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FOREWORD

I am pleased to put into the hands of readers Volume-5; Issue-5: 2018 (May, 2018) of “**International Journal of Advanced Engineering Research and Science (IJAERS)** (ISSN: 2349-6495(P) | 2456-1908(O)”, an international journal which publishes peer reviewed quality research papers on a wide variety of topics related to Science, Technology, Management and Humanities. Looking to the keen interest shown by the authors and readers, the editorial board has decided to release print issue also, but this decision the journal issue will be available in various library also in print and online version. This will motivate authors for quick publication of their research papers. Even with these changes our objective remains the same, that is, to encourage young researchers and academicians to think innovatively and share their research findings with others for the betterment of mankind. This journal has DOI (Digital Object Identifier) also, this will improve citation of research papers. Now journal has also been indexed in **Qualis (Interdisciplinary Area) (Brazilian system for the evaluation of periodicals, maintained by CAPES)**.

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

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

With warm regards.

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Mathematics as a Supporting Tool for Technological Management

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Abstract— *The necessity of production involving the applicability of mathematics in the management decision-making process stimulates the elaboration of this article. This approach seeks to develop under a new profile of Mathematical Science, now as another tool of technological management, while it allows to understand the diverse deductive paradigms of this knowledge of support to the administrative process. In this way, the general objective is to deal with the application of mathematics as a tool in technological management; (1), to evaluate the applicability of these tools in the management of small and medium enterprises (2), to propose a mathematical model that contributes to the innovation of the business enterprise (3). The theoretical foundation is in the Taxonomy of Bloom, prescribed for the development of abilities and cognitive attitudes of the individual. There will be no doubt that mathematical problem-solving procedures advance significantly, especially to the demands of complex solutions. The Content Analysis Method and related procedures apply to this task. As a result Therefore, the study of mathematical and statistical application, in addition to computer resources to identify the possible trend in the index of technological management, the present article states that mathematics as a tool has its widespread applicability within the most diverse types of technological management, regardless of their size and showing how mathematics is associated in different areas of knowledge as a trend for technological management, since it is still*

considered for some as a difficult element among managers.

Keywords— *Application, Tool, Technological management, Modeling, Mathematics.*

I. INTRODUCTION

Mathematics is considered the science that unites the clarity of reasoning to the synthesis of language. It arose from the social life, when of the exchanges and counting, with its practical, utilitarian and also empirical character. Several advances in today's society are carried out by this science, mainly in technological management, in the face of the significant subsidy for quality in management decisions, especially in problem solving.

The application of mathematics as a technology management tool is a basic modeling due to the growing need for distribution and management. In addition to being considered as support for information management in an unstable competitive economy. Provides solutions to issues that achieve effectiveness and functionality in organizations. As a support process in the management of information technology, it improves the routine in those solutions, not only by common sense, but also by the simple objectivity evidenced in the complex situations faced in the daily life of individuals.

II. OBJECTIVES

This research answers the following question: How do we configure the application of mathematics as

elements of support for technological management? This question will be answered throughout the development of this work, and for this purpose it is a general objective to study the application of mathematics as a tool in technological management. For the production of results, the specific objectives are to identify the elements that can support mathematics as a tool in the technological management processes (1), to evaluate the applicability of these tools in the management of small and medium enterprises (2), to propose a mathematical modeling that contribute to business innovation (3). This approach implies satisfying a gap in the processes of planning, control, structural organization and decision making, whenever the argument comes to impose rationality.

III. THEORETICAL AND CONCEPTUAL REVIEW

For this study we consider the theoretical and conceptual precepts based on the Bloom Taxonomy treated in Adams (2015), prescribed for the development of the individual's abilities and cognitive attitudes. If it refers to the retention of specific and discrete parts of information such as facts, definitions, methodology; sequences of events and processes or where knowledge can be evaluated through direct.

3.1 Concepts of technology management tool

Initial search in Bertero (1977) brings Felix Moreno affirming that technological management is the administrative capacity to perform functions of creation, evaluation, assimilation and commercialization of technology, as well as to acquire complete and timely information on the same. Therefore, there is no doubt that this statement dispenses with the application of mathematics in order to achieve results in acceptable parameters. This theoretical-conceptual duct allows the adaptation by heuristic means, to explain the development of a business organization from its inception to its end,

where the existing diversity develops a model of organizational growth in small, medium and large companies. , assumptions in them, propose the classification of mathematical models for organizational development in one of the following categories: Management of people and goods in the company, mathematical modeling.

Management of people and assets: this is the area responsible for managing and directing the financial resources of the company and analyzing proposals for new investments in relation to the area of human resources, it is important to highlight the training programs for the operationalization of the plans, but, moreover, it has as its functions the recruitment and selection of workers, as well as all matters related to them (contract, wage policy, labor relations). Finally, the maintenance establishes the follow-up and maintenance plans, in order to keep the equipment and facilities in perfect condition for use. Given this diversity of interrelated functions, there are several resources that allow a good management of this process, giving support to decision making, aiming for greater competitiveness and profitability, in the format discussed in Andrade, Fernandes and Nantes (2010).

Mathematical Modeling is a teaching and learning approach that involves a dynamic process that allows to investigate, problematize and transform situations, phenomena or reality data into mathematical expressions, that is, in mathematical models. Its process allows itself to be mediated by the managers, discovered by the collaborators and inserted in the educational companies with the purpose of exploring and solving certain situations and / or daily problems through Mathematics, verifying the relation and the understanding between reality and the models mathematicians In order to do so, those involved may come across various challenges and multiple contributions regarding Mathematics teaching and learning in Mathematical Modeling activities, according to Soares (2012), as shown in Figure 1 and Table 1 following.

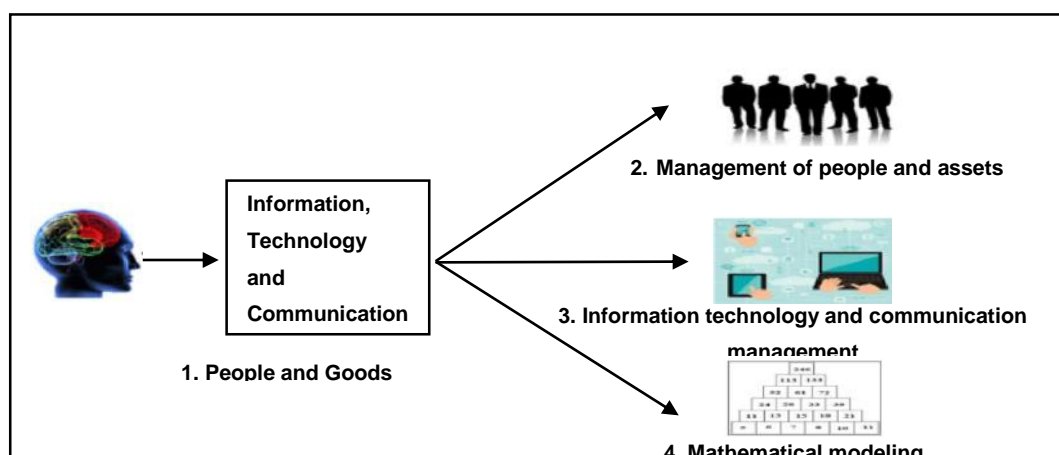


Fig.1: Classification of mathematical models for organizational development

Source: Prepared by the authors based on Soares (2012).

Table.1: Classification of mathematical models for organizational development

Feature diagrammed	Characterization
1. Goods and Person Manager	1.1 Individual who is able to obtain results from your organization (goods and services) with the efforts of your employees and organize, direct, coordinate the work of your company.
2. Operational management of people and goods	2.1 The employees in the companies receive several trainings that are not taken advantage of by lack of mathematical base that is the base of any technology. The efforts are all focused on the human being, his / her training and preparation to perform in the best possible way his activities and, above all, to become a more active and searching subject for solutions and continuous improvements.
3. Mathematical modeling	3.1 A tool applied in any and all systems, production, quality control, projects, prospecting new business, etc. Mathematics has a purpose in itself when it awakens in man the capacity to interpret and model phenomena in his environment, through logical reasoning, focused on strategies to optimize his process.
4. Information technology and communication management	4.1 The focus is on technology and not on the man who will employ it. The programs offer a series of parameters, statistical data, information, numbers, but does not guarantee that this data provided is interpreted properly. For in this case, the competence of the people enters to be able to take full advantage of these technologies.

Source: Prepared by the authors based on Soares (2012).

Mathematics as a management tool brings meant possibility, since the use of ICT supported programmes; this is because the concepts allow counting, numbering, sorting, knowledge of forms, and sorting of data. Thus, it is understood that companies can consolidate the so-called statistical process control system (SPC), in which statistics are applied in favor of the quality of products and processes; the SPC makes it necessary to also evaluate the measurement systems that are used to quantify the quality of the products, resulting in the Measurement System Analysis (MSA). It would be the construction of a proposal of mathematical modeling that contributes to the innovation of the business business, as it comes from this work as it deals with Kimbanda (2014).

First, it must be recognized that in the business environment, innovation has been associated with the technological advancement of products. It is rarely seen as organizational or managerial innovation, much less as alternative business models. It is how Wechsler (2014) treats, when referring to the concept of innovation, is usually linked to the process of turning ideas into something useful and of economic value. In this understanding, there is a distinction between innovation and invention, post innovation is one of those words that we believe to know the meaning, but which, when we discuss, we barely agree.

Mathematical modeling consists in the establishment of a set of mathematical tools that allow to make a theoretical analysis of a given situation. The proposition of mathematical modeling starts to contribute to the innovation of business, considering the practices of methods such as Operational Research (OR); this is a

method of decision-making, involving, in Wechsler's (2014) perception, the structure of the processes, and then the set of alternatives and actions, configured in the prediction and comparison of values, which always result in advantage, such as efficiency and optimization of business costs. The OR is, therefore, a system organized with the aid of models as well as the experimentation of models, in order to operate a system better.

3.2 Mathematical model

A mathematical model of an object (real phenomenon) is any simplified and idealized scheme, consisting of symbols and mathematical operations. A mathematical model is a case of formalization that employs the most diverse instruments produced in mathematical science.

3.2.1 Phases of construction of a mathematical model

It is important to mention that the vast majority of mathematical models are not accurate and have a high degree of idealization and simplification, since very precise modeling may be more complicated to handle than a convenient simplification. Therefore, the literature and practice of management and innovation in companies teach us that many cases, the construction or creation of useful mathematical models follows a series of well-determined phases of greater interest in business situations: identification of the model, choice of type model, formalization of the model and the choice of the result that are based on Guts et al (2013), being logical of its construction indicated in Table 2 that follows.

Table.2: Phases of construction of a mathematical model based on Guts et al (2013).

Phases of mathematical model construction	Theoretical description of the construction phase of mathematical models
1st identification	1.1 identifies a complex problem or situation that needs to be simulated, optimized or controlled and therefore would require a predictive mathematical model.
2nd choice of type	2.1 requires specifying the type of response desired, what input data or relevant factors, and what the model is intended to use. This choice should be simple enough to allow accessible mathematical treatment with available resources. This phase also requires identifying the largest number of reliable data, labeling and classifying the unknowns (independent and dependent variables) and establishing physical, chemical, geometric, etc. considerations. which adequately represent the phenomenon under study.
3rd formalization	3.1 formalization of the model in which it will be detailed what the input data are the input data, what kind of mathematical tool will be used, how they adapt to the existing previous information. It could also include the creation of algorithms, the assembly of computer files, etc. At this stage, it is also possible to introduce sufficient simplifications so that the mathematical problem of modeling is computationally treatable. in the company.
4th comparison of results	4.1 The results obtained as predictions need to be compared with the observed facts to see if the model is predicting well. If the results do not fit well, it is common to return to the stage.

Source: Prepared by the authors based Guts et al (2013).

3.2.2 Mathematical model according to the type of representation

In addition, mathematical models find different names in their various applications. A possible classification may determine whether they intend to make qualitative predictions or intend to quantify aspects of the system being modeled:

Qualitative or conceptual models may use figures, graphs, or causal descriptions, in general, they are content to predict whether the state of the system will go in a certain direction or will increase or decrease some magnitude, regardless of the exact magnitude of most aspects.

Quantitative or numerical models use numbers to represent aspects of the modeled system and generally include more or less complex formulas and mathematical algorithms that relate numerical values. The calculation with them allows to represent the physical process or the quantitative changes of the modeled system.

IV. METHODOLOGY OF PREPARATION

According to Gil (2007), the research allows an approximation and an understanding of the reality to investigate, as a permanently unfinished process. It proceeds through successive approximations of reality, providing subsidies for intervention in the real. To develop a research, it is indispensable to select the research method to be used according to the characteristics of the research, different research modalities may be chosen, and it is possible to combine the qualitative and the quantitative.

Qualitative research is not concerned with numerical representativeness, but with the deepening of the understanding of a social group of an organization. Researchers who adopt the qualitative approach oppose the assumption that a single research model for all sciences is defended, since the social sciences have their specificity, which presupposes their own methodology. Thus, qualitative researchers refuse the positivist model applied to study in social life, since they can not make judgments or allow their prejudices and beliefs to contaminate research, as Goldenberg (1997) states. In qualitative research, the results can be quantified. As the samples are generally large and considered representative of the population, the results are taken as if they constituted a real picture of the entire population targeted by the research. Quantitative research focuses on objectivity. Influenced by positivism, it believes that reality can only be understood based on the analysis of raw data, collected with the aid of standardized and neutral instruments. Quantitative research uses mathematical language to describe the causes of a phenomenon, the relationships between variables, and so on. The combined use of qualitative and quantitative research allows us to gather more information than could be achieved in isolation, according to Campos (2004).

4.1 The Question of Method

A content analysis is a research technique used to make valid and re-applicable inferences of data within their contexts. The data analyzed can be seen from several perspectives. The same author also emphasizes that the

meanings of the messages are not necessarily the same for all (the idea of the subjectivity of the interpretation is implicit). The organization of the content analysis starts from three chronological segments: the pre-analysis, the exploration of the material and the interpretation of the results. The pre-analysis is the organization of the work itself. It is at this stage that the choice of the object of study is made, as well as the formulation of the objectives of the work. If it is decided what to study, it is necessary to proceed with the constitution of the corpus, which is the set of material that will be submitted to an analysis, Monteiro and Carelli (2016).

