to 64 years and 52.7% among those aged 65 to 74 years. The prevalence of hypertension was also higher in people with low education, living in urban areas and in southeastern Brazil (BRASIL, 2017).

Data from the Surveillance of Risk and Protection Factors for Chronic Diseases by Telephone Survey (Vigitel) in 2016 showed that the prevalence of hypertension in Brazil was 25.7%, varying between 16.9 and 31.7%. The prevalence was higher among women (27.5%) than among men (BRASIL, 2017).

2.2 ETIOLOGY, PHYSIOPATHOLOGY AND CLASSIFICATION OF HYPERTENSION SYSTEMIC ARTERIAL.

In order for blood to circulate in the body, the heart must exert pressure when pumping it. When performing this task, this organ contracts, at the moment called systole, and plays a great amount of blood to the arteries. This is the pressure known as the maximum pressure or systolic (SBP). When the heart relaxes, the pressure of the blood vessels decreases; so it is known as diastolic pressure (DBP) or minimum. The determinants of BP are the cardiac and peripheral resistance and any change in one or the other, or both, interferes with the maintenance of normal blood pressure levels. Several mechanisms control peripheral resistance and cardiac output: cardiac, renal, neural, hormonal, ionic, vascular and structural mechanisms, termed as pathophysiological mechanisms of SAH. These complex mechanisms interact and balance, and are responsible for maintaining blood pressure as well as its variation moment to moment. It is known that a dysfunction in these BP control systems results in hypertension, however, the complex interaction between these physiological systems, as well as the environmental influences, such as excess salt in the diet and psychoemotional stimuli, make it difficult determine whether the changes found in hypertensive patients are the primary cause of SAH or consequence of other dysfunctions still unknown (RIVERO et al., 2020).

As to the origin, SAH can be primary or secondary. Primary hypertension or essential it is not possible to determine the etiology, being found in about 90% to 95% of the patients. It occurs due to changes in the BP control system caused by the interaction of genetic factors with environmental factors, such as excess sodium in the diet, smoking, obesity and stress. The others are carriers of secondary hypertension that can originate from other pathologies such as renal artery stenosis, pheochromocytoma, Cushing's syndrome, primary hyperaldosteronism and also to the use of drugs such as alcohol, oral contraceptives, sympathomimetics, corticosteroids, cocaine and others (COSTA et al., 2020).

While some forms of secondary hypertension can be treated and cured surgically, the control of primary hypertension requires the prolonged use of medications, which can affect dental treatment. These drugs can be of different groups pharmacological drugs, and the most common ones used to treat SAH are diuretics, beta selective and non-selective blockers, centrally acting adrenergic antagonists, blockers calcium channels, alpha-adrenergic blockers, vasodilators, sympathetic antagonists peripheral action and angiotensin-converting enzyme inhibitors (MENEZES, et al., 2020).

There are three guidelines that classify SAH, the Brazilian one published in 2002, the North American published in 2003 and the European one also published in 2003. As there is a considerable difference among them, especially in the areas of classification and management of the disease, it is questioned which recommendation more correct and that consequently must be adopted. The American HAS classification was modified in 2003 by the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (VII-JNC). A new category called prehypertension was created and the old stages two and three of SAH were combined into one stage, emphasizing its control and early treatment (DANTAS; RONCALLI, 2020).

The Brazilian Society of Hypertension published in 2010 the Brazilian Guidelines for hypertension VI, where it says that in the literature, borderline pressure is equivalent to normal-high pressure or pre hypertension (COSTA et al., 2020).

There is also office hypertension also called white coat hypertension, which consists of measuring persistently high BP values in the doctor's office or dental, but normal in the patient's day-to-day. It is present in about 20% of patients with increased BP. As a precursor to SAH, it should be monitored and continuously evaluated. It is important to differentiate SAH from office hypertension, keeping in mind that sometimes multiple BP measurements are necessary (MENEZES, et al., 2020).

The treatment of SAH involves changes in lifestyle (weight loss, physical activities, reduced sodium intake and moderation in alcohol consumption) and use antihypertensive medication. The goal of therapy is to maintain blood pressure levels below 140/90 mmHg, with a consequent reduction in cardiovascular complications. In hypertensive patients and diabetics and / or with kidney disease, the goal is to reach values below 130/80 mmHg (COSTA et al., 2020; MENEZES, et al., 2020).

2.3 ORAL MANIFESTATIONS PRESENT IN HYPERTENSIVE PATIENTS

Patients who use hypertensive drugs are closely linked to the dental care, since some of these medications can cause side effects in oral cavity. Some of these side effects deserve special attention from the dentist, since the SAH is the fourth most common medical condition in the dental clinic. Among the most common side effects cited in the oral cavity is gingival hyperplasia, which is very common in patients using calcium channel blockers such as nifedipine, with an incidence ranging from 1.7% to 38%.

As a form of treatment for cases of hyperplasia associated with the use of these drugs, periodontal surgical

intervention stands out; however, this is not definitive, since the patient will continue using the medicine. Therefore, the most effective way would be to ask the doctor to have the medicine reduced dose, if possible, or to be replaced by another drug of a different class, provided that it is this substitution is viable.

In addition to hyperplasia, pharmacological treatment with antihypertensive drugs can xerostomia, reduced tongue mobility, difficulty chewing and swallowing food, change in taste sensation, increased incidence of Candida infections, increased caries and periodontal disease, nocturnal oral discomfort and a burning sensation.

There are no clearly recognizable oral manifestations associated with hypertension, but many antihypertensive drugs can cause adverse reactions that can serve as clues for the dentist to recognize the condition presented by the patient. Among these, xerostomia, excessive gingival growth, erythema multiforme, paresthesias, altered taste, among others, can be mentioned.

Anxiety induces an increase in sympathetic activity, which leads to marked hypertension and tachycardia. There are no immediate contraindications to the use of benzodiazepine anxiolytics.

Patients with cardiovascular diseases should always be treated, even if the procedure is a simple restoration, as the pain tends to increase anxiety and induce tachycardia and elevated BP (blood pressure).

The use of an anesthetic solution containing vasoconstrictor should only be avoided in patients with very high and uncontrolled hypertension, but in general the benefits associated with the use of small doses of epinephrine outweigh the possible disadvantages.

The increase in BP is usually greater in the early hours of the morning, and in the afternoon the fluctuations in their values tend to be less. Thus, it is recommended to assist the patient who has cardiovascular disease in the afternoon.

Many hypertensive patients make daily use of acetylsalicylic acid and the dentist should investigate this possibility before the dental procedure, especially when there is a possibility of bleeding.

2.4 DENTAL TREATMENT FOR HYPERTENSIVE PATIENTS

For dentists, it is extremely important to knowledge of the consequences and possible complications that may arise during the clinical care or, as a result of therapy instituted drug. The use of antihypertensive drugs may cause some oral complications, such as decreased salivary secretion and increased tissue gingival - medication-associated gingival hyperplasia.

The performance of dental treatment should be based on the measurement of blood pressure at the time of care, the classification of hypertension by the doctor and has the following general parameters:

• Moderate or severe hypertension, even if controlled, always interact with the attending physician to define conduct for each procedure and individual need for the use of anxiolytics. Urgent procedures should be performed after using anxiolytic medication and reducing BP. If the pressure remains unchanged, treatment should be conservative (antibiotics and / or pain relievers).

• Uncontrolled hypertension: no procedure should be performed. In an emergency, treatment should be conservative (antibiotics and / or pain relievers).

• Controlled hypertension: simple non-surgical procedures performed normally; Major surgeries (multiple extractions, periodontal surgeries) consider the use of sedatives.

III. METHODOLOGY

The present integrative literature review followed the following points:

1st - elaboration of the guiding question;

2nd - search or sample the literature in the Scielo, PubMed and Science Direct databases. The inclusion criteria were articles published between 2015 and 2020 in Portuguese and English. The following consultation terms were used: blood pressure, hypertension and oral health. The query terms were combined by the Boolean operator 'OR' to request a comprehensive search of the available literature. All other samples were immediately excluded. The exclusion criteria were: duplicate studies, available only in the abstract or with the presentation of only the topic, with the content unavailable and paid articles.

3rd - data collection;

4th - critical analysis of the included studies;

5th - discussion and interpretation of results and;

6th - presentation of the integrative review, that is, presentation of the review / synthesis of knowledge)

The screening was carried out independently by the three authors. Disagreements regarding inclusion during the first and second stages of study selection were resolved by discussion.

The items recovered were selected based on a three-step selection process, which later considered titles, abstracts and full texts. In stage 1, a list of titles was obtained from the databases and titles that clearly did not refer to the theme. In stage 2, the abstracts of the selected

titles were selected and, if it was clear from the abstract text that the article did not deal with the theme, it was excluded from the review. In step 3, full-text articles were read carefully and it was verified whether the studies were relevant to the review objectives.

IV. RESULTS AND DISCUSSION

In the first stage of the study, 547 articles were found, which referred to the etiology, classification, epidemiology and risk factors of hypertension. Then, an attentive and systematic reading of the titles of the selected articles was carried out according to the theme addressed in the research, and 107 articles were selected. Subsequently to reading the abstracts, only 55 studies were chosen to be included in a more detailed analysis, of a critical and integral character. At the end of these verification and analysis steps, 13 studies remained that met the inclusion criteria. It was found that the most significant portion of articles was found in the SCIELO database, followed by the journals PUBMED and Science Direct, as shown in Figure 1.

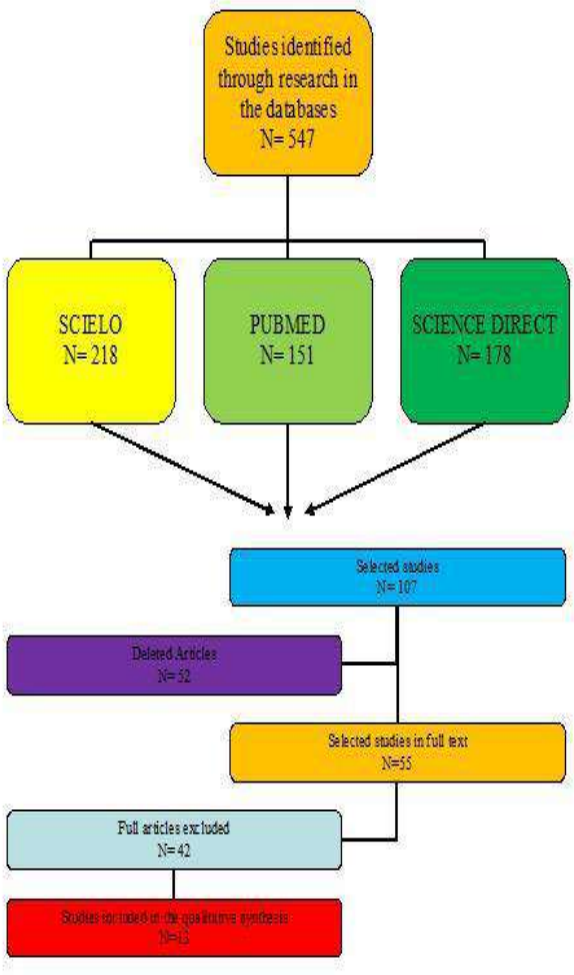

Fig. 1: Selection of studies for review.

This review consists of 13 articles published between 2015 and 2020. Of the selected sample, three were from a literature review, three were cross-sectional studies, a cohort study, a randomized study, a home study, a multicenter study and a survey study data, being distributed, as shown in table 1.

Table.1: References used in this review.

Authors	Title	Year	Objective	Methodology
Rodrigues et al.	Percepção de acadêmicos de Odontologia sobre seus conhecimentos para o atendimento odontológico de hipertensos e diabéticos.	2015	Verify the perception of the students of the Dentistry Course at the Federal University of Pará about their knowledge for the management of patients with SAH and DM in the dental clinic.	Cross-sectional research
Schueroff et al.	Importância do conhecimento do cirurgião dentista sobre pressão arterial, fatores modificadores e complicações sistêmicas durante atendimento cirúrgico.	2016	Clarify the level of knowledge of some professionals who work in the city of Maringá-PR in the areas of Implantology and Oral and Maxillofacial Surgery and Traumatology on BP.	Cohort search
Southerland et al.	Dental management in patients with hypertension: challenges	2016	To provide strategies for managing and preventing complication	Systematic review

	and solutions.		s when treating the patient with hypertension who presents to the dental office.	
Nakanishi et al.	Relationship of Hypertension to Coronary Atherosclerosis and Cardiac Events in Patients With Coronary Computed Tomographic Angiography.	2017	We investigated the relationship between hypertension and the presence, extent, and severity of coronary atherosclerosis in coronary computed tomographic angiography and cardiac events risk.	Multicenter study
Oliveira; Nogueira; Pereira	Relação entre percepção sobre serviços odontológicos e condições de Saúde Bucal em hipertensos e diabéticos.	2018	To evaluate the relationship between the perception of dental services and oral health in a population of hypertensive and diabetic patients enrolled in the Family Health Strategy in Alfenas, MG, Brazil.	Home study
Calistro et al.	Dental care in hypertense patients: systematic review	2019	perform a literature review on dental treatment in patients with hypertension	Systematic review
Gueiros et al.	World workshop oral medicine VII: immunobiologics for salivary gland disease in Sjögren's syndrome: a systematic review	2019	This systematic review evaluated the efficacy of immunobiologics for the management of oral disease in Sjögren's syndrome (SS).	Systematic review
Priyanka et al.	Evaluation of changes in Blood pressure and Pulse rate of hypertensive patient during early morning and evening dental appointments.	2019	The purpose of our study was to evaluate changes in Blood pressure and Pulse rate of hypertensive patient during early morning and evening dental appointments.	Clinical study
Rosa et al.	Efficacy assessment of oral and sublingual sedation using alprazolam in implantology surgical procedures	2019	The aim of this study was to evaluate the efficacy of two formulations of alprazolam (ALP) in patients undergoing oral implantology surgical procedures.	Randomized study
Silva et al.	Atendimento odontológico a hipertensos	2019	To identify the knowledge	Cross-sectional

	e diabéticos na atenção primária à saúde.		of dentistry professionals in primary health care in the city of Quixadá-CE, regarding the dental treatment of hypertensive and diabetic patients.	research
Leite et al.	Avaliação do conhecimento de cirurgiões dentistas diante do atendimento a cardiopatas graves na atenção primária.	2020	Assess the knowledge of dental surgeons who work in primary health care in a municipality in northeastern Brazil, facing the care of patients with cardiovascular diseases.	Cross-sectional research
Morais et al.	A prospective study on oral adverse effects in head and neck câncer patients submitted to a preventive oral care protocol	2020	To evaluate the occurrence and severity of oral complications, number of radiotherapy (RT) interruptions and quality of life (QoL) in a population of head and neck cancer patients receiving a preventive oral care program	Cohort search
			(POCP) and photobiomodulation therapy (PBMT).	
Yugar-Toledo et al.	Posicionamento Brasileiro sobre Hipertensão Arterial Resistente – 2020.	2020	Conduct a survey on the Brazilian Position on Resistant Arterial Hypertension - 2020	Data survey

From the relevant literature review, it was possible to identify that SAH is a disease cardiovascular disease with high prevalence in the Brazilian and worldwide population. With medical advances, patients with complex diseases are living longer and seeking care, more and more, in dental offices and outpatient clinics (NAKANISHI et al., 2017; YUGAR-TOLEDO et al., 2020).

The dental treatment of hypertensive patients, according to Calistro et al. (2019) represents a challenge for dental surgeons, who must be scientifically based to establish the best conducts for the management of this type of patient. Perform an anamnesis and blood pressure measurement, guide the patient about his systemic condition, clarify how therapies employed and recognize how changes resulting from them are fundamental to establish the best treatment plan and minimize or prevent problems that may occur during dental care.

The mean systolic and diastolic blood pressure (SBP) according to Priyanka et al. (2019) was higher in all groups during morning appointments. The average pulse rate (PR) was also higher during the early morning.

During dental care, Oliveira, Pereira and Nogueira (2018) reinforce these notes by Gueiros et al. (2019) and Rosa et al. (2019), which points out the need for a careful anamnesis, is indispensable for the decision of therapeutic procedures and correct performance of procedures. Special attention is recommended to the types and dosage of medications used by the patient, as well as the choice of local anesthetics.

As it was possible to observe in the literature review, the opinion of these authors when it comes to meeting whether or not a patient with high BP (above 140 by 90 mmHg) in the dental office is contradictory. In general, all authors agree that patients with prehypertension can receive any type of treatment, including local anesthesia

with vasocontractors. However, when pressure levels advance to stage 1 or 2, it seems to be difficult to decide Rodrigues et al. (2015) state that patients with stage 1 and stage 2 SAH should not receive treatment dental treatment and sent to the doctor immediately, however Schueroff et al. (2016) state that stage 1 patients can be treated normally and those in stage 1 e 2 should have their treatment postponed. Nakanishi et al. (2017) argue that dental treatment should be delayed only for patients with BP above 180 by 110. Silva et al. (2019) and Leite et al. (2020) are based on American College of Cardiology and American Heart Association guidelines that assess the risk of occurrence of a serious event in a patient with cardiovascular disease undergoing non-cardiac surgery, which can be applied to non-surgical dental treatment. According to these guidelines, it appears that the risk of providing routine dental treatment for most patients with BP high is very low.

V. CONCLUSION

Given the numerous possible oral manifestations of hypertension and the risk of an emergency in surgical procedures, it is important that dentists recognize and assess the impact of diseases on dental care.

With a complete understanding of this manifestation and its dental management considerations, the oral health team can work together effectively to provide excellent oral health care to hypertensive patients.