In the case of this study that has mathematics as a tool to support technological management, the exploration of the material consists of modeling procedures or model in function of previously formulated rules.

The method of content analysis is characterized by a set of methodological tools whose main reference is to analyze a set of communication analysis techniques that can use systematic and objective procedures of descriptions of the contents presented by the messages analyzed. This methodology consists of a meditation on logical and scientific methods.

Initially, the methodology was described as an integral part of the logic that focused on the different modes of thought and their application. The research has as a qualitative-quantitative research approach, post are not excluded defining the form and the interface, arrange contributions mixtures of research of procedures of a rational and intuitive nature to contribute to improve the understanding of phenomena that can be distinguished, according to the idea of Kapitya (2006)

4.2 Procedures adopted in the method

For the preparation of this article, the authors followed the procedure of the bibliographical research that was done from the theoretical references already analyzed, and published through written and electronic like books, scientific articles, pages of web sites. Just as any scientific work has the beginning of a bibliographical research, which allows us to know what has already been studied on the subject. The task here is based on biblical research, in the presence of published theoretical references, in order to collect previous knowledge about the problem about which the answers are sought, following the recommendations of Kapitya (2006).

4.3 Contribution of the Bloom Taxonomy

The methodological development of support in the recommendations that it approaches on the Taxonomy of Bloom. This Bloom Taxonomy is applicable to the contextualization given in the study of Mathematics as a Tool to Support Technology Management conducted by Légaré et al (2015). That is linked in content analysis, the

starting point of content analysis is the message, as Campos (2004) emphasizes, whether verbal (oral or written).

The theoretical field of content analysis goes from the domain of linguistics, or logical-aesthetic and formal methods, through logical-semantic methods to the domains of hermeneutics, that is, semantic and structural semantic methods.

The first method deals with questions that seek the typical formal aspects of the author or the text. The central dimension of content analysis, that is, logical-semantic methods, becomes important in relation to computer programs that can be used as an aid to an analysis. Reiterating semantic logical methods, Campos (2004) points out that:

a) they are not related to the researches that are dedicated to the analysis of the formal structure of a text, as, for example, the procedure of its construction or its style;

b) apply to the most varied types of texts, after the index of the various concepts used (their simple enumeration and their unfolding) and the classification of information elements (grouping by categories);

c) in short, these methods concentrate common similarities to those that precede: inventories, unfoldings, characterization, codification, search for possible correlations, ..., but always, and at the same time, from the understanding of meaning. Sense of words, meaning expressed in words, image and symbols, sense of perceptions and analogies of messages (basis of all regroupings and classifications of meaning of the hierarchies of the senses). According to Campos (2004), in the methods at the border with hermeneutics, the methodology of analysis should be considered as one of the dimensions of understanding and interpretation, often of a social investigation; but also involves the logical, formal and objective analysis of the logical and semantic fields. The methodology used in our analysis of preliminary content, in the detection of the categories of study, is inserted in the context of logical-semantic methods, since we do not place ourselves in the formal-aesthetic aspects and also eminently in hermeneutical questions, aiming after the reading, the composition of a mathematical model for the innovation of small and medium enterprises.

V. STUDY OF MATHEMATICS AS A TOOL FOR SUPPORTING TECHNOLOGICAL MANAGEMENT

Many of the developments of today's society are undoubtedly perpetrated by science and technology, making mandatory the application of various mathematical concepts and methods as tools for technology management. The universe of applications in which Mathematics is used, namely in the natural sciences and

engineering, in medicine, in economics and finance or in companies, to which the cited areas recur, are: modeling, simulation, optimization, linear programming, differential equations, probabilities and statistics, forecasting methods, financial mathematics, cryptography, graph theory, computer science, among others.

Companies need professionals who, in addition to solid training in these areas, have effective capabilities in their application to concrete problems. Faced with this reality, researchers propose a study of mathematics as a tool to support technological management. Without giving up rigorous mathematical training, this article can give sustainability to solve issues raised by society and the various companies.

5.1 Identification of the elements that support mathematics as a tool in business management

In this section we will describe the elements that underlie the sustainability of mathematics as a tool to support business management, including: Higher level, incorporating knowledge, attitude and cognitive processing at lower level, understanding the meaning of information, learning objectives, facts and opinion, knowledge and skills or techniques in new situations, mathematics as a tool to support technological management, analysis, critical thinking and formulation, evidence of information gaps, application identify the claims and evidence and results, as shown in Figure 2 below.

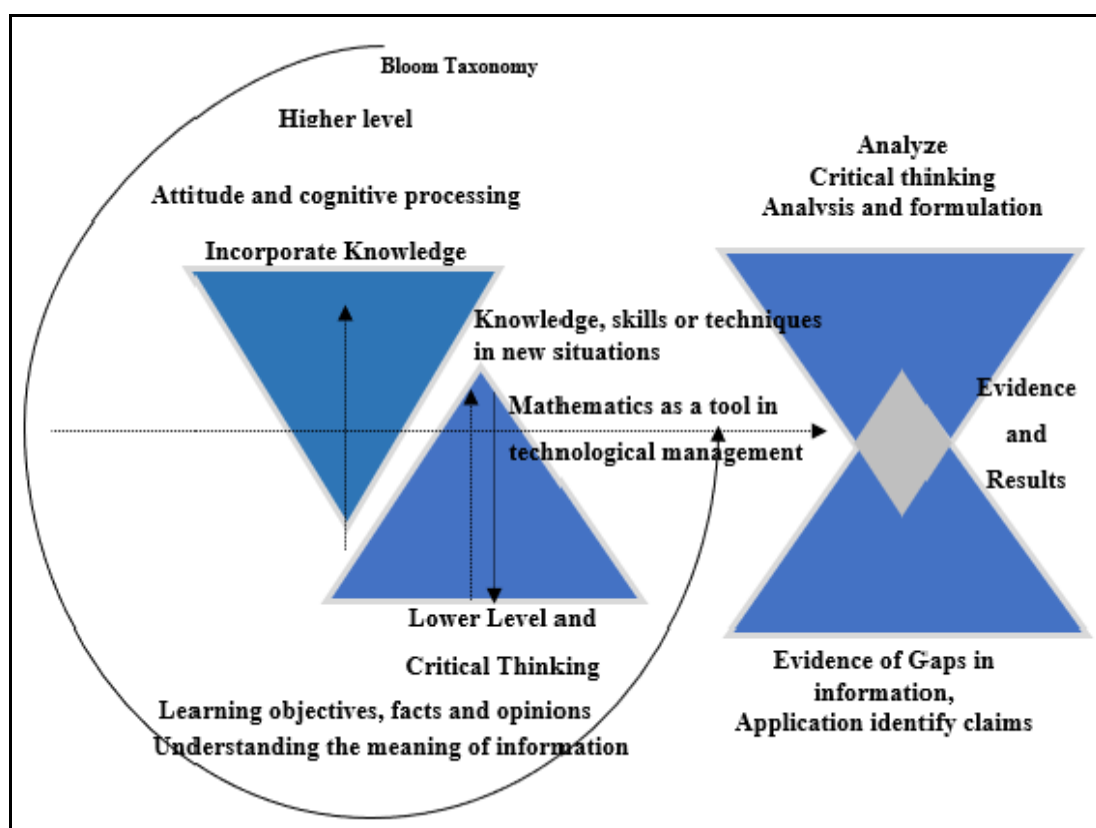


Fig.2: Bloom Taxonomy Diagram based on Adams (2015).

Source: Authors.

Table.3: Bloom Taxonomy com based on Adams (2015).

Feature diagrammed	Characterization
1. Higher level	1.1 For the purpose of this study, it is characterized as the decision-making level, composed of leaders and other components of the institutional command that depend on mathematics to qualify its performance.
2. Incorporate the Knowledge Attitude and cognitive processing	2.1 Refers to knowledge and intellectual skills, such as understanding, organization of ideas, analysis and synthesis of information, the application of knowledge, the choice between alternatives in the face trouble, and evaluation of ideas or actions.
3. In Lower level	3.1 Constitui o corpo dos colaboradores comandados e demais atores das organizações gerenciadas, e que de alguma forma aplicam a matemática nas suas atividades de rotina, na forma do indicado neste estudo.

4. Understanding the meaning of information	4.1 Employees must show that are to paraphrase it in your own words, sorting items into groups, comparing and contrasting items with other similar entities, or explaining a principle to others.
5. Learning objectives, facts and opinions	5.1 Refers to the employee know and comprehension able to do tasks with their participation in a learning activity. Well-defined learning objectives are fundamental to the development of the informational stages.
6. Knowledge and skills or techniques in new situations	6.1 Skills in memorizing information and techniques previously covered, such as facts, dates, words, theories, methods, classifications, places, rules, criteria, procedures. It can involve amount of information or specific facts.
7. Mathematics as a tool in technological management	7.1 It serves as an instrument to employees in order to incorporate knowledge into their cognitive schemas, through which they process their business routines to produce results. Expected.
8. Analysis, Critical Thinking and Formulation	8.1 Refers to the teaching and learning session, involving the feedback of the collaborator, the evaluation of the value of this session in which they participate. It brings the ability to distribute information to understand the structure, categorizing and recognizing patterns.
9. Evidences of information gaps, application Identify the claims	9.1 Ability to use information in a new situation, in order to apply knowledge and skills acquired in the organization, to solve problems and create new approaches to results.
10. Evidence and Results	10.1 They refer to the operational effect in the application of mathematics as a technology management tool. It offers consistency to what has been delivered for decision and refutes doubts, making the information reliable.

Source: Authors.

5.2 Evaluation of the applicability of mathematics as a tool to support the technological management of small and medium-sized enterprises

In this way, the evaluation related to the applicability of the characteristics diagrammed in the management of small and medium-sized companies, was summarized in three important points, namely: Strategic dimensions of the company quality, size of the company and size of the mathematical model and its quality, as well as shows Figure 3 oriented in Silva (1999).

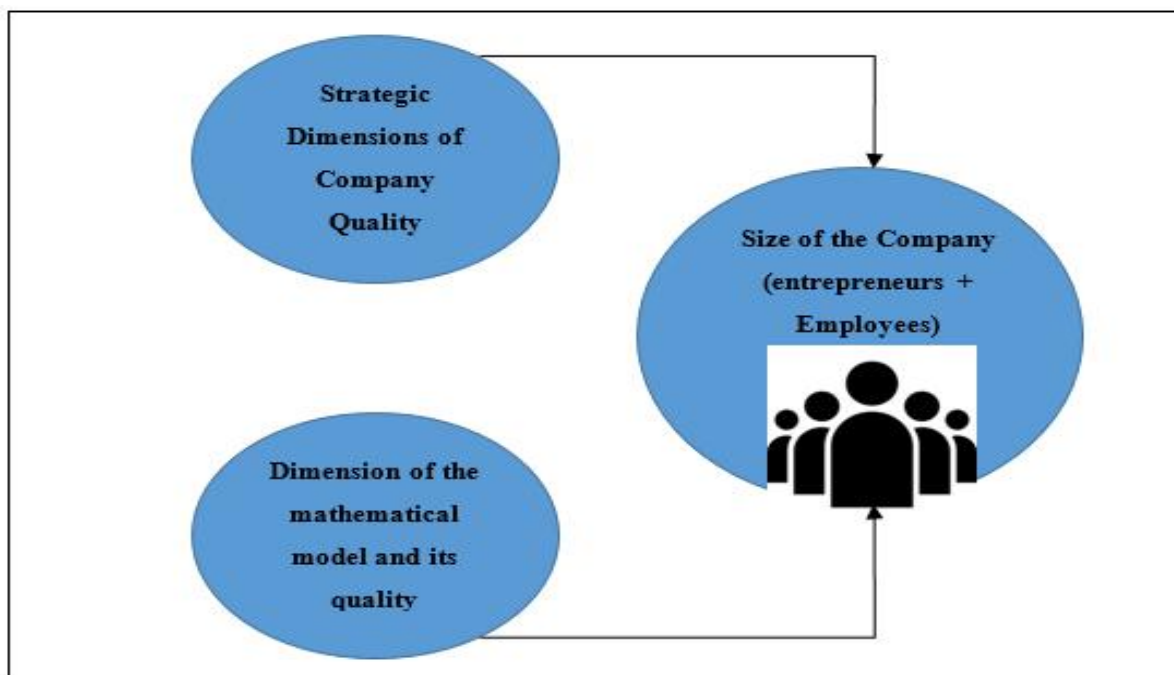


Fig.3: Dimension diagram based on Silva (1999).

Source: Prepared by the authors.

It is important to make clear that the Business Dimension (entrepreneurs + Employees) is dependent, among others, on the strategic planning configuration of

the company, that is, on the are included in this planning in the short, medium and long term, aiming to compare some aspects of management according to Parkin (1996).

Table.4: Dimensions based on the driving of Silva (1999).

Strategic dimension of Quality	Dimension of the mathematical model and its quality
Strategic planning practice.	Can be short, medium and long term, in the company; consists of communication between the employees of the company.
Self-evaluation.	Refers to the products compared to the competition; Training and education for the quality of the model in the company.
E-mail.	This addressing indicates interest in communication and information systems; involves the use of IDI statistical control for management control in the enterprise.
Management by objectives.	This management can not contradict the philosophy of total quality management, active market, national or international.
Evaluation of customer expectations.	It concerns technical assistance before, during and after sale; generates loyalty.
Centralization.	It may or may not occur, and refers to the definition of the company's overall goals and objectives; involves the distribution channels of the products.
Knowledge of company goals and objectives.	This knowledge is applied by the employees in the interest of the top management of the company by studies of organizational management. Type of production (small lots, mass, continuous process, fragmentation) existing in the company.
Knowledge of competitors at national and international level.	This knowledge takes place at national and international level. Top management trust in employees.

Source: Prepared by the authors.

5.3 Mathematical modeling proposal that contributes to business innovation

The implementation of a proposal of mathematical modeling that contributes to the innovation of the business, makes the organizational structure of the companies more efficient and effective, the planning of the activities, the definition and attribution of responsibilities, is the inclusion conceptual model as a tool and techniques for bridge the entrepreneurial difficulties.

According to Brooks and Robinson (2001), the conceptual model is a description of the model that one wishes to construct, independent of the simulation software that will be used.