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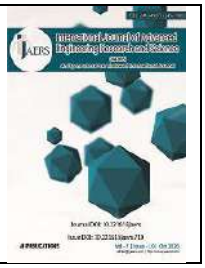

Dysnomy and Executive Processing Errors of SARS-COV-2 post-infection

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***Keywords*— SARS-COV2; Dementia; Neurological Complications; COVID-19.**

***Abstract*—** *Introduction: The disease SARS-CoV-2, named COVID-19, was officially declared a pandemic by the World Health Organization on March 11th, 2020. SARS-CoV-2 contains a single-stranded, positive-sense RNA genome surrounded by an extracellular membrane containing a series of spike glycoproteins resembling a crown. Neuropsychiatric manifestations are common during viral pandemics but are not effectively addressed. Case Report: We report the case of a man, 42 years old, who after the infection by SARS-COV2, presented dysnomy, cognitive easing and errors in motor processing. Results and Discussion: Studies have shown the neuroinvasive capability of SARS-COV2, resulting in neurological complications. Common neurological symptoms are headache, dizziness, anosmia, dysgeusia, mental confusion, and muscle weakening, progressing toward severe complications like cerebrovascular disease, seizures, muscle pain, and Guillain-Barre syndrome. The patient in the present case, about seven days after the initial infection, began to have difficulties in naming basic objects and "cognitive" slowness in the performance of basic and instrumental activities of daily life, especially those that required mutual tasks and that required concentration. Patients may be at higher risk of developing cognitive decline after overcoming the primary COVID-19 infection. Neuroinvasive capacities and neuroinflammatory events that may lead to the same short- and long-term neuropathologies that SARS-CoV had shown in human and animal models. The presence of dementia, minimal cognitive impairment and problems with motor planning and execution has been described. Conclusion: A structured prospective evaluation should analyze the likelihood, time course, and severity of cognitive impairment following the COVID-19 pandemic.*

I. INTRODUCTION

The potential involvement of COVID-19 in central nervous system (CNS) has attracted considerable attention due to neurological manifestations presented throughout the disease process. COVID-19 patients have presented a number of different neurological symptoms such as headache, dizziness, hyposmia, and hypogeusia during the course of illness. It has also been reported recently that some cases of COVID-19 have presented with simultaneous acute cerebrovascular disease (acute ischemic stroke, cerebral venous sinus thrombosis, cerebral hemorrhage, subarachnoid hemorrhage), meningitis/encephalitis, acute necrotizing hemorrhagic

encephalopathy, and acute Guillain-Barré syndrome. Evidence suggests that the virus has both central and peripheral nervous system manifestations.[1-4]

Cognitive manifestations associated with the severity of a new coronavirus (COVID-19) infection are unknown, however, it can affect patients and compromise them in their work activities. Almeria M et al (2020), in our single-center cohort study, included adult patients, with ages between 20 and 60 years old with confirmed COVID-19 infection. The Neuropsychological assessment was performed by the same trained neuropsychologist. Individuals with previous cognitive impairment, any central nervous system or psychiatric disorder were excluded. Thirty-five patients were included in the study. The authors described patients presenting: headache, anosmia, dysgeusia, diarrhea. A particular group, who required oxygen therapy, had lower scores in memory, attention and executive function subtests as compared to asymptomatic patients. Patients with headache and clinical hypoxia scored lower in the global cognitive index. Memory domains, attention and semantic fluency in the working memory, mental flexibility and in phonetic fluency were also described in the sample. Higher scores in anxiety and depression were found in patients with cognitive complaints[5].

The purpose of this article is to report and discuss the case of a patient, who after days of acute SARS-CoV2 infection began to show slowness of reason, difficulty in naming objects and loss of automation in the execution of some motor tasks.

II. CASE REPORT

MAON, male, 41 years old, doctor with training in neurology, triathlete, without pre-existing diseases. He reports that on December 30th 2020 a condition started, marked by dry cough for two days with subsequent onset of fever and myalgia. This one started on 01\ 01\ 2020 and lasted for 72 hours (last episode). Symptoms of hypogeusia and hyposmia were observed on the fifth day of illness. After the quarantine period and the end of symptomatic treatment, he began to perceive difficulties in naming simple objects, although he recognized some. "Sometimes I look at a package of cookies, I know it is a package of cookies, but when I ask my children to get it, the name is not spelled by me". In addition, it points out that the processing time for executive functions has been "encouraged". Daily activities that required little complexity and quick execution have become less "automatic" and undoubtedly requires a higher level of attention. The patient signals that the act on focusing attention on relevant information and inhibiting irrelevant information is hampered, as well as directing processes to perform complex tasks, and planning a sequence of sub-tasks to achieve a certain objective. Update and monitor, through working memory, the steps in progress to determine the next step in a sequential task, the problems also reported by the same. The encoding of representations in working memory according to space and time does not seem "normal" to you. In another words, there is a diversity in terms of theoretical models and cognitive processes involved in the executive functions of the present case that should be better explored. It draws our attention because it is a health professional with training in neuropsychiatry who, based on the assumption, has a broad understanding of these functions. Neurological Examination: Normal; Skull MRI: Normal; Liquor: Normal; EEG: normal. Battery of Neuropsychological Tests: Normal. Laboratory Complete with inflammatory, infectious and other markers that could cause problems like the ones above: Normal. Minimental Test: 28\30. However, during the formatting of the clinical picture and questioning, there is a delay between the receipt of information from researchers, speech processing and obviously slowness in the speed of responses. We have in mind that exams, such as PET-SCAN, would be necessary, and although our case is not interested in being exposed to new exams.

III. CONCLUSION

A structured prospective evaluation should analyze the likelihood, time course, and severity of cognitive impairment following the COVID-19 pandemic.

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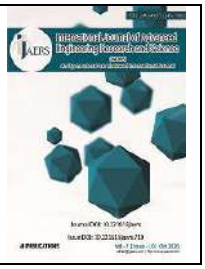

The use of Antibiotics and the Contribution to the Increase in Bacterial Resistance: A Perspective from a Research in a Health unit in Salvador

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***Abstract*—** *Antibiotics mark an era of modern medicine, after their discovery, the death rates from infections decreased 100%. However, with the potential of this class threatened by excessive and unnecessary use, associated and emerging infectious diseases arose due to the ineffectiveness of antibiotics. Bacterial resistance has become a public health problem. This paper aims to track a health care unit profile focused on medical care in a BHU in Salvador-BA, Brazil, through a descriptive exploratory study. Identifying the main antibiotics in use, if there are interactions with continuous use drugs, analyzing the factors that contribute to bacterial resistance and discussing the importance of the pharmacist in guiding the use of this class. A literature review conducted from Scielo, Journal of Public Health, WHO, ANVISA support the elaboration of a questionnaire applied to 150 participants from the community covered by the study in health unit after consent by signing the Informed Consent Form. The participants cited eight types of antibiotics, among which there was a prevalence of beta-lactams, and five types of antihypertensive drugs associated with antibiotic use. The analysis of the results identified some drug interactions. Thus, it is necessary to strengthen health education strategies, since the drug dispensing involves until the instructions given to the patient, to minimize the consequences of misuse of this class and avoid cases of bacterial resistance.*

I. INTRODUCTION

The development, distribution and using of antibiotics since the 20th century has favored the control of bacterial infections, however, although the discovery of this class has favored drug therapy, the potency of antibiotics is threatened by bacterial resistance, nowadays [1,2,3]. Thus, it is necessary to use strategies that inform and raise awareness about the proper use to control of the evolution of resistant strains [4,5,6].

Bacterial resistance related to the indiscriminate use of antimicrobials is increasing, noticeable; resistance rates are higher in drugs of higher consumption[7,8,9].

Overuse of antibiotics is a serious global public health problem. Regrettable, the increase in established and emerging infectious diseases related to the ineffectiveness

of antibiotics can confirm this [10,11]. Thus, in order to avoid the expansion of this problem, it is necessary to monitor the rationalization of the use of antibiotics, especially those in which they are most used. Pay attention to the duration of treatment, the appropriate dose and the real therapeutic indication are good attitudes [6, 12,13,14].

The drug dispensing involves entire process beginning at the delivery of the medication until the instructions given to the patient. These set of actions will contribute to the rational use of medications, guiding the administration, informing duration of treatment and indicating possible adverse reactions and interactions between medicines and food[10]. Thus, drug dispensing is part of pharmaceutical care, being a guide in the pharmacist's clinical practice and provided by the health system as a service called drug therapy management. (MTM) [15, 20].

Despite pharmaceutical care to be an essential practice for a greater focus on patient, its practice is very limited in health services. Because of it, pharmacist need to be prepared to have attitudes and skills with the health team to provide to the patient and the community guidance on the appropriate use of antibiotics, improving their quality of life[3,7].

The lack of information about the rational use of antibiotics is another issue discussed. The inefficient medical assistance followed by little or no guidance in the act of medication dispensing can be the cause of the lack of information that leads the patient to leave treatment, commit administration errors and make unnecessary use[4,9].

Given the above, the present study aim to outline a profile on the use of antibiotics in patients from a basic health unit in Salvador-BA. In addition, an education intervention project was carried out that addressed the rational use of antibiotics, focusing on the discussion about the importance of the pharmaceutical professional in guiding the correct use of these drugs. This project aimed guide the correct use of these drugs, identifying the main antibiotics used possible interactions with other drugs and identifying the indicators that contribute to irrational use. This work contribute to a better quality of life of patients and the effectiveness of treatment.

II. METHODOLOGY

A. Type of study

This is an exploratory descriptive study with a bibliographic review on antibiotics, from the databases Revista de Saúde Pública, Scientific Eletronic Library Online (SciELO), and sites such as the National Health Surveillance Agency (ANVISA) and the Organization World Health Organization (WHO).

Then, data collection carried out through interviews with 150 participants who attended a Basic Health Unit in the city of Salvador.

B. Period and local study

The study was applied from October to November 2019, with people who attending a Basic Health Unit, in Salvador-Bahia.

C. Population and sample

One hundred and fifty patients contributed to the research, they were of both sexes, aged 18 years and older, who were in the drug dispensing sector, were selected. In an unintentional method, carried out with patients randomly treated at the UBS.

D. Procedures, data collection and analysis

As data, we used the questionnaire with pharmacotherapeutic variables collected during the study period. The variables studied were the characterization of the interviewees: gender, age, and education, type of infection, antibiotics in use, other medicines in continuous use and habits of use of medicines. To assess the interactions and risks associated with other drugs, we used Drugs.com and DrugBank as tools.

The data was used after be approved by the Ethics and Research Committee of Universidade Salvador the Free and Informed Consent Term and the questionnaire signed by the patients who agreed to participate after knowing the research.

Therefore, the produced Health Education Intervention Project aimed to guide patients on how to use antibiotics and raise awareness about problems that may occur due to indiscriminate use. A timetable distributed to the patients provided a guidance about how to use the antibiotic, the appropriate time to use without interfering with other medications in case of continuous use.

E. Ethical aspects

The developed project started after approval by the Ethics and Research Committee (CAEE 22076819.9.0000.5033), according to resolution 466/12 CNS / MS. The Informed Consent Form (ICF) guaranteed the research participant respect for their autonomy rights.

III. RESULTS AND DISCUSSIONS

Small businesses and a hospital complex in Salvador, which serves the population of the neighborhood and other neighbors, surround the Basic Health Unit. This unit has a team of multiprofessionals trained to meet the daily demand in the various health areas, such as clinical, dental, gynecological, nutritional, pharmacological and family

support centers, the latter in conjunction with community agents in the neighborhood.

In this unit, 150 questionnaires applied, for participants of both sexes, who signed the Consent and Clarification Term and thus the results were prepared. The interviewees' aged between 18 and over 60 years old. Most interviewed predominated in the 18 to 30 age group.

Table 1 shows the number of respondents (n = 150) according to gender, age group and education. It was possible to verify that among the interviewees 56% were female, while 44% were male. In comparison with the study carried out in a health unit in Paraíba with hypertensive patients[10], it was identified the high representation of women in relation to men. Notably, people here are able to do the treatment because they are housewives or retired.

Table 1: Characterization of patients: gender, age and education.

		Frequency	Men	Women	%
Gender	**Female**	84	-	-	56.0
	Male	66	-	-	44.0
Age	**Age (years)**				
	18 - 30	52	18	34	34.7
	30 - 40	33	11	22	22.0
	40 - 50	19	11	8	12.7
	50 - 60	24	14	10	16.0
	Over 60	22	12	10	14.7
Education	**Elemantary school incomplite**	63	26	37	42.0
	Elemantary school complite	13	5	8	8.7
	High-school incomplete	8	2	6	5.3
	High-school complete	19	7	12	12.7
	Higher education complite	29	16	13	19.3
	Higher education incomplete	18	10	8	12.0

The majority of individuals aged between 18 and 30 years old (34.7%), followed by 30 and 40 years old (22%), 40 and 50 years old (12,7%), and between 50 and 60 years (16%) and over 60 years old with a frequency of (14.7%). This data is in line with a study on the knowledge of the use of antibiotics by the population of Vizela, where there was a predominance of young people aged between 21 and 30 years[16].

The number of young women (n=34) seeking care at the unit is high when compared to other ages. It occurs because today women are more susceptible to diseases due to hormonal and circulatory changes; this demand for health services tends to be favored in terms of health promotion and prevention. While the male gender usually seeks, medical attention later or in some cases ignores the symptoms[1, 11].

Regarding the level of education, the vast majority have an incomplete elementary level (42%), a worrying data. Due to the low level of knowledge and understanding on the part of these people together the lack information about the correct use of the drugs, these people have become more subject to health problems.

According to the data presented in Table 2, the group of penicillins (Amoxicillin, Amoxicillin + Clavulonate and Penicillin G) were the most used (44%) among the antibiotics prescribed due to their effectiveness; it is generally a first-rate antibiotic choice by professionals. Therefore, the group of first generation cephalosporins (20%), quinolones (16%), macrolides (8%), fluoroquinolones (6%) and finally aminoglycosides (6%) less frequently prescribed.

Table 2: Main antibiotics used by respondents.

Antibiotics	Type	Number women	Number men	Total	%
Amoxicillin	penicillin	10	3	12	26
Amoxicillin + Clavulonate	penicillin	4	0	4	8
Azitromicin	Macrolides	3	1	4	8
Cefalexin	cephalosporin	5	6	10	20
Ciprofloxacin	Quinolones	6	2	8	16
Levofloxacin	Fluorquinolone	1	2	3	6
Penicillin G	Penicillin	3	2	5	10
Tobramycin	Aminoglycoside	1	2	3	6

Among the pharmacological classes of antibiotics prescribed, mainly for women, the most prevalent was amoxicillin (26%). this medication is an antibiotic with a broad spectrum of activity against numerous types of bacterial infections, few side effects, oral administration and stability in acid medium, so this data was expected. Previous studies pointed that this class contains the drugs most commonly used in the treatment of bacterial infections[8].

Cephalexin, belonging to the group of first generation cephalosporins, was the second most prescribed type of antibiotic (20%), mainly indicated for the treatment of the respiratory tract.

Thirdly, the quinolones represented by Ciprofloxacin (16%). This antibiotic is ideal for the treatment of urinary tract infections, prescribed for females in majority, probably due to the anatomical characteristics that make them more suitable for this type infection. A study conducted in Cuba found the inappropriately and indiscriminately use of this antibiotic, due to unnecessary self-medication. Consequently, it leads to increased bacterial resistance[14].

In a study carried out in Vitória - ES in Brazil[1], the prevalence of ciprofloxacin resistance identified at 13.4% of women indicate that if the use of this antibiotic is not judicious, the number of resistant strains will increase.

Penicillin G, prescribed in 10% of cases, is an antibiotic of first choice in the treatment of syphilis, a disease that has been affecting many people, and in rheumatic fever. According to Ordinance n. 3,161 of 12.27.2011, that recommend penicillin use in all Primary Health Care units, in situations where the use is indicated and within the scope of SUS, prescribed by nurse, doctor or pharmacist [17,18].

Morejon[12] reports that multiple mechanisms had impacts with the increase of the bacterial resistance, as the evolutions suffered by the beta-lactamase and the mutations experienced by the penicillin transport proteins causing inactivation of the beta-lactams and misuse of the antimicrobial. Thus, it is necessary to promote the appropriate use of this antibiotic in order to minimize the increase in resistant strains.

Azithromycin, belonging to the group of macrolides, prescribed in 8% of cases, has as its main characteristic a rapid uptake by the systemic circulation and by the tissues after oral administration. Thus, especially in the treatment of aggressive periodontitis, this class is widely used in dentistry due to its high penetration into soft tissues[19].

Another important data are that the antibiotics most often dispensed in a drugstore in the municipality of Jequié-Bahia, were azithromycin, amoxicillin and cephalexin, representing 20, 16 and 10%, respectively, of antibacterial prescriptions[2].

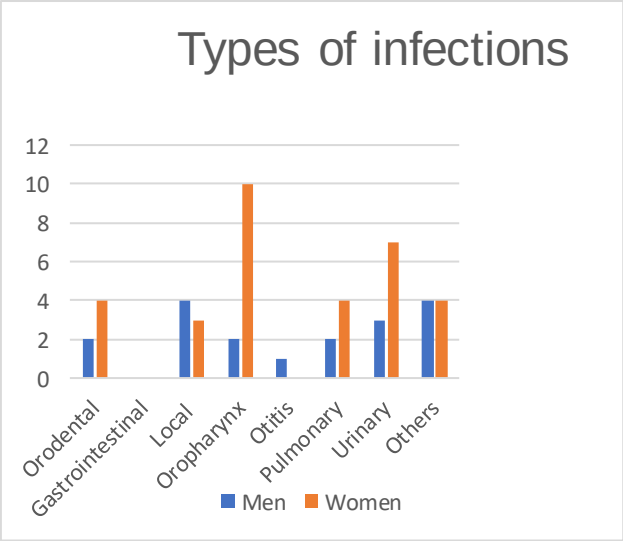
Amoxicillin + clavulonate and azithromycin, used for the treatment of rhinosinusitis, an upper respiratory tract infection, were prescribed at the same frequency (8%). Specifically for the treatment of rhinosinusitis, there is a preference for azithromycin due to the shorter duration of treatment, on a three-day basis, whereas amoxicillin + clavulonate lasts for 10 days[23].

Commonly used in the treatment of the respiratory tract, levofloxacin (6%), prescribed for patients with tuberculosis and community-acquired pneumonia, which usually occurs in winter periods. In some cases, levofloxacin can be indicate for patients who have acute pyelonephritis, a urinary tract infection.

Finally, the class of aminoglycosides, represented by tobramycin (6%), a topical antibiotic indicated for external

infections of the eyes, such as conjunctivitis, a highly contagious disease.

Regarding the infections presented, 50 infected participants were found, oropharynx infections being more prevalent (n = 12), followed by cases of urinary infections (n = 10), others (n = 8), local (n = 7), pulmonary (n = 6), orodental (n = 6) and otitis (n = 1) (Graph 1). During the study period, there were no participants with gastrointestinal infections.