A conceptual model can guide the data collection stage, in order to define the collection points, as well as to speed up the process of elaboration of the computational model. Despite these important contributions, authors like Wang and Brooks (2007) point out that of all the activities involved in a simulation project, conceptual modeling is probably the one that receives the least attention and consequently the least understood. The nature of the conceptual model is very different from the verification, validation and analysis of the results, which have strong mathematical and statistical elements.

Although important, it is very common to find in simulation presentation of this model or even its omission. As the objective of this article is to present mathematics as

a tool to support technological management, we seek a conceptual modeling proposal using existing techniques in business process modeling, we present the important technique that will be used namely IDEF.

Based on Aguilar-Saven (2004), the IDEF family is used according to different applications. The most important versions are IDEF0, IDEF1, IDEF2, IDEF3, IDEF4 and IDEF5. However, for business process modeling, the most commonly used versions are IDEF0 and IDEF3. Further details on applying IDEF can be found at the site maintained by *Knowledge Based Systems* (www.idef.com). Briefly, we will describe the function and functionality of each IDEF mentioned above.

IDEF0 is a method designed to model the decisions, actions and activities of an organization or system. IDEF0 was derived from a well-established graphical language, the Structured and Design Analysis Technique (SADT). The United States Air Force has commissioned SADT developers to develop a function modeling method to analyze and communicate the functional perspective of a system.

Effective IDEF0 models help organize the analysis of a system and promote good communication between the analyst and the customer. assists the modeler in identifying which functions are performed, what is needed to perform these functions, what the current system does and what the current system does wrong. Thus, IDEF0

models are often created as one of the first tasks of a system development effort.

IDEF1 was designed as a method for analysis and communication in setting requirements. IDEF1 is generally used to identify what information is currently administered in the organization (1), to determine which of the problems identified during the needs analysis are caused by the lack of management of appropriate information (2), and to specify what information will be managed in the implementation of TO -BE (3). IDEF1 captures the information that exists about objects within the scope of a company. The IDEF1 perspective of an information system includes not only the components of the automated system but also non-automated objects such as people, filing cabinets, telephones, etc. The IDEF1 was designed as a method for organizations to analyze and clearly state their information resources management needs and requirements.

Instead of an IDEF2 database design method is a method for designing relational databases with a syntax designed to support the semantic constructs required in the development of a conceptual schema. A conceptual schema is a single integrated definition of enterprise data that is unbiased to any application and independent of its access and physical storage. As a design method, IDEF2 is not particularly suitable to serve as an AS-IS analysis tool, although it is often used in this capability as an alternative to IDEF1. IDEF2 is the most useful for the logical database design after the information requirements are known and the decision to implement a relational database has been made. Therefore, the system perspective of IDEF2 is focused on the actual data elements in a relational database. If the target system is not a relational system, for example, an object-oriented system.

The IDEF3 captures the behavioral aspects of an existing or proposed system. The knowledge of the captured process is structured in the context of a scenario, making the IDEF3 an intuitive knowledge acquisition device to describe a system. IDEF3 descriptions allow you to record the raw data resulting from actual research interviews in system analysis activities; determining the impact of an organization's information resource on the main operating scenarios of an enterprise; document the decision procedures that affect the states and life cycle of critical shared data, particularly product production, engineering and maintenance data; trade-off analysis of system design and design; you can manage data configuration and change the control policy setting and provide simulation model generation. IDEF4 divides object-oriented design activity into discrete, manageable pieces. Each subactivity is supported by graphical syntax that highlights the design decisions that must be made and their impact on other project perspectives. No single diagram shows all the information contained in the IDEF4

design template, limiting confusion and allowing for quick inspection of the desired information. The carefully designed overlap between diagram types serves to ensure compatibility between different submodels. The IDEF4 method allows the designer to easily trade-offs between class composition, class inheritance, functional decomposition, and polymorphism in a project.

IDEF5 provides a theoretically and empirically grounded method, specifically designed to assist in the creation, modification and maintenance of ontologies. Standardized procedures, the ability to represent ontology information intuitively and naturally, and the higher quality results allowed through IDEF5 also help reduce the cost of such activities.

5.3.1 Functions of an IDEF that contributes to business innovation

IDEF, Integrated Definition Methods developed and maintained by Knowledge Based Systems, Inc. (KBSI), Developers of Next Generation IDEF Methods These definition languages were developed under funding from the US Air Force and are heavily used by them as well like other military agencies and the US Department of Defense, are also used by many corporations to capture and improve business processes.

The intuitive nature of object-oriented programming facilitates code production. Unfortunately, the ease with which the software is produced also facilitates the creation of poorly designed software, resulting in systems that lack reuse, modularity, and Functions of an IDEF that contribute to business innovation, as well as:

a) Entity: are the items to be processed by the system, representing material, products, people, documents, among others. They can be grouped or divided along the productive process and are moved by their own means or through resources. Once represented, the symbol will only appear the moment a new entity is created. In this way, it becomes clear the number of entities to be used and in which points of the model the entity will undergo a transformation.

b) Functions: represent the places where the entity will take some action. It is understood as functions: jobs, moving mats, queues and stocks, service stations. These functions can modify an entity, as in the case of jobs, or even change the time rhythm of this entity in the flow, such as a wait (queue, stock).

c) Flow of the entity: targeting of the entity within the model, characterizing the moments of entry and exit of the entity in the functions. Resources represent elements used to move entities and perform functions. Resources can represent people or equipment. In a system there may be static or dynamic features. Static resources are not

endowed with movement. Dynamic resources, in turn, can move over a defined path.

e) Controls: rules used in functions, such as sequencing, queuing rules, schedules, among others. Incoming flow in the modeled system: defines the entry or

creation of entities within the model. System Endpoint: I defined the end of a path within the modeled flow. Connection with Figure 4 below is used to divide the model into different configurations.

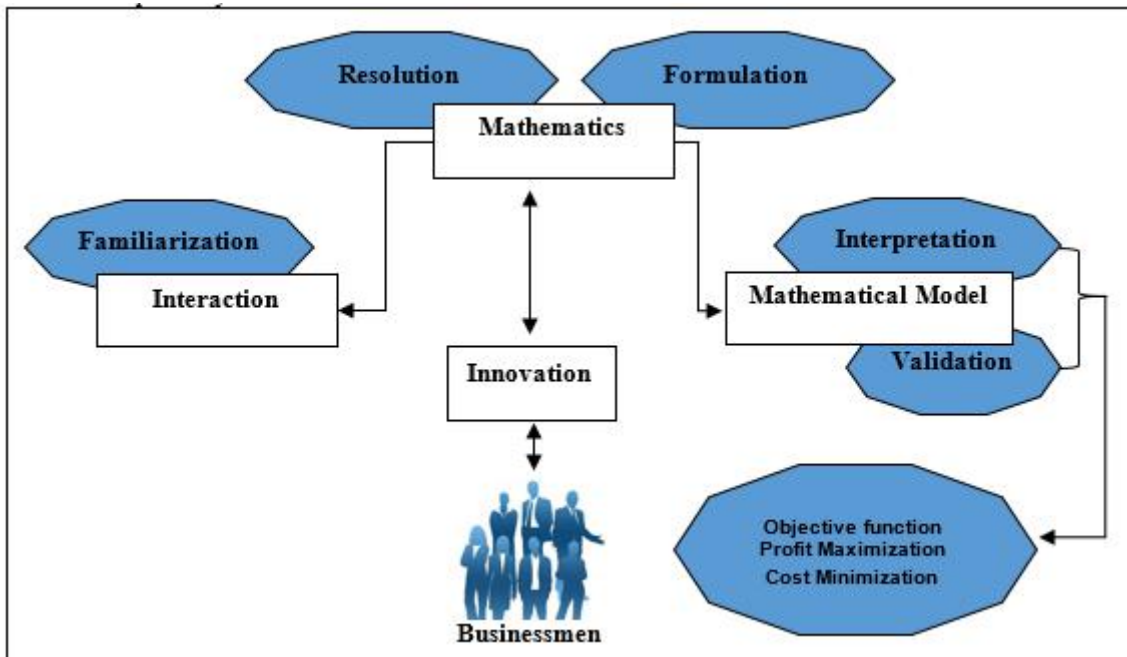


Fig.4: Context as a proposal for mathematical modeling in the innovation of business enterprises based on Chwif and Medina (2007).

Source: Prepared by the authors.

According to the researchers' report on their modeling proposal outlined here in the context, there are tools that will contribute to business innovation. Thus, we intend to provide an environment of discussion and reflection with the researched and not only regarding the moments of conduction of activities of this nature, as well as the concerns and dilemmas of doing Modeling Mathematics reflecting the innovative possibilities of entrepreneurial business as shown in Table 5 below.

Table.5: Context as a proposal of mathematical modeling in the innovation of business.

Feature diagrammed	Characterization
1. Interaction	1.1 For this case, it should make the recognition of the situation of the problem, as well as familiarization as the subject to be modeled. After all done the company should define the problem including the objectives of the company and the parts of the organization that should be analyzed before everything is resolved.
2. Mathematisation	2.1 For this case, it is necessary to collect data after defining the problem in question to stimulate the value of the parameters that affect the problem of the organization of the company that will be used to develop the mathematical model. This time, having the elaboration of the mathematical model, one must analyze a model for the problem. Trying to determine if the model developed in the previous step is a representation of reality and verifying if the model is good or not suitable.

3. Mathematical Model	<p>3.1 It is the solution of problems, as the aspects of quantification and ordering are more or less complex and play a fundamental role, for several reasons: a) Abundance of information provided by the capacity of computers to acquire, store and process data, b) Greater integration of production processes in each company and between companies, c) Awareness of quality and productivity, with the need for statistical analysis of cause and effect relationships and the construction of systems to support strategic, tactical and operational decisions, d) Restructuring of responsibilities (sales, production, logistics, supplies), e) Revision of cost systems whose distortions are evidenced by the changes in the relations between labor and technology, differentiating the problem as minimizing costs and maximizing expected profits associated with the operation of the cash.</p>
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Source: Elaborated by the authors based Chwif and Medina (2007).

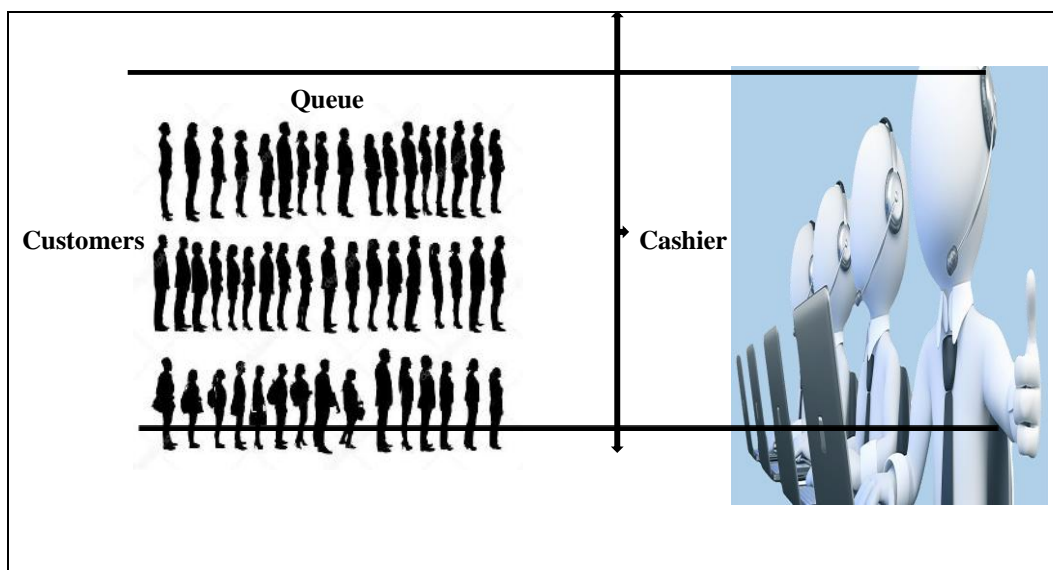
5.3.2 Operational proposal of the modeling proposed in this study

IDEF Modeling is the operational proposal proposed in this study, since it allows to streamline the processes of your company by visually designing high performance workflows and automatically generating simulation models of these projects. Where you can distribute your process models in different formats, and allows you to organize the business processes by main value delivery scenarios; to scroll or rotate to different views of the process architecture; which identify business objects, critical states of these objects and the processes that must occur to reach a state; which captures multiple function views of the execution of a process step; capture detailed process features such as resource allocation rules and flow time distributions for processes; run process cost analysis and Monte Carlo simulations for fast workflow analysis; create animated simulations and virtual reality visualizations of your WITNESS ® workflow; Publish

your knowledge base on the World Wide Web; index on distributed corporate information sources with process knowledge map; and to provide and distribute knowledge of standardized processes.

Regarding the operation carried out with IDEF modeling, some considerations may apply; to show and evaluate the use of the modeling technique, we will consider some situations: among them, the use of the modeling technique post-computational model, with the purpose of documenting the model; and the pre-model computational use, with the classic objectives of a conceptual model. Thus, the first case represents an already elaborated computational model, where the IDEF technique has the objective of documenting the logic used. For this, an excerpt from the computational model was used, Leal (2003), representing the organization of how to attend a telephone company. In this case, the computational model was elaborated in ProModel® software, as shown in Table 6 below.

Table.6: Representation of modeling through IDEF.



Source: Elaborated by the authors based, Leal (2003).

This piece of system represents the customer entering the queue, and being served by one of the four available boxes. After the service, the customer leaves the system. The documentation registered through IDEF shows that only one entity was used in the model, in addition to five function locations: queue, box 01, box 02, box 03 and box 05. It is known, therefore, that in each of these functions there is a specific schedule in the model, such as operation or standby time. The operation performed in the functions only occurs through the presence of these resources. Once these resources have shifts, with stops for lunch, the function interrupts its action, once it is conditioned to the resource.

VI. CONCLUSION

The present article analyzed the study of Mathematics as a Tool to Support Technological Management, through a simplified conceptual model that relates some strategic and operational aspects of management and innovation of small and medium enterprises. Where we used the taxonomy of bloom that allowed us to analyze these tools to support technology management, the application of some of these concepts was investigated through content analysis research, which is characterized by a set of methodological tools that has as main reference analyze a set of communication analysis techniques that can be used systematic procedures and objectives of descriptions of the contents presented. Thus, as a qualitative-quantitative research approach.