Graph 1- Types of infections presented by the interviewees

Climatic associations, changes in temperature, humidity and rainfall can increase the effects of respiratory tract infections [22]. So, it is worth mentioning that the period of data collection occurred during the months of October and November; the sudden climate change with many rainy periods in Salvador provoked many cases of oropharyngeal infections, especially in who have a previous respiratory problem.

The second most common infection was the urinary tract infection, more prevalent in women, corroborating with Costa[3], who reports that the urinary tract infection has a higher incidence in women, especially when women are sexually active, due to the greatest risk factor during intercourse. Although in males, the cause is related to prostatic pathology.

According to Graph 1, the category "Others" identified in third place, with eight cases of infection, the Sexually Transmitted Infections (STIs) being the most common. The highest incidence of cases was syphilis, a serious infection predominantly sexual, possibly passed from the mother to the fetus. It is essential that there is a counseling service with the patient when the result of the infection is positive, to encourage adherence to treatment and the performance of tests on sexual partners, to minimize the number of cases and discuss strategies to reduce risks[18].

Among the pharmacological classes of drugs for continuous use, there is a predominance of antihypertensive drugs, highlighted in Table 3 below.

Table 3- Antihypertensive drugs used by the interviewees.

Medicines	Men	Women	Total %
Losartan	10	16	38.2
Hydrochlorothiazide	7	9	23.5
Amlodipine	6	7	19.1
Simvastatin	3	5	11.8
Enalapril	2	3	7.4

Losartan, commonly the second most used antihypertensive agent, was the most used antihypertensive medication among the participants, 38.2%. This medicine belongs to the group of blockers of angiotensin II receptors. Its action is the result of inhibition of vasoconstriction and minimization of aldosterone synthesis. Patients who use this medication must monitor renal function and potassium levels, especially patients who have chronic renal failure because they can worsen hyperkalemia[16].

Secondly, Hydrochlorothiazide, 23.5%, classified as a diuretic from the benzoatiazides class, used as an adjunct to the treatment of hypertension. Hydrochlorothiazide presents drug interaction with beta-adrenergic blockers, such as propranolol, with non-steroidal anti-inflammatory drugs, exemplifying ibuprofen, and therefore inhibitors of the angiotensin-converting enzyme, enalapril[9].

Amlodipine, considered a vasodilator of first choice for the treatment of hypertension, used by 19.1% of respondents. Simvastatin (11.8%), belong to the group of statins, has activity of inhibition of hydroxymethylglutaryl coenzyme A reductase. Finally, enalapril mechanism of action based on the conversion of angiotensin I to II, from 7.4% is the most used drug. Its use associated with a diuretic requires caution due to the risk of pulmonary edema rebound.

Some of these drugs for continuous use may have drug interactions with other antibiotics. Drug interaction,

classified as pharmacological or clinical response, occurs due to the action of a certain drug on the effect of another or in concomitance with the first. Several factors related to this type of interaction, such as prescription, with high risk in cases of polypharmacy, when using multiple medications; the health condition and age of the individual, as each organism can react in a different way.

According to literature descriptions, there are moderate interactions between antibiotics and antihypertensives. Twenty interactions were identified between antibiotics found during the study period and drugs for continuous use. Frame 1 classifies the interactions according to the degree of severity and which interaction presents; the most prominent antibiotic was Ciprofloxacino. Among the drugs of continuous use, Hydrochlorothiazide.

Frame 1: Classification of drug interactions, using the tools Drugs.com and DrugBank.

Medicines	Interactions and risk	Classification
Amoxicillin + Hydrochlorothiazide	Decreased excretion rate of the antibiotic, resulting in a higher serum level.	Severe
Azithromycin + Simvastatin	Side effect on muscles	Moderate
Azithromycin + HCTZ Or Azithromycin + Amlodipine Or Levofloxacin + HCTZ Or Ciprofloxacin + HCTZ	The serum concentration of Losartana can be increased	Moderate
Ciprofloxacin + Simvastatin	Increased blood levels; liver damage.	Severe
Ciprofloxacin + Amlodipine	Increased blood levels; irregular heart rhythm; liquid retention; heart failure and low blood pressure.	Moderate
Ciprofloxacino + Losartana Or Ciprofloxacino + Enalapril	The risk or severity of hyperkalaemia may increase.	Moderate
Cefalexin + Losartana	Antibiotic metabolism can be decreased when combined.	Moderate
Azithromycin + Enalapril Or Levofloxacin + Amlodipine Or Levofloxacino+ Losartana Or Levofloxacin + Enalapril	Serum antibiotic concentration may be increased	Moderate

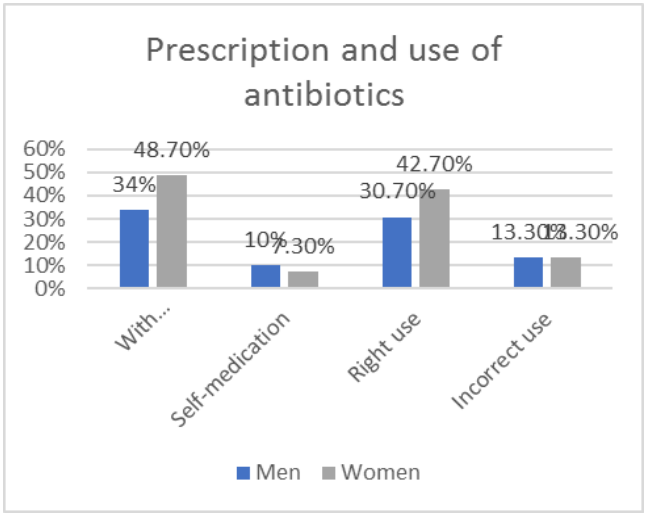
Penicillin G + HCTZ Or Penicillin G + Enalapril Or Penicillin G + Simvastatin	HCTZ excretion can be decreased	Moderate
Tobramycin + HCTZ	The risk or severity of nephrotoxicity can be increased	Severe

Amlodipine in combination with ampicillin can increase the bioavailability of antihypertensive drugs by suppressing the metabolic activity of the intestinal flora by antibiotics. Consequently, there is an increase in plasma levels of amlodipine, which can cause an increase in its potential as well as its side effects[21].

Gentamicin is an antibiotic used with caution by cardiac patients, due to its use with diuretics such as hydrochlorothiazide being responsible for causing severe damage. This is because its use leads to the minimization of serum potassium levels, developing cardiac arrhythmias.

During this study, we asked the participants whether the use of the antibiotic in use was under medical guidance and whether it was used correctly. As shown in Graph 2, 82.7% said it was under guidance and 17,3% without. Cases of self-medication, which can contribute to cases of future bacterial resistance, are common.

Graph 2: Medical guidance and use of antibiotics.



In addition, questions about the correct use of the antibiotic during the treatment period showed that among men, 30.7% said they had followed the treatment correctly and women, 42.7%. However, 26.6% of men and women reported not having followed the treatment correctly (Graph 2) for several reasons, reported in Table 4.

Table 4: Reasons for the incorrect use of the antibiotic.

Reasons				
Reasons	**Men**	**Women**	**Total**	**%**
Wrong time	2	4	6	14.3
Forgetfulness	7	6	13	31.0
They didn't know how to manage	1	6	7	16.7
Misunderstanding	2	1	3	7.0
Others	9	4	13	31.0

Table 4 shows that 31% of respondents reported having forgotten to take the medication and the same proportion reported not having followed the treatment for several other reasons, including the feeling of clinical improvement because they no longer feel the symptoms, leading to interrupting treatment.

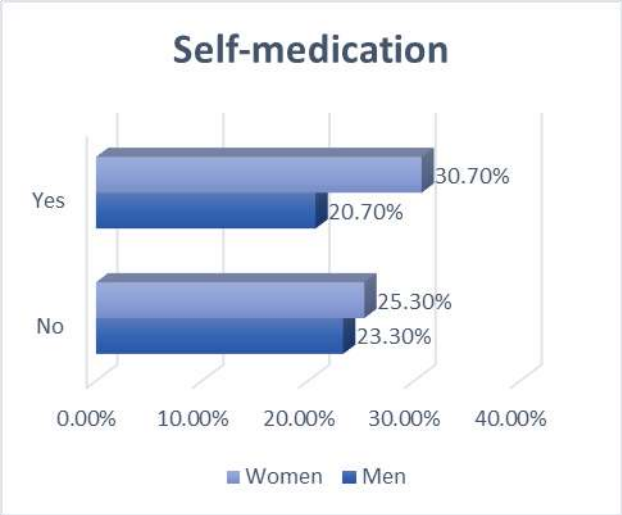
In addition, 16.7% of respondents reported lack of knowledge about how to administer the medication, which may have been due to the lack of information. Then, 14.3% reported taking the medication at the wrong time and 7% stated that they change the medication in some situations; especially patients who use continuous medications, these lasts reported difficulties regarding the definition of schedules for each medication.

Correct medication administration is essential. Ribeiro, Pinto and Pedrosa[16] work is in agreement with these results. Situations such as forgetfulness and taken as soon as possible, identified by the authors in 45.2% of respondents, while 29.1% do not take it and continue the

treatment the next day, 18.9% do not take and redo the schedule and 7.8% abandon the treatment.

Thus, even with the passage of time, some people continue to use antibiotics incorrectly, which can contribute to the increase of resistant strains. The extensive and sometimes inappropriate use of antibiotics as well as the delay in the diagnosis of bacterial infections has favored the increase in bacterial resistance[8].