Within a reality of mathematics as a tool to support technological management, which involves identifying the elements that can support mathematics as a tool in the technological management processes, we highlight as: Higher level, incorporate knowledge, attitude and cognitive processing, at the level understanding of the meaning of information, learning objectives, facts and opinion, knowledge and skills or techniques in new situations, mathematics as a tool to support technological management, analysis, critical thinking and formulation, evidence of information gaps, claims, evidence and results.

And they can be the ways to innovate the management of small and medium enterprises, evaluating their applicability as tools in the management of small and medium enterprises. As well as improving the conformation quality of the company, but with high production costs, we propose a mathematical modeling that contributes to the company's business innovation, with the implementation of the context diagram (DFD), making the organizational structure more efficient and effective. planning of activities, definition and assignment of responsibilities, documentation, practices, procedures and processes required for the development, implementation, review and updating of the policy organizations of small and medium enterprises. being a platform for analysis,

measurement, monitoring and characterization of innovation, based on indicators in mathematics modeling in the statistical variant and perception metrics based on questionnaire responses.

There are indications that the current difficulties of small and medium-sized enterprises are not due to the globalization of the economy, but rather to management and adaptation to a stabilized economy. Thus, we conclude by the necessity of adequacy and development of theories and practices, procedures and methodologies, in the field of mathematics as a tool to support technological management that this article can give sustainability in the process of development of small and medium management company in management of information technology.

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http://www.ubi.pt/Entidade/Ciencias_Sociais_e_Humanas

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Carbonic nanoparticles and C-S-H insertion into cementitious nanocomposite

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Abstract—Use of nanomaterials in cementitious nanocomposites is a possibility to improving mechanical properties as well as increased durability. In this research the insertion of multi-walled carbon nanotubes (MWCNT) and particles of Calcium Silicate Hydrate (C-S-H) with Ca/Si=0.8 and Ca/Si=1.2 ratios were used in microconcrete specimens. The effects on the compressive and tensile strength were tested, besides analysis of the porous structure by mercury intrusion, as well as the microstructure by scanning electron microscopy. Nanocomposites were produced by varying NTCPM insertions at 0.1% and 0.2% and C-S-H inserts at 1% and 2%, all of them based on cement mass. The results showed that the nanocomposites with C-S-H insertion with Ca/Si=0.8 ratio were the least porous and presented the highest tensile and compressive strengths, reaching strength increases in the order of 30% compared to the control material because C-S-H insertion with Ca/Si=0.8 ratio is reactive and causes reduction of the total porosity.

Keywords— nanocomposites, mechanical properties, carbonic nanoparticles, C-S-H, nucleation.

I. INTRODUCTION

The development of nanotechnology has been a great opportunity for the improvement and even the creation of new materials such as the discovery of carbon nanotubes (NTC) [1]. Cementitious materials have high compressive strength, but their low performance in tensile strength limits its use in structural elements subjected to tensile stresses as the case of flexural tensile.

To solve this problem the structural elements, use the steel as reinforcement of Portland cement concrete, in the so-called reinforced concrete. The better understanding of the structure and behavior of concrete at micro/nano-scale could help to improve concrete properties and prevent the illness, such as ASR [2].

The use of nanotechnology should be sought to solve the deficiency problems of conventional materials. A closer look at this assertion reveals that nanotechnology has indeed been sought for material enhancement in specific applications [3].

Applied in a smart way, using advanced mix design tools, nanoparticles can play an important role and can enable a cost effective and more sustainable development of civil and residential concrete structures [4].

The search for materials with homogeneous performance such as compressive strength and equivalent tensile strength has been a goal of many engineering researchers.

In this case the structural elements of constructions would be more durable and would have the calculation and production processes facilitated and safer as with structural elements produced in steel, which is considered for calculation purposes the same strength both to traction and compression.

NTCs are cylindrical shaped particles with a diameter at the nanoscale and composed basically of carbon and hydrogen, which have, among other characteristics, high tensile strength (some researchers report resistances greater than 100 times the tensile strength of steel, high modulus of elasticity and low specific mass). Carbon nanotubes have been used in various fields of applications in recent years due to their high physical, chemical, and mechanical properties [5].

Another alternative for improving cementitious materials is the use of materials that may result in micro-structural modifications based on chemical reactivity with Portland cement components.

The extremely fine size of the particles can alter the specific surface area and hence the properties of concrete. Nano particles added cement composite can increase the workability, strength and durability characteristics [6].

The C-S-H inserts that are of the same chemical composition of the calcium silicate hydrates (present in the Portland cement composition) can be considered.

The C-S-H are particles (monocrystals) whose thickness can be as small as 5 nm [7]. C-S-H represents between 50% and 60% of the volume of solids of the fully hydrated cement paste [8].

[9] investigated laboratory-precipitated C-S-H insertions and concluded that there was an increase in the hydration process of Portland cement pastes measured by thermal analysis.

These researchers recommend the use of inserts that are CSH because they are particles with the same chemical composition of the Portland cement hydrate products and may result in elimination of the induction period (without chemical activity) due to acceleration of hydration in the first hours with higher hydration peaks.

The result of the increased chemical activity produced by the C-S-H inserts can be explained by the crystalline nucleation and growth process that may occur in the porosity regions and does not focus only on Portland cement silicates.

Thus, in addition to maintaining the dense cementitious matrix by reducing the porosity, there is also the formation of nucleation spaces outside the surface of the silicates. in this way the negative effect of the layer formation (barrier) on these silicates is reduced and allows the diffusion decrease and the result is the possibility of increasing hydration of the silicates and formation of heavy crystalline structures such as the C-S-H gel.

Seeding with a pure form of laboratory made C-S-H would have a similar effect. Adding this type of C-S-H to C₃S paste increased nucleation sites for hydration to occur [9].

II. RAW MATERIALS AND METHODS

2.1 Production and chemical treatment of NTCPM

The NTCs used were of the multi-wall type (NTCPM) and were produced by the method of chemical vapor deposition (CVD), as shown in figure 1, in the Carbon Nanomaterials Laboratory of the Franciscan University (UFN), where were submitted to treatments and characterization.

This method was adopted because it is relatively simple and reliable, besides providing production in reasonable quantities to meet the expected consumption in the production of the tested nanocomposites.

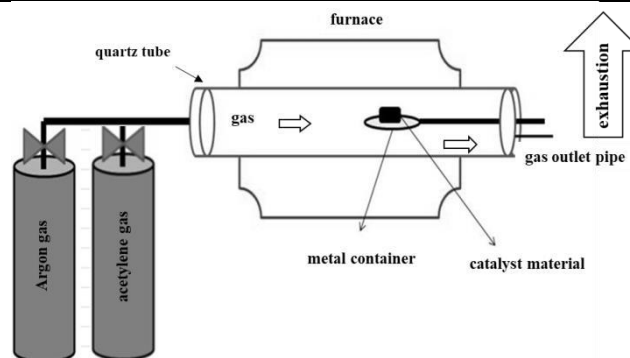


Fig.1: NTCPM production scheme - DVQ method, ¹⁰.

The NTCPM were subjected to chemical oxidation with the purpose of adding functional groups such as carboxyl group (-COOH) and hydroxyl radical (-OH), in the existing faults of the tube walls and especially in the extremities. After functionalized the NTCPM were denominated NTCPM-OX differentiating from non-oxidized nanotubes (NTCPM). The functionalization solves the problem of the hydrophobicity of the NTCPM facilitating their dispersion in aqueous solutions that is the case of cementitious materials in the fresh state.

The oxidation process was performed by immersion in an acid solution composed of a 3:1 mixture of H₂SO₄ and HNO₃ submitted sonication (by immersion) for 1 hour, according to a technique proposed by Mokhtar et al. [11], which effectively provides functionalization chemical properties of the material and preserves the structure of the treated material, according to figure 2.

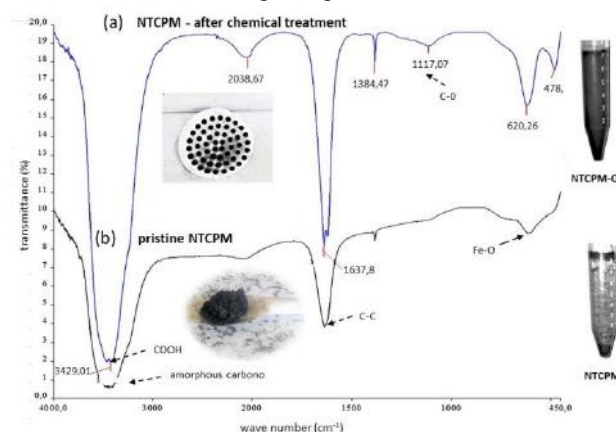


Fig.2: NTCPM Analysis - Fourier Transform Infrared Spectroscopy (FTIR). Presents NTCPM as produced and after chemical oxidation treatment. The COOH functional groups are well identified in the material after the chemical oxidation process demonstrating effective functionalization and facilitating the dispersion in water.

Dispersion of nanofillers plays a very important role in the use of filler properties in polymeric composites. A technique to achieve good dispersion of nanoparticles is ultra-sonication which can be used also for CNTs [12].

Table 1 - Quantity of material insertion

	Ca/Si	C	S1-0,8	S1-1,2	S2-0,8	S2-1,2	T1	T2	ST1-0,8	ST1-1,2	ST2-0,8	ST2-1,2
C-S-H	0.8	-	1%	-	2%	-	-	-	1%	1%	2%	2%
C-S-H	1.2	-	-	1%	-	2%	-	-	-	-	-	-
NTCPM-OX	-	-	-	-	-	-	0.1%	0.2%	0.1%	0.1%	0.2%	0.2%

* Insertion quantity - in relation to cement mass

The result of Fourier-transform infrared spectroscopy (FTIR) demonstrates the presence of the carboxylic groups after the chemical treatment with acids, indicating that the NTCPM were effectively functionalized. The peak around 3429 cm^{-1} is a characteristic of the stretching of the hydroxyl group (O=C-OH and C-OH) that can be attributed to the oscillation of carboxylic groups (-COOH) [13].

2.2 C-S-H Production

The production of C-S-H was performed by direct precipitation, according to the method described by Thomas, Jennings and Chen [9]. The chemical reagents used were calcium nitrate tetrahydrate ($\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$) and sodium silicate (Na_2SiO_3). The proportions of the reactants were determined by stoichiometric calculation and then 2 types of C-S-H with different Ca/Si ratios (0.8 and 1.2) were produced. Precipitation occurred after the bath sonication process (immersion for 60 minutes).

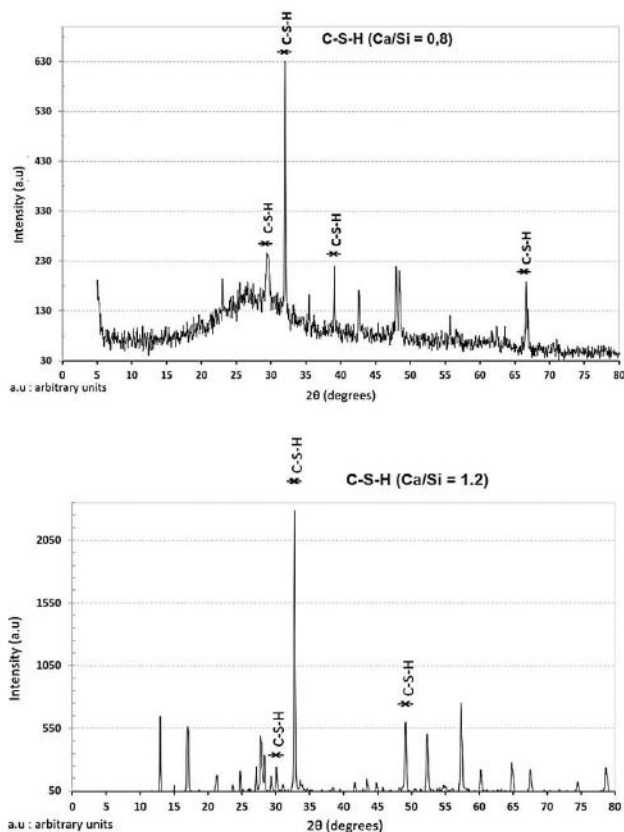


Fig.3: C-S-H. X-ray diffraction analysis (XRD).

Precipitation occurred after the bath sonication process (immersion for 60 minutes). After filtration, the materials

were dried in an oven at 100 °C until the material had a constant weight.

Finally, the material was subjected to milling in the ball mill (ceramic beads for 12 hours. X-ray diffraction (XRD) analysis confirms the presence of C-S-H produced, as shown in figure 3.

2.3 Specimens for testing

For the tests of simple axial compressive strength, concrete specimens of dimensions (diameter x height) 32x64 mm were molded in cylindrical molds of wood specially produced for this purpose, and the molding was adapted according to the recommendations of the standard ABNT NBR 5738 [14]. The test was performed according to ABNT NBR 5739 [15].

The fragments of the specimens after the flexural traction test were packed in plastic bags to avoid contamination, to be used in mercury intrusion porosimetry tests in the GREENTEC laboratory in the Chemical Engineering Department of the Federal University of Rio de Janeiro (UFRJ), where the assay was performed on the AutoPore IV 9500 V1.09 equipment of micromeritics and still.

The same procedure was performed for transmission electron microscopy analysis, which was performed at the Analytical Center of the Federal University of Ceará (UFC), in the Quanta FEG 450 equipment, in the secondary electron module (SE).



Fig.4: Fragments packaged for porosimetry and microanalysis assay.

The fragments were subsequently prepared with a size of about 6 mm in diameter. After being immersed in absolute ethyl alcohol for 24 hours and dried in an oven at 60 °C for a period of 12 hours. This procedure removes free water and induces the halting of the hydration reactions and serves to avoid changing the microstructure

of the material after the tests have been carried out. They were then packed in a hermetically sealed container and identified, figure 4, until they were properly submitted to microanalysis tests by transmission electron microscopy.

For the flexural tensile strength test, prismatic specimens measuring 4x4x16 cm (height x width x length) were produced. Metallic forms were used, the same ones used for mortar tests and the test was adapted and followed the recommendations of ABNT NBR 13279 [16]. The nanocomposites and the control material were prepared with basic materials (cement, sand, water and chemical additive based on carboxylates) in addition to carbonic material inserts (NTCPM-OX) as well as C-S-H. The terminology for identification of the nanocomposites and the quantities of insertion are shown in table 1.

III. RESULTS AND DISCUSSIONS

3.1 Microstructure analysis

The result of the mercury intrusion porosimetry test revealed the modification of the microstructure of the nanocomposites with inserts when compared to each other and especially as the control material (C).

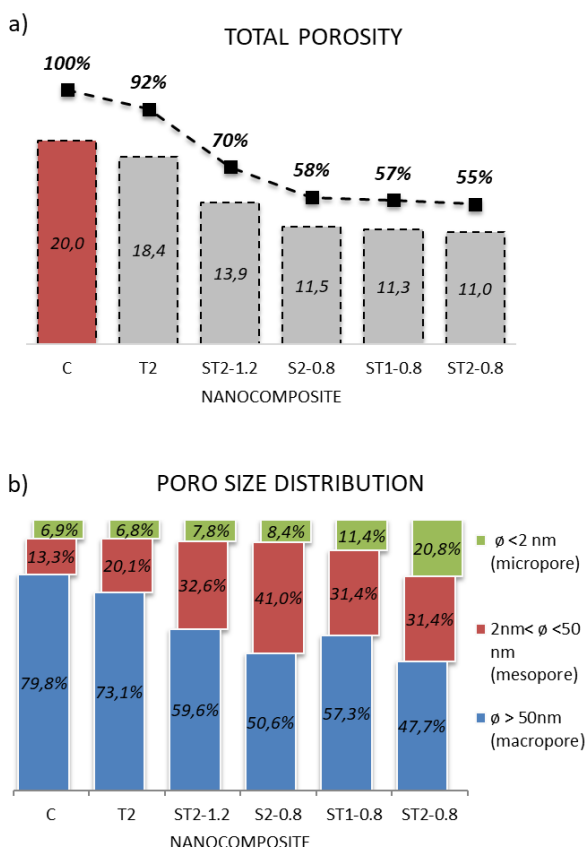


Fig.5: Pore size distribution

The C-S-H insertions with Ca/Si=0.8 ratio resulted in the reduction of the total porosity to values around 55% when compared to the control material (C), as was the case of the nanocomposites ST2-0.8 (mixed insertion 2% of C-S-H ratio Ca/Si=0.8 and 0.2% of NTCPM-OX) and S2-0.8

(insertion 2% CSH Ca/Si ratio = 0.8) and ST1-0.8 (mixed insertion of 1% C-S-H Ca/Si=0.8 ratio and 0.1% NTCPM-OX) according to Figure 5-a.

In addition to the modification of the pore size distribution that resulted in macro and mesoporous reduction and significant increase of micropores, as shown in Figure 5-b.

The nanocomposite ST1-0.8 presented a percentage of macropores of 50.6%, a significant reduction when compared to the control material (C) with a high amount of macropores, 73.1%. If we analyzed the micropores the amount was 8.4% higher than the control material, which presented only 6.8%.

For mesopores, the ST1-0.8 nanocomposite presented the amount of 41% double that of the control material, 20.1%.

It is verified that there was a differentiated porosity distribution for the mixed insertion nanocomposite that resulted in a more compact micro-structure by the substitution of larger pores for smaller pores, which is called refinement.

This refinement has several advantages for cementitious materials such as increased mechanical strength, reduced permeability and consequently increased durability of these materials against aggressive agents.

The transformation of the microstructure of the nanocomposites with insertions can be explained by the nucleation and growth of crystalline structures, stimulated by C-S-H insertions with Ca/Si=0.8 ratio, which were chemically active and compatible with the hydrated products (Portland cement silicates) which made the matrix (micro structure) of these materials denser since crystal growth also occurred in the weakened pores or sites, as shown in Figure 6.

The growth in the porous region has positive characteristics of reducing the total porosity, refining the porous micro structure and also reinforces the matrix resulting in increased mechanical strength.

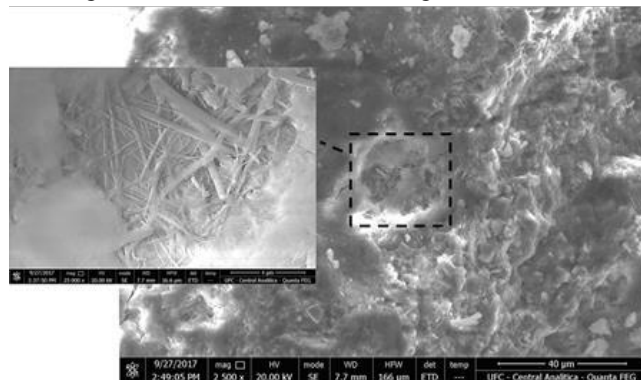


Fig.6: SEM-FEV nanocomposite ST2-0.8 - It shows the formation of interlaced crystalline structures occupying a region with filling failure.

3.2 Compressive strength

The use of C-S-H inserts with Ca/Si = 0.8 ratio resulted in the increase in the compressive strength of the nanocomposites when compared to the control material. The most resistant were the nanocomposite ST2-0.8 (mixed insertion of 2% CSH Ca/Si ratio = 0.8 and 0.2% NTCPM-OX) and S2-0.8 (insertion 2% of CSH ratio Ca/Si = 0.8) that showed resistance 30% and 26% higher than the control material (C), according to figure 7.

On the other hand, isolated inserts of NTCPM-OX did not present significant results considering error (5%) as was the case of T1 nanocomposites (insertion of 0.1% of NTCPM-OX) and T2 (insertion of 0.2% of NTCPM -OX). The nanocomposites with C-S-H insertion with Ca/Si=1.2 ratio had considerable performance only for mixed insertion such as the case of the nanocomposite ST2-1.2 (insertion 2% of C-S-H Ca/Si=1.2) that presented strength 17% higher when compared to the control material.

This result shows that the C-S-H with ratio Ca/Si =1.2 has a lower chemical reactivity than the C-S-H Ca/Si=0.8 ratio resulting in lower nucleation and growth of hydrated products, such as secondary C-S-H, as happened with the isolated inserts of NTCPM-OX.

The increase of the compressive strength can be explained by the transformation of the microstructure and consequent reduction of the total porosity and reinforcement of the cementitious matrix of the nanocomposites with insertions of C-S-H with Ca/Si=0.8 ratio that proved to be more active and stimulated the growth of resistant hydrated products such as secondary C-S-H.

Compression tests are performed on cylinders of seeded cement pastes with the understanding that a dense microstructure should cause high compressive strength [17].

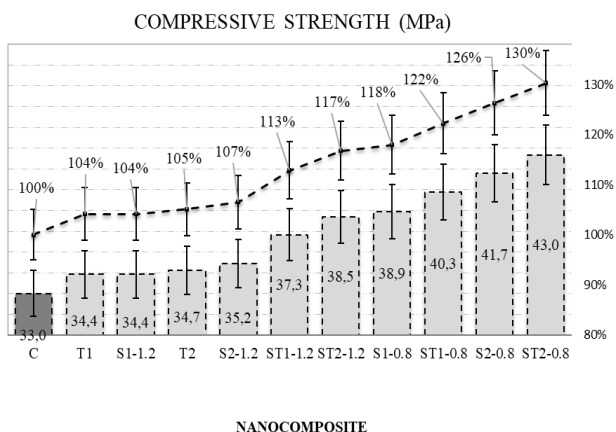


Fig.7: Compressive strength

An increase in compressive strength accompanies the development of a denser, less porous, microstructure for cement materials because C-S-H gel acts as a seed for nucleation sites for further C-S-H growth, an increase in

compressive strength would reinforce this observation [18].

3.2 Tensile strength by flexural stress

In this parameter it is verified that the insertion of NTCPM-OX was relevant in the results, especially in the mixed inserts as

the case of the nanocomposites ST2-0.8 (mixed insertion of 2% C-S-H Ca/Si=0.8 ratio and 0.2% NTCPM-OX), ST1-0.8 (mixed insertion of 1% C-S-H Ca/Si=0.8 ratio and 0.1% NTCPM-OX) and ST2-1.2 (mixed insertion of 2% of C-S-H Ca/Si=1.2 ratio and 0.2% of NTCPM-OX), resulting in a tensile strength increase of up to 33% higher than the control material, according to figure 8.

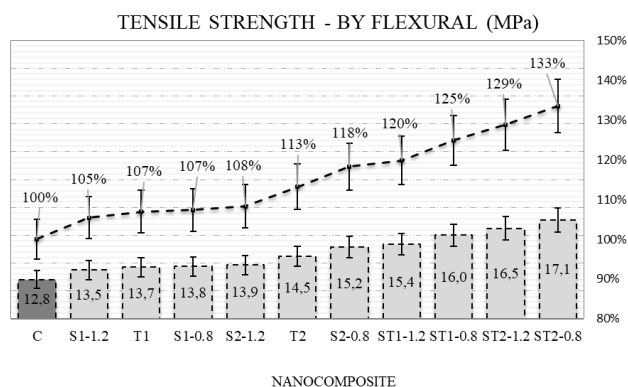


Fig.8: Tensile strength by flexural stress

Furthermore, the isolated insertion of NTCP-OX as the nanocomposite T2 (insertion of 0.2% of NTCPM-OX) presented tensile strength 13% higher than the control material, which can be explained by the fact that materials such as NTC exhibit high tensile strength and when well distributed in the matrix results in a nanoscale reinforcement [19,20], according to figure 9, preventing the appearance of the first cracks, which results in the increase of tensile strength.

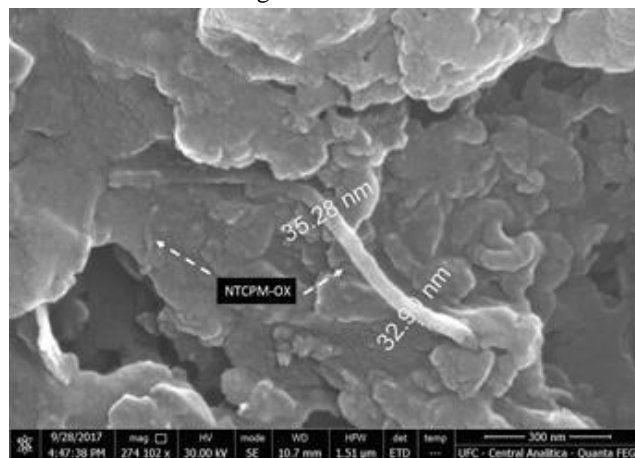


Fig.9: SEM / FEG nanocomposite image ST2-0.8. Presence of nanotubes adhered and reinforcing to the cementitious matrix.

IV. CONCLUSIONS

Analyzing the numerical results and also the microscopy images, it was possible to verify that the insertions of C-S-H ratio $Ca/Si = 0.8$, result in the modification of the microstructure of the cementitious nanocomposites because they cause the nucleation and growth of resistant materials, especially in the region porous, in this way the matrix becomes more compact and resistant to both compression and traction.

The addition of functionalized carbon nanotubes caused relevant results because the nanoparticles were well distributed in the matrix and acted as reinforcement in this way the result in the flexural tensile strength was demonstrated for the nanocomposites with this type of insertion, especially those with mixed insertion.

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Nursing Interventions in the Clinical Settings and Implications of the Documentations

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Abstract—This study investigated the implications of documentation of nursing interventions in the clinical settings. Documented nursing actions for 264 clients in the medical, surgical and maternity units of six health care facilities were obtained for the study using purposive and simple random sampling techniques. One research question and four null hypotheses guided the study. Checklist on nursing documentations in the clinical setting was used for data collection. Descriptive statistics of frequency, means and standard deviation (SD) were used to summarize the variables. Pearson Product moment correlation was used to answer the research question, while analyses of variance (ANOVA) was used to test the null hypotheses at 0.05 level of significance. The result showed that the core principles of nursing documentation significantly apply to all nursing documentations. In addition, significant differences existed across the units of the health care institutions with regard to the legal implications and the impacts of nursing documentation on quality assurance and science of nursing.

Keywords—Nursing interventions, Nursing documentations, Implications, Clinical settings.

I. INTRODUCTION

Tools are needed to support the continuous and efficient shared understanding of a patient's care history that simultaneously aids sound intra and inter-disciplinary communication and decision-making about the patient's future care[1]. Such tools are vital to ensure that continuity, safety and quality of care endure across the multiple handovers made by the many clinicians involved in patient care. Generally, tools are implements held in the hands, which in the healthcare setting refer to documentation. Documentation is anything written or electronically generated that describes the status of a client or the care or services given to that client[2]. Nursing documentation refers to written or electronically generated client information obtained through the nursing process[3]. Nursing documentation is a vital component of safe, ethical and effective nursing practice regardless of the context of practice or whether the documentation is paper based or electronic, it is an integral part of nursing practice

and professional patient care rather than something that takes away from patient care, and it is not optional. Nursing documentation must provide an accurate and honest account of what and when events occurred, as well as identify who provided the care[2]. The documentation should be factual, accurate, complete, current (timely), organized and compliant with standards (Professional and Institutional). These core principles of nursing documentation apply to every type of documentation in every practice setting[2].

Documentation in nursing covers a wide variety of issues, topics and systems[4][5][6][7]. Such areas of coverage include all aspects of nursing process, plan of care, admission, transfer, transport, discharge information, client education, risk taking behaviours, incident reports, medication administration, verbal orders, telephone orders, collaboration with other health care professionals, date and time of any event as well as signature and designation of the recorder.

The primary purpose of documentation is to facilitate information flow that supports the continuity, quality and safety of care. Researchers[2] noted that data from documentation allow for communications and continuity of care, quality improvement/ assurance and risk management, establish professional accountability, make provision for legal coverage, funding and resource management, and also expand the science of nursing. Studies have also shown that clear, complete and accurate health records serve many purposes for the clients, families, registered nurses and other health care providers[2]. Documentation is the professional responsibility of all health care practitioners, and it provides written evidence of the practitioner's accountability to the client, the institution, the profession and the society[8].

Literature has revealed that the tensions surrounding nursing documentation include the amount of time spent in documenting, the number of errors in the records, the need for legal accountability, the desire to make nursing work visible, and the necessity of making nursing notes understandable to the other disciplines[9][10][11][12]. This study therefore intends to

investigate the implications of documentations of nursing of interventions in the clinical settings.

Research Question:

- What is the relationship between documented nursing actions and the core principles of nursing documentation?

Hypotheses:

- Preciseness of documented nursing actions differ significantly across the Medical, Surgical and Maternity units of Health care institutions.
- The legal implications of documented nursing actions differ significantly across the medical, surgical and Maternity units of Health care institutions.
- The impact of documented nursing actions on quality assurance does not significantly differ across the medical, surgical and maternity units of Health care institutions.
- There is no significant difference across the medical, surgical, and maternity units of Health care institutions with regard to the impact of documented nursing actions on Nursing Science.