Regarding the practice of self-medication, 51.4% of participants reported using this practice, with the largest adherence of the female population being (30.7%), while (48.7) of both genders refer not to use this practice.



Graph 3: Prevalence of self-medication by participants.

Thus, participants after being asked about self-medication (Graph 3) reported whether they had any symptoms after using the medication on their own. Table 5 shows the frequency and symptoms related to self-medication reported by respondents at the research site.

Table 5: Classification of symptoms presented due to self-medication.

Symptoms				
Symptoms	**Men**	**Women**	**Total**	**%**
Headaches	18	13	31	20.6
Nausea	7	13	20	13.3
Dizziness	3	12	15	10
Tremors / Palpitations	4	6	10	6.7
Accelerated beats	2	8	10	6.7
Hives / Allergies	4	6	10	6.7
None	24	30	54	36

Only 36% of the interviewees reported that they did not feel symptoms after using medication without medical guidance, while 64% reported that they felt some symptoms. These reports are similar to a previous study who observed that, among the self-medicating participants, 15.38% had complications after self-medication[7].

Headaches were the symptoms most reported by 20.6% of participants, followed by Nausea (13.3%), Dizziness (10%), Tremors / Palpitations (6.7%), Rapid Beats (6.7%) and Hives / Allergies (6.7%). Thus, the use of medications on their own may result in serious adverse reactions. Additionally, headaches are one of the main motivators for the practice of self-medication and may be related to other health problems, such as high blood pressure[21].

There are some relations between correct medication and level of education, but also due the lack of information during the purchase of the medication contributes to the wrong use of medicines. Graph 4 shows the percentage of respondents who have knowledge about the expressions used in the prescriptions such as the interval of each dose.

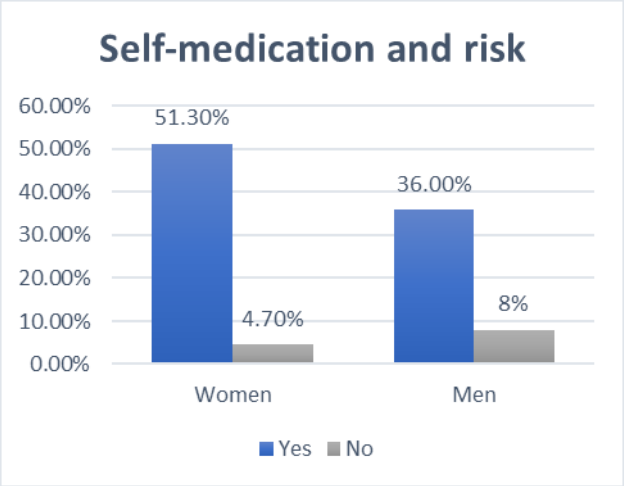
Graph 4: Classification of respondents who have knowledge about prescriptions.

Between men and women, 73% of the interviewees claimed to have knowledge about the expressions used in the interval of each dose, and 27% do not know its meaning. Despite being a lower percentage sample, doubts related to the use of the medication can interfere with any pharmacological treatment.

A study carried out in the state of Santa Catarina reported that a good part of the population did not have

enough information about medicines, presenting doubts about how to use them. However, in this same research in the medication dispensing doubts clarified complements the importance of the pharmacist in the orientation of these medications[13].

When asked about the opinion that the use of drugs without medical guidance can lead to health risks, 87.3% of patients (51.3% female and 36% male) stated that using drugs without medical guidance is a health risk, while 12.7% (4.7% females and 8% males) said they thought they were not at risk.



Graph 5: Relationship between medications without medical guidance and health risk.

These data corroborate the findings of Ferraz and coworkers[7] who found that among the self-medicating participants 89.85% are aware of the risks that this may present, while 10.15% are unaware, but continue to use the practice. It is worth mentioning that in this research, 61.54% are aware of the adverse effects of medications, and 38.6% are not.

Therefore, the practice of pharmaceutical care is essential for the rational use of medicines, especially antibiotics. It is through this practice that guidelines must be passed to patients with the objective of success in pharmacotherapy.

Strategies with health education can be intensified in order to guide patients about problems related to the incorrect use of antibiotics, with daily practices of monitoring the prescription, identifying, preventing and solving problems related to some medications.

According to Reginato[16], the pharmacist has a fundamental role in rationalizing the use of antibiotics; actions such as evaluating the prescription for possible occurrences of interactions with other medications, assisting the patients regarding the dose, duration and especially the time interval between the administrations of the patients. The practice of these actions aims at the proper use of this class of drugs and thus guarantee the effectiveness of the treatment.

Based on the problems observed in the studied population, an Intervention Project was carried out in the health unit with an emphasis on the relationship between the health professional and the patient, in an attempt to help with the problems reported above regarding forgetfulness and medication administration time.

For this, guidelines on the correct use of antibiotics, that emphasizing on their rational use and the importance of adhering to the treatment correctly, respecting the interval between each dose and especially avoiding taking more than one medication at the same time, as well as following with treatment until the end without interrupting on your own were given. Then, the participants received a timetable where they could organize according their own routine the medications, dose and interval.

The presence of a pharmaceutical professional at the health center will provide effective pharmacotherapy to the patient[24]. In view of the above, the insertion and performance of the pharmacist in combating bacterial resistance is essential, since it tends to contribute to the rational use of medicines, especially antibiotics.

IV. CONCLUSION

This study characterized the profile of the health unit related to the use of antibiotics by UBS patients. The high rate of young women using antibiotics together drugs for the treatment of hypertension is high, which reinforces the importance of the pharmaceutical professional in caring for these patients.

The antibiotics most used were those belonging to the penicillin class, and the main drugs for continuous use were antihypertensive drugs. However, with polypharmacy, it is evident that the amount of prescription drugs can affect adherence to the medication and compromise its therapeutic efficacy. The practice of self-medication is quite frequent as well as factors that contribute to the increase in bacterial resistance.

Thus, it is essential that pharmaceutical professionals follow up with patients who attend the unit for therapeutic monitoring, in addition to guiding and clarifying doubts about the prescriptions to contribute to adherence and improve the patient's quality of life.

In addition, communication must be reliable and objective, in order to minimize the risks of self-medication and the

indiscriminate use of antibiotics. The practice of pharmaceutical care must be reinforced in order to prove the importance of correct treatment, through educational strategies to provide a better understanding by patients.

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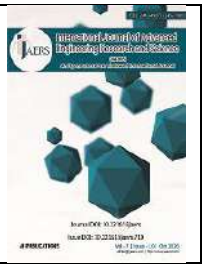

Scientific Dissemination as Journalistic Activity

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Keywords*— *Scientific Journalism. Journalistic Enunciation. Retextualization.

***Abstract*—** *This article makes a brief analysis of the discursive resources used as scientific dissemination strategies through journalism in the institutional newsletter Jornal do Semi-Árido, conceived, produced and edited by EmbrapaSemiárido's press office. In addition to the newspaper, the digital information bank named* Knowledge Trees *is also under analysis, with data from the most diverse fruit species cultivated in the Brazilian semiarid region. As a methodology, the perspective of mapping was used from the contributions of Santos (2002) and Biembengut (2003). The discussion proposed in the course of the work is the potential that Journalism has in bringing the public closer to such technical and specific terms used in the scientific environment. Therefore, the dialogue of authors such as Bakhtin (1992; 1997), Vizeu (2004; 2007), Zamboni (2001),*

I. INTRODUCTION

Current studies on science communication refer to various types of approach, from public perception of science, scientific literacy or analysis of scientific discourse. In general, these studies deal with the importance of scientific dissemination in order to make public knowledge restricted to a group of people, generally specialized in certain areas (biological, agrarian, robotics, among others). On the other hand, such approaches also refer to scientific journalism as one of the tools of this type of dissemination.

In order to reflect on scientific journalism as an important tool for the dissemination of science, this article presents a brief analysis of two journalistic productions prepared by the Brazilian Agricultural Research Corporation - Semi-Arid, a public institution focused on scientific production in the Brazilian semi-arid region. Therefore, the institutional newsletter, Jornaldo Semi-Árido and the digital content Knowledge Trees are under analysis here.

The relevance of the work was to realize how journalism, especially Multimedia Journalism, focused on activities of the various possible media for communication, including print, electronic media, hypertext, among others, is a tool for disseminating knowledge that they can do. part of people's daily lives. Thus, it was possible to demystify the idea of science as a distant field from everyday life. Another aspect was to show the contribution of the Theory of Enunciation, created by the philosopher of language Mikhail Bakhtin, to the studies on journalism in a more directed way to the enunciation that occurs in the spheres of journalistic communication, for example, the journalistic enunciation as suggested by Vizeu (2007). And, inserted in the context of journalistic enunciation, as the processes of retextualization is also a mechanism to create statements in order to direct them to the public. The enunciation, among other aspects, accounts for a speaker in constant dialogue with his interlocutor and the repertoire of the latter is also formed by such interaction, (BAKHTIN, apud VIZEU, 2007, p.2). Retextualization as suggested by Marcuschi (2001) is a constant linguistic procedure for people. In view of this, the work pointed out how this process of retextualizing is part of the journalistic enunciation. Retextualization as suggested by Marcuschi (2001) is a constant linguistic procedure for people. In view of this, the work pointed out how this process of retextualizing is part of the journalistic enunciation. Retextualization as suggested by Marcuschi (2001) is a

constant linguistic procedure for people. In view of this, the work pointed out how this process of retextualizing is part of the journalistic enunciation.