II. MATERIALS AND METHODS

Design and Sampling:

The study was a retrospective research design. Judgmental sampling technique was adopted in selecting one teaching Hospital and one specialist Hospital (tertiary Health Institutions) in Anambra State of Nigeria. Simple random sampling was used to select two General Hospitals (secondary Health institutions) and two comprehensive Health centres (Primary Health Institutions) out of the 24 General Hospitals and 10 comprehensive Health Centres in Anambra State. This was to give all the primary and secondary health institutions equal chance of being selected for the study[13].

Nursing documentations on Clients were obtained from three units (medical, surgical and maternity units) of each of the selected institutions. Other units (e.g. Emergency unit, Out-patient Department, and other special units) were excluded in the study. Documented nursing actions for 96 clients were obtained from the selected tertiary health institutions, 72 were obtained from the secondary health institutions and 96 from the primary health institutions. On the whole, nursing documentations for 264 clients were used for the study. Ethical approvals were obtained from the six institutions used for the study. Informed consent was also obtained from the clients whose records were used. Confidentiality was ensured by not including the names of the health institutions in the data collection. Alphabetical Codes were used to represent the selected

health Institutions while numerical codes were used for the patients whose records were obtained for the study.

Instrument:

The instrument used for data collection in the study was checklist titled Checklist on Nursing Documentation in the clinical setting (CNDCS). Section A of the instrument provided general information of the health institution (eg level of the health institution, clinical specialty, form of documentation, client clinical diagnosis, demonstration of accountability). Section B of the instrument was made up of eight sub-sections designed to measure documented nursing actions (eg admissions, transfers, discharges, plan of care, client education, medication, incident reports, vital signs, etc), extent of ensuring core principles in the documentation (eg whether factual, accurate, complete, timely, organized and compliant with standards), ensuring promotion of interdisciplinary communication (eg name(s) of the people involved in the collaboration, date and time of the contact, information provided to or by healthcare provider, responses from healthcare provider, etc), timeliness of the documentation (eg how timely, chronological and frequency), preciseness of the documentation (eg objectivity, unbiased, legibility, clear and concise, etc), legal implications (eg use of authorized abbreviations, informed consent, advanced directive, etc), impact on quality assurance/ improvement (eg facilitates quality improvement initiative, facilitates risk management, and used to evaluate appropriateness of care), and impact on the science of nursing (eg provides data for nursing/health research, used to assess nursing intervention and client outcomes, etc). The instrument was designed in a 4 – point scale ranging from 1 to 4 with poor/many omissions having 1 point, 2 points for fair/incomplete with few omissions, 3 points for good/almost complete, and 4 points for very good/complete.

The instrument was subjected to reliability test by collecting data from nursing documentations for 15 patients from three levels of health institutions (primary, secondary and tertiary) in another State of Nigeria that was not used for the study. The instrument test/ retest reliability was 0.65.

Data Analysis:

Standard descriptive statistics of frequency, means and standard deviation were used to summarize the variables. Mean score, standard deviation and Pearson product moment correlation (r) were used to answer the research question while Analysis of variance (ANOVA) was adopted in testing the null hypotheses at 0.05 level of significance. SPSS version 21 was used in the data analysis.

III. RESULTS

Table.1: General Information of the Health Institutions used for the study.

Variable	Frequency	Percentage
Level of Health Institution:		
Primary	96	36.4
Secondary	72	27.3
Tertiary	96	36.4
Clinical Specialty:		
Medical unit	97	36.7
Surgical unit	63	23.9
Maternity unit	104	39.4
Form of Documentation:		
Written documentation	262	99.2
Electronic documentation	2	0.8
Client Diagnoses:		
Obstetric condition	105	39.8
Medical condition	93	35.2
Surgical condition	61	23.1
Sepsis/Infection	5	1.9
Demonstration of Accountability:		
Primary provider	247	93.6
Secondary provider	15	5.7
Third party provider	2	0.8

Total N = 264

Table 1 shows the general information of the health institutions used for the study. Primary Health Centre constituted 36.4% of the Health institutions, 27.3% constituted secondary level while tertiary health institution constituted 36.4%. The clinical specialties of the health institutions that were used for the study were medical unit 36.7%, surgical unit 23.9% and maternity unit which formed 39.4%. Out of the forms of nursing documentations, 99.2% was written documentation while

electronic documentation formed 0.8%; 39.8% was obstetric conditions, medical conditions 35.2%, surgical conditions 23.1% while documented infective conditions constituted 1.9%. For demonstration of accountability in the documented nursing actions, 93.6% was done by primary providers, 5.7% by secondary providers while third party providers accounted for 0.8% of the documentations. Total number of each variable was 264.

Table.2: Descriptive Statistics of the Measured Variables.

Variables	N	Minimum	Maximum	Mean	SD
Nursing Action Documentation	264	23.00	76.00	54.6402	9.86811
Core principles of Documentation	264	11.00	24.00	19.2462	2.38101
Promotion of interdisciplinary communication	264	9.00	36.00	30.8485	5.61433
Timeliness of Documentation	264	6.00	12.00	9.5568	1.32703
Preciseness of Documentation	264	18.00	40.00	31.9470	3.30299
Legal implication	264	11.00	24.00	19.6439	2.47153
Impact on quality assurance	264	4.00	12.00	9.6250	1.63129
Impact on Nursing science	264	4.00	16.00	13.7462	2.43860
Valid N (Listwise)	264				

Table 2 shows the descriptive statistics of the measured variables. Out of the 264 documented nursing actions, the mean was 54.6402 and the standard deviation (SD) was 9.86811. Mean for the core principles of the

documentation 19.2462 with SD of 2.38101. For promotion of interdisciplinary communication, the mean was 30.8485 with SD of 5.61433. Timeliness of documentation had a mean of 9.5568 with SD of 1.32703.

Mean for preciseness of the documentation was 31.9470 with SD of 3.30299. For legal implications, the mean was 19.6439 with SD of 2.47153. Impact of the

documentation on quality assurance had a mean of 9.6250 with SD of 1.63129, while impact on Nursing Science had a mean of 13.7462 with SD of 2.43860.

Table.3: Relationship between nursing action documentation and the core principles of the documentation

Variables	N	\bar{X}	SD	r	Critical value	Level of significance
Nursing action documentation	264	54.6402	9.86811	** 0.670	0.000	0.01
Core principles of documentation	264	19.2462	2.38101			

** Correlation was significant at 0.01 level (2 – tailed).

In table 3,r correlational value between nursing documentation and the core principles of documentation was 0.670. It was significant at 0.01 level.

Table.4:ANOVA showing comparison of nursing action documentations in the medical, surgical and maternity units with regard to preciseness, legal implication and impacts of the documentations on quality assurance and nursing science.

Variable	Units in the Health Intuition	N	\bar{X}	SD	Source	Sum of squares	df	Mean squares	F-cal	F-crit (Sig)
Preciseness of Documentation	Medical	97	31.0412	3.65410	Between Group	142.763	2	71.382	6.833	0.000
	Surgical	63	32.0635	2.97773						
	Maternity	104	32.7212	2.94762	Within Group	2726.495	261	10.446		
	Total	264	31.9470	3.30299		2869.258	263			
Legal Implication	Medical	97	18.7835	2.95179	Between Groups	117.798	2	58.899	10.326	0.000
	Surgical	63	20.3492	2.54101						
	Maternity	104	20.0192	1.56404	Within Groups	1488.733	261	5.704		
	Total	264	19.6439	2.47153		1606.530	263			
Impact on Quality Assurance	Medical	97	9.0722	1.61534	Between Groups	53.893	2	26.946	10.887	0.000
	Surgical	63	9.6825	1.64440						
	Maternity	104	10.1058	1.48728	Within Groups	645.982	261	2.475		
	Total	264	9.6250	1.63129		699.875	263			
Impact on Nursing Science	Medical	97	13.1649	2.67192	Between Groups	52.083	2	26.042	4.496	0.012
	Surgical	63	14.0317	2.36212						
	Maternity	104	14.1154	2.16013	Within Groups	1511.913	261	5.793		
	Total	264	13.7462	2.43860		1563.996	263			

Probability: 0.05 level of significance

Table 4shows that across the medical, surgical and maternity units of health institutions, the calculated F-

ratios were 6.833 for preciseness of documentation, 10.326 for legal implications of nursing documentation, 10.887

and 4.496 for the impacts of documentations on quality assurance and nursing science respectively. These results were more than the critical values. Hence the null hypotheses are rejected. Scheffe Post-Hoc[14] tests of

multiple comparison of means were used to determine the order of significant differences across the medical, surgical and maternity units of the Health Institutions.

Table.5: Scheffe Post-Hoc test of multiple comparison of the means of preciseness, legal implications, impacts of nursing documentations on quality assurance and nursing science across the units of Health institutions.

Dependent variable	(I) Units in Health Institution	(J) Units in Health Institution	Mean Difference (I – J)	Standard Error	Sig (F – Crit)
Preciseness of Documentation	Medical	Surgical Maternity	-1.02225 -1.67992*	0.52298 0.45622	0.052 0.000
	Surgical	Medical Maternity	1.02225 -0.65766	0.52298 0.51600	0.052 0.204
	Maternity	Medical Surgical	1.67992* 0.65766	0.45622 0.51600	0.000 0.204
Legal Implication	Medical	Surgical Maternity	-1.56570* -1.23573*	0.38645 0.33712	0.000 0.000
	Surgical	Medical Maternity	1.56570* 0.32998*	0.38645 0.38129	0.000 0.388
	Maternity	Medical Surgical	1.23573* -0.32998	0.33712 0.38129	0.000 0.388
Impact on Quality Assurance	Medical	Surgical Maternity	-0.61037* -1.03360*	0.25456 0.22207	0.017 0.000
	Surgical	Medical Maternity	0.61037* -0.42323	0.25456 0.25117	0.017 0.093
	Maternity	Medical Surgical	1.03360* 0.42323	0.22207 0.25117	0.000 0.093
Impact on Nursing Science	Medical	Surgical Maternity	-0.86680* -0.95044	0.38945 0.33973	0.027 0.006
	Surgical	Medical Maternity	0.86680* -0.08364	0.38945 0.38425	0.027 0.828
	Maternity	Medical Surgical	0.95044* 0.08364	0.33973 0.38425	0.006 0.828

Key: *The mean difference is significant at 0.05 level

In table 5, for preciseness of nursing document, the mean difference of 1.02225 between medical and surgical units was in favour of surgical unit, mean difference of 1.67992 between medical and maternity units was in favour of maternity unit, for legal implications, the means deference of 1.56570 between medical and surgical units was in favour of surgical unit, while the mean difference of 1.23573 between medical and maternity units was in favour of maternity unit. For the impact on quality assurance, the mean difference of 0.61037 between medical and surgical units was in favour of surgical unit, and the mean difference of 1.03360 between medical and maternity units was in favour of maternity unit. For the impact on nursing science, mean differences of 0.86680 and 0.95044 were all in favour of surgical and maternity

units respectively against medical unit. These mean differences were significant at 0.05 level.

IV. DISCUSSION

Findings from the study indicate significant correlation (r=0.670) between nursing documentation and the core principles of documentation (table 3). Nursing documentation must include the components of the core principles to ensure completeness of the documentation. Studies have indicated increased completeness of documentation particularly in the proportion of discharge planning notes[15]. Studies have shown that completeness of a record may have an impact on the quality of care, but only if it reflects completeness of the right content[16][17]. The significant differences observed across the medical, surgical and maternity units of the

health care institutions with respect to preciseness, legal implications and impacts on quality assurance and nursing science (tables 4 and 5) is in the line with other studies. It has been observed that documentation requirement differ depending on the setting within the facility (eg emergency room, peri-operative, medical-surgical unit) and with specific client population (e.g obstetric, paediatrics, geriatrics), and that nursing notes must be logical, focused and relevant to care[18].

V. CONCLUSION

The study indicate that the core principles of nursing documentation should apply to documentation in every nursing practice, and that significant differences exist across the units of health care institutions with regard to preciseness of nursing documentation, the legal implications and impacts of the documentation on quality assurance and nursing science.

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Probiotics in Aquaculture Review: Current Status and Application in Tambaqui Cultivation (*Colossoma macropomum*)

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Abstract— *The development of aquaculture guarantees the supply of animal protein of great nutritional value, contributing to food security. Currently one of the main problems faced is the occurrence of diseases, responsible for a worldwide economic loss, equivalent to US \$ 9 billion per year. Aiming to increase resistance to diseases, increasing growth rates and food efficiency in intensive crops, some strategies have been developed, one of them is the use of probiotic bacteria. These, when in contact with the digestive tract of the host generates a series of benefits, among them, the modulation of the immune system, developing defense mechanisms and increasing resistance to stress. However, there are few documented reports on the efficiency of probiotics in native species, such as tambaqui (*Colossoma macropomum*). This species shows some resistance to stress, through physiological mechanisms of adaptation, such as lip expansion when subjected to hypoxia situations, which added to the positive effects of using probiotics would represent an increase in its resistance. The purpose of this work is to review the literature on the use of probiotics in aquaculture in order to provide a comprehensive synthesis of the current knowledge about its use in aquaculture, with emphasis on the intensive cultivation of tambaqui.*

Keywords— *probiotic; immunity; stress; tambaqui.*

I. INTRODUCTION

Intensive cultivation with the improvement of modern sustainable techniques contributes to reduce the pressure on natural stocks, increasing the supply of fish with good nutritional quality, with essential protein and essential fatty acid indexes for human consumption, as well as increasing the reliability of the consumer (Ibrahim, 2015, Sartori and Amancio, 2012).

Fish is the most widely produced animal protein with a share of 36.36%, higher than that of poultry - 24.70%, pork - 24.44% and bovine - 14.52% (FAO 2017). In 2017, world aquaculture contributed 83.6 million

tonnes, corresponding to 48.04%, close to half of total fish production, presenting a constant growth rate equivalent to about 4.5% and a growing associated demand the recovery of some major emerging markets, like Brazil (FAO, 2018).

In 2016, Brazilian aquaculture reached a production value corresponding to US \$ 1.22 billion with fish farming contributing 70.9% of this total (IBGE, 2016). More recent data points to a growth of 8% in relation to the year 2016 and a production of 691,700 tons, with tilapia (*Oreochromis niloticus*) being the most produced species with 51.7%, followed by native species (*Colossoma macropomum*), with 47% of the total production, where production is concentrated in the states of Rondônia and Amazonas (North region), Mato Grosso and Goiás (Central-West region) and Maranhão (Northeast region) (Peixe BR, 2018).

The tambaqui is the main native species produced in the Brazilian fishery, belongs to the order of Characiformes, family Serrasalminidae. It occurs naturally in the basins of the Amazon and Orinoco River (Azevedo et al., 2016; Ferreira, 2014). It can reach up to one meter in length standard and weigh up to 30 kg. Their natural diet is composed of zooplankton, fruits and seeds, being classified as an omnivorous species with a tendency to herbivore, filtering and frugivore (Ferreira, 2014; Lopera-Barreto et al., 2011).

Its success in fish farming is related to the presence of characteristics favorable to cultivation such as acceptance of artificial rations, good (Azevedo et al., 2006). In addition, the results obtained in the present study were similar to those reported in the present study.

Under hypoxia conditions, tambaqui presents physiological adaptation represented by lip expansion, as well as morphological and molecular adjustments related to oxygen uptake by hemoglobin (Val, 1995). In the same condition Val (1986) observed an increase in the number of erythrocytes and the hemoglobin content for this species, to favor the transport of respiration gases.

The stress occurrence is verified by intensive management practices, common in fish farming, represented mainly by excessive handling, transportation and densification that favor its installation, a condition that weakens the immune system of the fish leading to a greater susceptibility to diseases (Dawood et al. Hunsuke, 2016, Yuji-sado, 2014, Mohapatra et al., 2013, Gabbay, 2012).

The emergence of diseases is mainly due to the imbalance of the epidemiological triad composed by pathogen, host and environment, considered an emerging problem limiting the growth of the activity, as it entails large mortalities and consequently economic losses (Jesus et al., 2016; Boijink et al. Mourino et al., 2008). The disease can occur in different stages of growth of the cultured animals and represents an estimated economic loss for the world aquaculture corresponding to US \$ 9 billion per year (Jesus et al., 2016; Boijink et al., 2015).

Outbreaks of bacterial and parasitic diseases are responsible for productive and economic losses in the intensive cultivation of tambaqui, with emphasis on the bacterioses caused by mobile *Aeromonas*, *Flavobacterium columnare* and *Streptococcus agalactiae* (Lacerda, et al., Kotzent, 2017).

In order to minimize such losses, the use of probiotic has been considered a preventive sanitary practice, since it helps to increase zootechnical parameters, as well as to mitigate the effects caused by stress by increasing the immunological capacity of the fish. It is considered an alternative to the use of antibiotics and an important factor for health management in aquaculture (Dawood and Koshio, 2016; Newaj-Fyzul, 2014; Qi et al., 2009).

It is known that the use of antimicrobials causes a serious impact on the aquatic environment due to the release of their residues into the water, as well as to generate economic impact due to residues present in the carcass represent a barrier to export to the United States and Europe (Kotzent, 2017).

Thus, it is well known that probiotics can be considered a sustainable and promising strategy, since it represents an alternative for the generation of a product of high quality in terms of size, health and safety, allowing an improvement in the quality and quantity of aquaculture production. (Paixão et al., 2017, Jesus et al., 2016, Ibrahim, 2015).

The aim of this work was to carry out a review in the literature about the advances in the use of probiotics in aquaculture, in order to provide a comprehensive synthesis of the current knowledge about its use in aquaculture, especially in the cultivation of tambaqui (*Colossoma macropomum*).

Probiotics Definition

The term probiotic means "in favor of life" originates from the Latin term PRO - Para, and from the Greek word BIOS - Life, being its concept, continually revised since 1965 (Jesus et al., 2016). For Fuller (1989) probiotics are defined as "food supplements composed of living microorganisms that benefit host health by balancing the intestinal microbiota." Ferreira (2014) reports that probiotics are non-digestible, non-hydrolyzed and inabsorbed ingredients in the gastrointestinal tract, beneficially affecting the host by selectively stimulating the growth and / or activity of desirable bacteria, improving their microbiota. In the most recent literature, the use of the term food supplement is commonly used to report the use of probiotic in aquaculture (Yu et al., Zhai et al., 2017, Azevedo et al., 2016 and Gabbay, 2012). The Food and Agriculture Organization (FAO) and the World Health Organization (WHO) define that probiotics are living microorganisms that when administered in adequate amounts confer a health benefit to the host (Newaj-fyzul and Al-harbi, Austin, 2014).

More broadly, Mourino et al. (2008) defines probiotic as: "living microorganisms, which when added to the culture so that they enter the digestive tract of the animals and stay alive, acting beneficially on the target species, improving the alimentary efficiency, the immune system and / or balance of beneficial and pathogenic bacteria in the digestive tract".

Among the various definitions found, they all have one point in common, in the assertion that probiotics are living organisms that are administered orally and brings benefits to the health of the animal of interest (Jesus et al., 2016; Newaj-Fyzul, et al., 2014, Ibrahim, 2015, Iribarren et al., 2012, Nayak, 2010).

II. MECHANISMS OF ACTION

Several claims to the mode of action of probiotics in aquaculture are currently found. Many, verified from in vitro tests. This question the fact that the efficiency of a probiotic tested in vitro can change significantly when administered to the host, that is, in vivo, generating a correlation incompatibility between the two forms of investigation (Ibrahim, Balcazar et al., 2006).

Among the different forms of action of probiotics, competitive exclusion is one of them. Consisting of the ability to prevent the growth of pathogenic bacteria in the intestinal tract of the host. For aquatic animals the evidence is that this occurs through the colonization of probiotic bacteria in the digestive tract, especially in the epithelium of the gastrointestinal mucous (Lazado and Caipang, 2014; Mahayhi et al., 2012). Balcazar et al. (2007), verifying the form of adhesion of probiotic bacteria in fish, summarized the process in the following stages: attraction, association to the surface secreting

substances and binding the cells of the animal tissue. As adhesion to the surface is an important protection mechanism against pathogens due to competition for binding sites, nutrients and consequently for modulation of the immune system (Ibrahim, 2015).

According to Nayak (2010), the immune stimulator capacity of probiotics may be affected by some factors, such as: source, type, dose and duration of supplementation. Luis-Villaseñor et al. (2015) found that the use of two probiotic mixtures composed of an experimental mixture of *Bacillus* (*Bacillus tequilensis* + *B. endophyticus*) and a commercial probiotic, contributed positively in modulating the bacterial community of larvae of shrimp *Litopenaeus vannamei* against the challenge with *Vibrio parahaemolyticus*.

In addition to the increased immune stimulator capacity, the adhesion and colonization of probiotic bacteria are important in the competition for nutrients and energy sources, an extremely necessary condition in the composition of the intestinal tract microbiota (Dawood and Koshio, 2016; Newaj-Fyzul et al., 2014). In the present study, the use of probiotic agents in the digestion of nutrients by stimulating and / or producing digestive enzymes, such as amylase, lipase and protease, was observed with the addition of probiotic in the fish diet (Lazado, et al., 2014, Qi et al., 2009). In a study conducted by Wang et al. (2008) showed an increase in protease activity in common carp - *Cyprinus carpio*, fed a diet containing *Bacillus* spp.

Another important mechanism of action is the production of several antimicrobial compounds, such as bacteriocin, commonly produced by bacteria of the genus *Bacillus* that are capable of inhibiting the growth of undesirable bacteria (Mohapatra et al., 2012; Ali et al., 2000; Gildberg et al., 1997). The compounds produced in an antagonistic way, have also been shown to be efficient against viruses, as verified by Balcazar (2007).

Vitamin production is another important action of probiotics, observing the ability of some strains to produce water-soluble vitamins such as complex B and folic acid (Leblanc, 2011).

Required Characteristics and Selection Form

In order to use microorganisms as a probiotic in aquaculture, it is necessary that they present some essential characteristics among which they are safe for the cultured animal, for the environment in which they live and for humans, being innocuous and not presenting resistance genes antibiotics (Moubareck et al., 2005).

It should also have anticancer properties, be able to colonize the digestive tract of the host and be resistant to the enzymes present in it and bile, besides being stable to the process of inoculation in the ration, the time of storage and transport (Gabbay, 2012).

According to Balcazar (2006), the colonization of the host gastrointestinal tract is only verified when the probiotic is administered for a long period of time. In the literature, there is a variation in the time of action of probiotics for different species in aquaculture (Paixão et al., 2017).

However, the use of autochthonous probiotic strains is more likely to colonize the intestinal tract of the host and to remain viable, as well as being part of the culture environment (Kotzent, 2017; Jesus et al., 2016). According to Cahill (1990), bacteria present in the aquatic environment influence the composition of the intestinal microbiota, in the same way that the intestinal microbiota influences the aquatic environment.

In the absence of a microorganism with all the characteristics mentioned above, several studies have aimed at the simultaneous use of several probiotics (Paixão et al., 2017; Torres, 2014) or of probiotics with prebiotics (Azevedo et al., 2016 Ganguly et al., 2010), satisfying the necessary characteristics and generating greater benefits to the host.

Microorganisms Used as Probiotics in Aquaculture

It is now possible to find in the literature a variety of probiotic groups used in aquaculture, from Gram-positive and Gram-negative bacteria, unicellular algae, bacteriophages and yeasts (Ibrahim, 2015; Das et al., 2008). In this work the focus was given to gram-positive bacteria (Table 1).

Table.1: Gram positive bacteria used as probiotics in Aquaculture

Probiotic microorganism	Target species	Source	Study developed	Referencies
<i>Lactobacillus plantarum</i>	<i>Oreochomis niloticus</i>	Target species	Acute inflammatory response in Nile tilapia fed probiotic <i>Lactobacillus plantarum</i> in diet	Dotta et al. 2011
		Colection	Dietary <i>Lactobacillusplantarum</i> supplementation enhances growth performance and alleviates aluminum toxicity in tilapia	Yu et al. 2017
		Colection	Dietary <i>Lactobacillusplantarum</i>	Zhai et al. 2017

	<i>Yoshitomi tilapia</i>	Soy	supplementation decreases tissue lead accumulation and alleviates lead toxicity in Nile tilapia (<i>Oreochromis niloticus</i>)	Tang et al. 2017
<i>Bacillus subtilis</i>	<i>Colossoma macropomum</i>	Commercial	Deoxyojirimycin from <i>Bacillus subtilis</i> improves antioxidant and antibacterial activities of juvenile <i>Yoshitomi tilapia</i> Lining	
	<i>Colossoma macropomum</i>	Commercial	Prebiotic, probiotic and symbiotic supplementation for tambaqui juveniles at two storage densities	Azevedo et al. 2016
	<i>Colossoma macropomum</i>	Commercial	Effect of commercial probiotics (<i>Bacillus subtilis</i> and <i>Saccharomyces cerevisiae</i>) on growth performance, body composition, hematology parameters, and disease resistance against <i>Streptococcus agalactiae</i> in tambaqui (<i>Colossoma macropomum</i>)	Paixão et al. 2017
<i>Bacillus</i> spp.	<i>Colossoma macropomum</i>	Commercial	Use of probiotic during transport of tambaqui (<i>Colossoma macropomum</i>) juveniles in a closed system	Ferreira. 2014
<i>Weissellacibaria</i>	Surubins híbridos	Target species	Immunological parameters of surubins vaccinated against and supplemented with probiotic	Pereira, 2013
lactic acid bacteria	<i>Oncorhynchus mykiss</i>	Target species	Identification and characterization of lactic acid bacteria isolated from rainbow trout (<i>Oncorhynchus mykiss</i> , Walbaum 1792), with inhibitory activity against <i>Vagococcus salmoninarum</i> and <i>Lactococcus garvieae</i> .	Didinen et al., 2017
<i>Lactobacillus</i> spp	<i>Oncorhynchus mykiss</i>	Target species	Evaluation of the effect of probiotic microorganisms on the zootechnical, hematological and stress tolerance performance of rainbow trout <i>Oncorhynchus mykiss</i>	Torres, 2014

Among the gram-positive bacteria, there is a group composed of lactic acid, anaerobic or aerotolerant bacteria, in general they present catalase negative and do not present spores and movement. They produce lactic acid as the largest or only product of their metabolism (Gabbay, 2012; Poffo e Silva, 2011). Within this group, several bacterial species of the genus *Bacillus*, *Lactobacillus* and *Lactococcus* were successfully isolated from the intestinal tract of fish and are widely known as the main probiotic species in aquaculture (Kotzent, 2017; Balcázar et al., 2006).

The genus *Lactobacillus* has been frequently used as a probiotic in aquaculture (Yu et al., 2017, Gabbay, 2012, Dotta et al., 2011, Jatobá et al., 2008). Some results point to an improvement in host response to the presence of pathogens. Aly et al. (2008) found that *Lactobacillus acidophilus* contributed to improvement in the immune

modulation of Nile tilapia increasing its resistance to the pathogen *P. fluorescens*. Ferreira (2014) found that the probiotic *Bacillus* spp. was not efficient in suppressing stress responses and in improving the innate immune system of tambaqui submitted to the transport procedure. Similar, Passion et al. (2017) did not observe a difference in performance and body composition. already Azevedo et al. (2016) identified improvement in growth and better use of food with *Bacillus subtilis* in conjunction with a symbiont. However, there may be differences in the immunological effect of fish among different probiotics (Mohapatra et al., 2013).

According to Balcázar et al. (2007), species of the genus *Lactococcus* have favorable characteristics to be used as a probiotic in aquaculture. In a recent study by Kotzent, (2017) six strains of bacteria isolated from the intestinal tract of tambaqui were tested. Only

Staphylococcus hominis, *Enterococcus hirae*, *Pediococcus pentosaceus* and *Lactococcus lactis* were shown to be potential probiotics in diets for the species. *Lactococcus lactis* presents coccus formations; measuring between 0.5 and 1.5 μm , presents hemolysis and catalase negative, develop at temperatures between 30 ° C and 40 ° C, with 37 ° C at optimum temperature (Kotzent, 2017).

Didinen et al. (2017) observed that *L. lactis* administration in the rainbow trout diet resulted in a significant reduction in mortality caused by *Lactococcus garvieae*, being a viable alternative for the management of lactococcosis in cultured fish.