To account for the search and analysis of data in the construction of the work, the methodology applied was Mapping from the perspective of Santos (2002) and Biembengut (2003) where the authors speak of maps as a way of representing reality. Santos, (2002) when dealing with the theme makes a sociological approach to cartography inserted in his studies on Cartography of Law, discussing the usefulness of maps and drawing an analogy with Law, in which he places that both occupy in society, a place of representation .Biembengut, on the other hand, uses the same perspective as Santos, however, considering the context of educational research.

The author puts the role that research has in meeting social demands, and how it can be an instrument in search of answers to the demands of the educational context. The mapping for it serves as a way to search for information that can enable the construction of the answers that Education needs. In the case of this work, the mapping served as a way to search for information as close as possible to the context where it occurs, in addition to analyzing the data without forgetting to send it back to its origin, not even the route to reach it.

Therefore, this article is organized in two parts, first the methodological path and an exposition of the analyzes of the Jornal do SemiÁrido, informative by EMBRAPA Semi-Árido, and the institution's website, together with the dialogue of some authors used in the research, will be discussed. Subsequently considerations of the work.

II. MAPPING AS A METHODOLOGICAL ROUTE

To search for information about the processes of construction of journalistic statements in the context of a press office focused on the dissemination of scientific knowledge, it was necessary to search for elements that would answer the guiding question of the monograph. Therefore, the route traced to the construction of the work was to collect evidence of the procedures of the press officer in preparing the texts published in the various enunciative supports that EMBRAPA Semiárido has. For this, a methodology applied in both research in the social sciences and in the human sciences, mapping, was used.

The use of this procedure is based on the proposal of Boaventura Sousa Santos, in which the author in his work on Cartography of Law deals with maps as forms of representation of reality. The author discusses the usefulness of maps as instruments that serve to imagine and represent space making an analogy with the Law. For him, it is possible to work with mapping in a sociological perspective as a reference for the construction and representation of space. The understanding of such a perspective is precisely to collect information in the place where they present themselves with the objective of gathering them to get to know them.

In an educational approach using the same methodology, Biembengut (2003) suggests a tool that is capable of breaking the barrier between discourse and action. The author works from an applied research perspective, also emphasizing that, as an obligation, educational research should serve society in order to respond to the various problems that arise in this context. The author also points out that mapping cannot be understood only as an accumulation of information, nor as graphics, but as knowledge closer to a reality through significant and relevant details (BIEMBENGUT, 2003, p. 297). Therefore, this methodology was fundamental for the maturation of the research path, seeking to analyze the data without losing sight of the context in which they are inserted.

III. ANALYSIS OF THE ADVERTISING SUPPORTS

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.

Here to reflect on the practices of scientific journalism, the analysis material is the Jornal do Semi-Árido, a newsletter from the Brazilian Agricultural Research Corporation - EMBRAPA, installed in Petrolina and focused on research in this region of the Brazilian semiarid. The newspaper, of an institutional nature, began to be published in the 1980s, currently it is published quarterly, with a circulation of one thousand copies. The content is mainly aimed at the internal public of the company and the institution's partners in order to keep them updated on progress and results of research carried out at the institution.

In general, in the data collected it was evident that the company's newspaper presents a remarkable procedure in the construction of the publication's statements, the retextualization. This is the process by which the statement suffers when taking on another language format (MARCUSCHI, 2001). The author shows that these are routinely procedures, exemplifying that the alleged quotes ipisisverbis, is a form of transformation, reformulation, recreation, modification of someone's speech. He states

that retextualization happens in a very diverse way in societies and their linguistic games:

> In reality, our daily linguistic production, if carefully analyzed, can be seen as a chain of reformulations, such as the overlapping of linguistic games practiced in this interdiscursivity and intertextuality. (MARCUSCHI, 2001, p.48).

In the case of the construction of the statements of the information in question, it should be considered that the source used by the journalist are research results, and in the case of the company in question, research aimed at the agricultural sector. One of the examples of retextualization can be pointed out in the research comparing the language used by a researcher and a news item published in the newsletter dealing with her research.

Below is an original excerpt from the researcher:

> The present study was developed during the years 2005/2006, in a commercial mango plantation, of the Tommy Atkins variety, at Fazenda Frutex, in Petrolina-PE, aiming to verify the floral biology, as well as the comparative study on behavior, frequency and the seasonality of floral visitors in organic and conventional cultivation. The inflorescences of the mango tree have male and hermaphroditic flowers, in the proportion of 2: 1, with predominance of the former at the base of the panicle. The anthesis is diurnal, asynchronous, with the release of a strong sweet odor. The flowers present dicogamy, characterized by anh dehiscence 24h. after anthesis. The production of nectar is continuous and in small quantities, on average 0.045 μL / flower. As for floral visitors, 21 species were registered, belonging to the orders; Diptera, Hymenoptera, Lepidoptera and Odonata. Apis mellifera was the most frequent species in both types of cultivation. Among the dipterans, Belvosiabicincta (17.7%) and Musca domestica (10.2%) stood out as the most frequent in conventional and organic cultivation, respectively. The diversity and the number of visits were greater in organic cultivation. The use of pesticides during flowering reduced the frequency of visits by bees by 50% and by diptera by 20%. Due to its behavior, frequency and active displacement in the inflorescences, A. mellifera was considered as the most efficient pollinator of the culture for the region of Vale do Submédio São Francisco. (SIQUEIRA, 2007) 2%) as the most frequent in conventional and organic cultivation, respectively. The diversity and the number of visits were greater in organic cultivation. The use of pesticides during flowering reduced the frequency of visits by bees by 50% and by diptera by 20%. Due to its behavior, frequency and active displacement in the inflorescences, A. mellifera was considered as the most efficient pollinator of the culture for the region of Vale do Submédio São Francisco. (SIQUEIRA, 2007) 2%) as the most frequent in conventional and organic cultivation, respectively. The diversity and the number of visits were greater in organic cultivation. The use of pesticides during flowering reduced the frequency of visits by bees by 50% and by diptera by 20%. Due to its behavior, frequency and active displacement in the inflorescences, A. mellifera was considered as the most efficient pollinator of the culture for the region of Vale do Submédio São Francisco. (SIQUEIRA, 2007) mellifera was considered the most efficient pollinator of the crop for the region of the Vale do Submédio São Francisco. (SIQUEIRA, 2007) mellifera was considered the most efficient pollinator of the crop for the region of the Vale Submédio São Francisco. (SIQUEIRA, 2007).

The above text is the summary of one of the thesis chapters: Comparative study of the pollination of Mangifera Indica (ANACARDIACEAE) in conventional and organic cultivation in the region of the São Francisco sub-medium valley, authored by researcher Kátia Maria Medeiros de Siqueira, in 2007. From the process of retextulization and adaptation to the journalistic language, the restricted content of this scientific text presented above, has the following statement:

> **Ecology of mango pollination in the São Francisco Valley**
>
> Investments in research, in the installation of modern packaging structures and post-harvest storage of fruits, in road, air and sea transport logistics, and in specialized labor, along the mango production chain, do not dispense with the providential activity of bees, flies and wasps to obtain high productivity in the orchards of the crop. Flying from plant to plant for most of the day, these insects provide a unique and essential service: the pollination of flowers, the first stage for their transformation into fruit. (RIBEIRO, 2007).

The characteristic procedures of journalistic language, such as the use of graphics, photographs, the lead itself favor the understanding of the lay public with technical language used by scientists. On these issues Zamboni (2001) was an essential theoretical support to elucidate such points and in the analysis of the newspaper some of the paths pointed out by the author were evident. The author calls this mechanism one of the "attractiveness resources", a "global strategy to make the material more attractive for reading" (Zamboni, 2001 - p. 106). Some examplesthatcanbeshown are:

Image 1 (Ribeiro, 2007)
Researcher showing new variety of watermelon. Feature: First powdery mildew resistant watermelon.

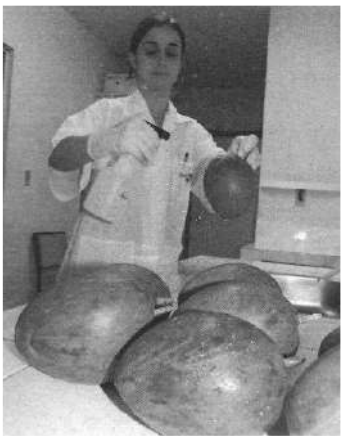

Image 2 (Ribeiro, 2007)
Laboratory researcher shows natural extract, mango preservative. Feature: Natural product preserves natural quality of mango, October 2007.

The two researchers act as representations of the activities they perform, in addition to representing the institution itself. In image 1, the researcher is the portrait of the conception of a new variety of fruit, while in image 2 the researcher, in her workplace shifts the reader's view from action to the act of peculiar experimentation of science. In addition to Zamboni's (2003) look at these techniques used in journalistic work, it was also possible to consider journalistic enunciation. Vizeu (2007) puts how the audience is present in this context.

> It is in the enunciation work that journalists produce discourse. And it is within the discursive process itself, through multiple operations articulated by language processes, that the audience is constituted in advance ". (VIZEU, 2007, p. 2).

Therefore, as an enunciative support, it is possible to attribute to Jornal do Semi-Árido an element of scientific culture, as Vogt points out. The author emphasizes that science serves beyond everything, as a form of social intervention, emphasizing that scientific development is a cultural process, with a social dynamic in it, from the production of scientific knowledge to its dissemination, and it is in this process that finds the power of social intervention that science has (VOGT, 2003).

As far as the institution's website is concerned, in addition to the points highlighted in the printed newsletter, it also goes through other journalistic procedures related to language. It is necessary to consider that because it is an electronic vehicle, it requires another approach and has a different type of target audience. The website is the channel that the company has with the public connected to the internet, it has been on the air for about 10 years. A particularity of the information published on the institution's website is the texts on the news board. The materials published on the website are the same as those sent to the information vehicles in the form of a release. The news board is, therefore, a series of suggestions for guidelines on the research and actions of the institution.

The Knowledge Trees, as they are called, are statements developed by the institution to facilitate public access to these research results. Through a semiotic analysis of the figure, the tool has an iconic meaning, as it suggests in the figure a representation of a real tree, in which its fruits are different, that is, the knowledge, the information generated by the company, therefore its structure is a attempt to have uniformity with the parts of a tree (roosters, canopy, among others). As it is a mechanism that gathers summary information of each step of the fruit production, from preparation to commercialization, an interesting factor of the tree as a tool for scientific dissemination is that the company makes a general overview of such information and disseminates it in an accessible way to the public.

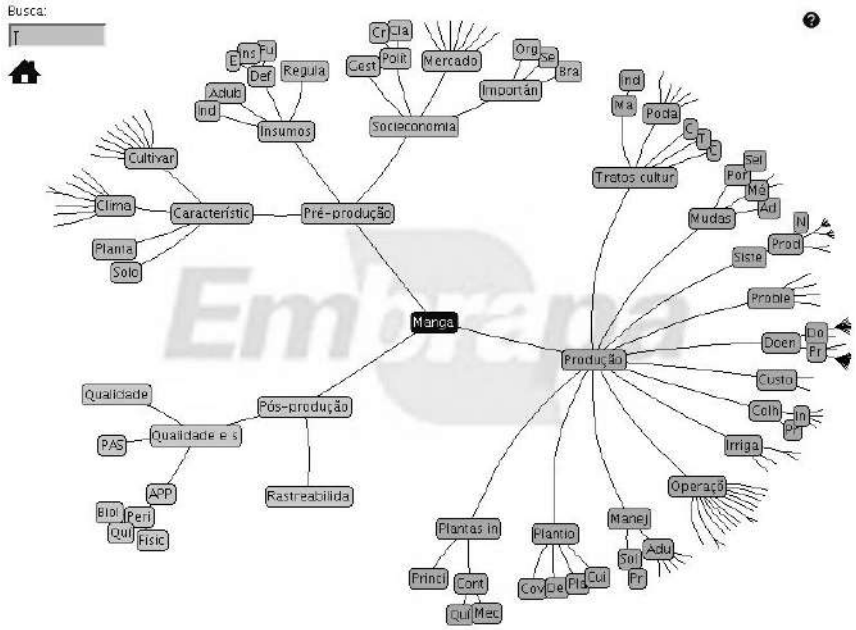

Image 3 Embrapa Semiárido website

The construction of the trees was an initiative of the institution to enable yet another mechanism for the dissemination of the knowledge generated by the company. As was put in the analysis of the newspaper, the content of the tree also undergoes a process of retextualization, but with a different direction, for an audience interested in this subject, but who can also be a diverse audience, since such statements contained in the tree, in a way general can be accessed by most people. Jargon, graphics, scientific nomenclature are not present in this content, so this statement creates another enunciative scenario based mainly on the public's attractiveness for the form, colors and dispositions of the information.

IV. CONCLUSIONS

In the context of the data collected, it was possible to see how journalism is an important tool for the dissemination of scientific knowledge, favoring the appropriation of such knowledge by the non-specialized public. It is possible to make such a consideration because the analyzes show how these statements produced by a journalist are also marked by the voice of the audience for which they are intended. Because, to deal with concepts, which are mostly restricted to a limited group of people, it is necessary to use mechanisms of approximation with the diverse public. Among the mechanisms pointed out is the retextualization: when preparing a news article about a certain topic in this universe, the journalist needs to approach these concepts using a simplified language.

On the other hand, the work also showed that the analyzed supports are part of Scientific Culture, as highlighted by Vogt (2003), because as tools for the dissemination of science, through these supports the idea of science being a field distant from the daily life of women is demystified. people. The comprehension of topics debated and analyzed scientifically serves as support for the production of culture, creation, evaluation and improvement of public policies.

With regard to the dissemination tools that the institution has, the trees of knowledge are utterances proper to scientific discourse, as they are produced entirely by researchers, according to the logic of their activities. However, they also show themselves as improved statements for dissemination, since the statements that scientists have, in most cases, do not reach much of the public, and, as pointed out in the work, trees are the most accessed pages in the EMBRAPA website. In this case, it is also possible to consider that journalism, especially multimedia journalism, which assumes the task of using the various possible means to 'speak' to the public, should appropriate these principles.

The question that arises in this current research context is the fact that journalism appropriates such tools and mechanisms that allow the possibility of thinking about work practice, emphasizing its complexity. And, as far as scientific dissemination is concerned, journalism creates a bridge between this knowledge and the public, not only in the sense of mediating this information, but mainly because it allows access to concepts that are of interest to society, because from them other issues are created, undone and redone.

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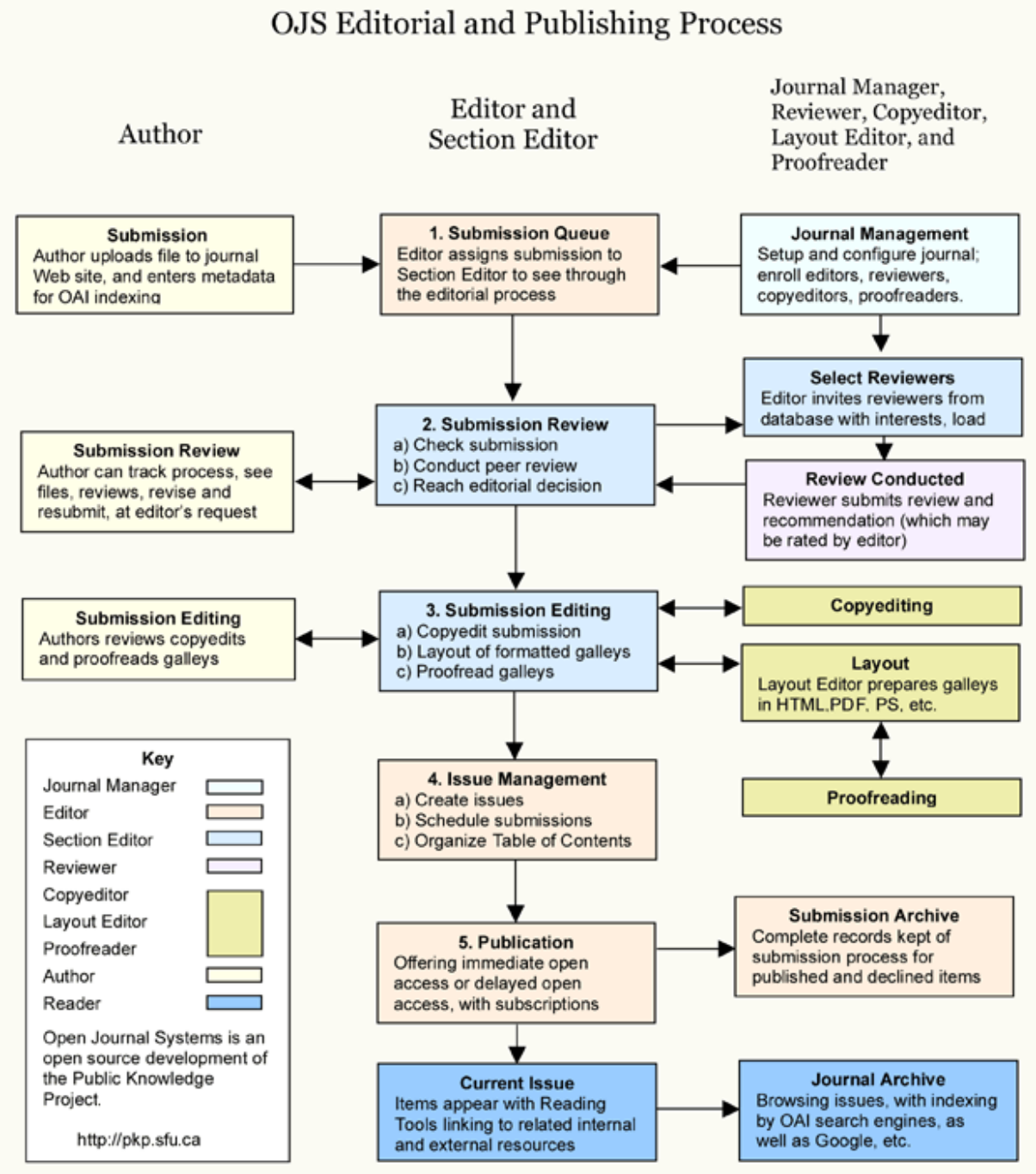

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