Linh, et al. (2018) evaluated the probiotic properties of *L. lactis* for application in aquaculture from fermented vegetables and found its efficacy against Gram-positive and Gram-negative pathogenic bacteria.

There are few studies in the literature regarding the use of probiotics for tambaqui. Ferreira et al. (2014), Azevedo et al. (2016) and Paixão et al. (2017), tested the use of allochthonous strains, that is, from another species, making evident the need for evaluation of autochthonous strains, especially with in vivo studies (Kotzent, 2017).

Stress in pisciculture and probiotics

In fish culture, the most effective way of administering probiotics is through feed, with the microorganisms incorporated into the feed, using soybean oil as a vehicle, in order to guarantee the adhesion of the cells to the grain of the food (Ferreira; Torres, 2014; Gabbay, 2012).

From its ingestion, one of the most important roles is the development of innate immunity in cultured animals, which are subject not only to the action of pathogenic microorganisms but also to changes in the environment, which can seriously affect their physiological state (Mohapatra et al., 2013).

Brandão et al. (2006) states that the response to stress occurs in three ways: primary - related to hormonal responses; secondary - changes in physiological and biochemical parameters; behavioral changes, changes in behavior and increased susceptibility to diseases.

To be effective for the organism grown, probiotics must exert physiological importance on the consumer, when they reach populations above 10^6 to 10^7 CFU / g or mL of bioproduct. However, there is a need to establish reference values according to the microorganism used the target species and their health status (Torres, 2014).

III. PROBIOTICS AND STRESS VARIABLES

Hematologic Parameters

Studies on the hematological picture of Brazilian fish in fish farming have increased greatly, since blood parameters can be used as biological indicators in

identifying the stress that the environment and parasites can impose on cultured animals (Dias, et al. 2009).

According to Dias et al. (2009) the inhibitory effects of acute or chronic stress can affect the immune response of the fish implying a significant reduction in resistance to diseases. Variables related to leukogram help in the diagnosis of infectious processes and states of homeostatic imbalance, or erythrogram, in the identification of anemiemic processes. The reference values for the tambaqui erythrogram are shown below (Table 2).

Table.2: Reference values of the erythrogram for tambaqui

Parameters	Minimum/Maximum	Reference
	m	range
Erythrocytes (x 10 ⁶ μL)	1,250 - 2,960	1,625 - 3,383
Hematocrit (%)	26,0 - 38,0	36,0 - 40,0
Hemoglobin(g/dL)	6,3 - 13,7	8,9 - 10,9
VCM (fl)	70,8 - 123,7	112,7 - 192,6
CHCM (g/dL)	20,2 - 30,5	26,2 - 49,6

Source: Dias et al., 2009

Generally, in stressed fish there are changes in hematocrit, hemoglobin concentration and number of lymphocytes followed by hyperglycemia (Torres, 2014). For Nile tilapia fed with *Lactobacillus plantarum* in the diet, submitted to an inflammatory response by the injection of carrageenan, there was an increase in the number of neutrophils (Dotta et al., 2011).

Paixão et al. (2017) testing *B. subtilis* in the diet of tambaqui juveniles subjected to *Streptococcus agalactiae* infection found an increase in the number of erythrocytes. However, there was no difference in this parameter using *Saccharomyces cerevisiae*.

Histopathological Parameters

Histological methods have been considered an important tool to evaluate pathological changes in tissues and have been used in toxic studies for different aquatic organisms (Díaz-de-alba et al., Yu et al., 2017), providing information on biochemical changes at the cellular level and the presence of pathologies in the tissues (Mohapatra et al., 2013). On the other hand, tissue analysis can serve as a biomarker of environmental pollution (Zelikoff, 1998). Lesions observed, for example, by histopathological analysis of the liver, may present hepatocytes with wide vacuolization, reduction of glycogen stores, inflammation, alteration in the shape of sinusoidal vessels, and are even considered markers of the quality of the environment in which these animals are inserted (Teh et al., 1997).

Enzymatic Parameters - Antioxidant Enzymes

In addition to the presence of contaminants in the aquatic environment, other factors such as the physical-chemical parameters of the environment may be related to changes in the physiological state of the cultured animals being responsible for the oxidative stress in the animal (Mohapatra et al., 2013).

hai, et al. (2017) found that the use of *L. plantarum* in the diet of *Nile tilapia*, decreased the oxidative stress caused by lead. Similar was observed by Yu et al. (2017) that verified improvement in the effects caused by the oxidative stress generated by the aluminum concentration, in addition to an improvement in the growth performance for the species. For Castex (2009), the use of probiotic in the diet plays an important role in the antioxidant activity.

The effects caused by oxidative stress can be verified by means of enzymatic analyzes. The enzyme superoxide dismutase (SOD) and catalase (Cat), are among the major antioxidant defense enzymes. SOD is a metalloenzyme acting on the O₂ radical - disrupting it to H₂O₂ and protecting the targets of the superoxide anion attack (Trevisan, 2008).

The oxidative stress and the activity of antioxidant enzymes in the liver and white muscle of *Nile tilapia* submitted to chronic exposure to ammoniacal nitrogen were investigated by Hegazi et al. (2010), showing an increase in levels of stress biomarkers and enzymatic activity according to the increase in nitrogen concentration in the environment.

IV. FINAL CONSIDERATIONS

Aquaculture is an extremely important activity in ensuring the planet's food security. The emergence or improvement of techniques used to promote the supply of a high quality product is desirable by all involved with the aquaculture production area.

In promoting a product offering safety, good growth, health and production time, the use of probiotics has proven to be a promising alternative. Its use is already a reality worldwide and its application is already considered part of the aquaculture of the future.

Based on the results shown in this work, it is evident the need for studies related to the effects of probiotics, for native species, especially for tambaqui, this important species for Brazilian fish farming.

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Space, City and Post colonialism in the Poetic Discourse of the “Independent Writers of Pernambuco”

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Abstract— *In Altas literaturas (High Literatures), Leyla Perrone Moisés reminds us that in the scope of Catholicism the canon acquired the meaning of a "list of saints recognized by the papal authority" which "by extension came to mean the set of literary authors recognized as masters of tradition" (1988, p. 61)¹. That, undoubtedly, guided the literary studies in Brazil until very recently. These studies ignored non-canonical literary works. In other words, the canonical thinking was oblivious to a rich literary production which was not in accordance with a colonialist view of the academic studies developed in our universities. In this work, we intend to study the literary production of some poets in Recife (Brazil), in the 1980s in relation to the established canon. We focus on the Movement, known as “Independent Writers of Pernambuco” aiming to bring to light a literary movement forgotten by Brazilian academic community.. Our study has a postcolonial perspectives we explore the need to pay attention to literary production by writers who do not always belong to “traditional canon” (Said, 2004). The poetical works of the movement we study may play a vital role in the context of Brazil and Pernambuco. By considering the emerging social responsibilities of writers and intellectuals in an ever more interdependent world, we suggest that studying the movement and its authors who are not much explored by Brazilian scholars we may be decolonizing the knowledge on literature in Brazil. We take into account the movement’s relations with Brazilian Northeastern culture and its program of action, dating from 1981, the beginning of the so-called “Lost Decade.” The movement had an important voice against the most conservative and*

traditionalist criticism at that time. We believe that by studying the movement we are offering the opportunity to rethink our Brazilian and Pernambucan literary canon.

Keywords— *Literary Canon, History, “Recife Independent Movement”, Poetry.*

“In order to be able to understand a humanistic text, one must try to do so as if one is the author of that text, living the author’s reality, undergoing the kind of life experiences intrinsic to the author’s life, and so forth, all by that combination of erudition and sympathy that is the hallmark of philological hermeneutics. Thus the line between actual events and the modifications of one’s own reflective mind is blurred [...]. [The author’s] relationship to his age [is] an organic and integral one, a kind of self-making within the context of the specific dynamics of society at a very precise moment in its development. (Edward Said)

I. INTRODUCTION

In his work *Humanism and Democratic Criticism* (2004), Edward Said criticizes scholars who tend to consider only the euro-centric works as part of their studies. Said suggests that the inclusion of a broader range of writers in our classroom and in our studies could favor a more democratic form of humanism, because when incorporating more literary works in our studies we may help emancipate and enlighten diversity and new knowledge. In this sense he proposes a more expansive literary canon as strategies to revitalize humanities and the literary studies: “Humanism is about reading, it is about perspective, and, in our works as humanists, it is about transitions from one realm, one area of human experience to another.... and when we go on to expand the area of attention to include widening circles of pertinence” (HDC, 80). Moreover, as we see in the epigraph, Said proposes that words as literary works are

¹ Our translation from the original: “lista de santos reconhecidos pela autoridade papal” and “por extensão passou a significar o conjunto de autores literários reconhecidos como mestres da tradição”.

not merely passive figures but vital agents in historical and political change. Intellectuals must be able to realize the role of works of arts and other production in relation to the time and the political situation when the works were written, is very important. It is with this purpose that in this work we study a literary movement in Brazil during the Brazilian dictatorship. The movement was initiated in Recife, the capital city of the state of Pernambuco, in Brazilian Northeast. We consider that it is very important to bring pay attention to this movement and bring to light the importance of it in a historical time in Brazil. We consider that university scholars and researchers need to look toward production which do not belong to the traditional cannon, but which are worth of investigation and studies. Therefore, we agree with Said's view that we need to go beyond a very traditional canonical look and walk

towards new linguistic and literary experiences that demand study and recognition Within a world literary production. Besides, we need perceive the political relevance of displaying the poetical production of the Recife Movement which was almost forgotten by students of literature. This, reflects what Said himself says: "Humanism, I strongly believe, must excavate the silences, the world of memory, of itinerant, barely surviving groups, the places of exclusion and invisibility..(HDC, 81). The Recife Movement of Independent writers also reminds the reader of Fanon (1972), when he writes in the *Wretched of the Earth* about the "poetry of revolt" which was a way of bringing awareness to important current events and a form of freedom of speech, expressing individual or group thought. With this in mind we will study the Recife Independent Movement.

II. ORIGIN OF THE MOVEMENT

The end of the 1970s in Brazil was marked by a series of political and cultural factors that resulted in the proliferation of groups and tendencies on the sidelines of official systems of cultural production in extremely distinct ways, but that found in their common axis the fight against the military dictatorship, which was the center on which art and the mobilization of Brazilian society revolved.

It was also a period in which writers, due to the strong surveillance and repression exerted by the state machine on bodies that produced culture, searched other ways for the elaboration, disclosure and diffusion of the literary work in its diverse forms as a way to circumvent the repressive apparatus of the state.

In this context, coming from an oppositional stance towards the system and proposing a final blow in the modernist tradition, an entire generation

seeks through the mimeograph and through clandestine printing shops an alternative way to escape the government control and to maintain art as a flag representing the resistance to the culture of silence imposed by the dictators.

This stance – of being on the sidelines of the official systems of production and diffusion of art and of retaking the individuality lost by the Modernist propaganda – characterized the arrival of marginal artists, who placed themselves in the margins of the official publishing system of the country.

It is in this context, unless there is better judgment, that the following decade begins, with the strengthening of street demonstrations in different Brazilian cities, in search of the re-democratization of the nation, such as "Diretas Já" ("Free election right now!"), in 1983, and the rupture of a big part of artists with the traditionalist posture that prevailed in the official education and its institutions.

In this sense, the Movement of independent writers was intimately related to this cultural rebellion of the 1980s in the academic area, more precisely manifested at the First ENEL (NATIONAL MEETING OF STUDENTS OF MODERN LANGUAGES AND LITERATURE) held in Salvador, Bahia, in 1980². The movement organized a response to the conservatism that was already rousing even the bastions of the mimeograph generation, delighted with the invitation of big publishing houses to participate in the formal publishing market in 1970s. On this institutionalization of the marginal generation that was initiated in the 1980s, Luiz Carlos Monteiro, in an interview with the website *interpoética.com.br*, states that:

[The generation of the 70s was born on objecting grounds and today is institutionalized. The "marginal" poetry of Chacal is distributed throughout Brazil through official editorial programs that involve public schools. When I participated in the independent movement, I assumed radical ideological and editorial positions, but tried to maintain a dialogue with other groups – the Generation of 1965, the Poets

²All the references were extracted from the personal archive of the poet Eduardo Martins and from ESPINHARA, Francisco. *Movimento dos escritores independentes*. Recife: Editora Universitária, 2000.

of the Emperor's Street, the local neo-tropicalist vanguard.]³

Certainly due to this beginning of the institutionalization of the mimeograph generation, the authors who were still labeled as "new artists" opted to discuss several questions about the nomenclature through which they were labeled, the relations between art and power and the process of creation in relation to the systems of production and diffusion of the literary work of art, which resulted in the holding of a new meeting in Vitória, in the state of Espírito Santo, in 1981.

This second event counted on the participation of approximately 16 states of the federation. It was in this event that the writers, until then labeled as "new", deliberated for the nomenclature of "Movement of the Independent Writers". They returned to their states of origin with the purpose of promoting local events and of discussing a definition for the authors thus designated, since the term independent had already been mentioned by some historians of literature in relation to some isolated cases of poets of other centuries and of other generations.

III. EVENTS AND MEETING: THE LETTER OF PRINCIPLES

Pernambuco held two of these events at the institution Fundação Casa das crianças de Olinda (Children's House Foundation of Olinda), home of poets of popular culture, popular singers known as cordelistas⁴ and "emboladores"⁵, and it was from their deliberations at state level, through the "LETTER OF PERNAMBUCO" that the independent writers reached the following topics of definition at the NATIONAL MEETING OF

In the original: A geração 70 nasceu em bases contestatórias e hoje se encontra institucionalizada. A poesia "marginal" de Chacal é distribuída em todo o Brasil através de programas editoriais oficiais que envolvem as escolas públicas. Quando participei do movimento independente assumi posições ideológicas e editoriais radicais, mas tentando manter o diálogo com outros grupos – a Geração 65, os Poetas da Rua do Imperador, a vanguarda local neotropicalista.³ In the original:

⁴ Cordelistas- are the poets who practice "literatura de cordel" or "sting literature" very common in the Brazilian Northeast.

⁵ Similar to "cordelistas" The "emboladores" are oral poets whose practices allow people who, originally, were not very familiar with the reading world to experience literacy practices. Poets need to create a poem in response to a previous one by another author.

INDEPENDENT WRITERS, in Fortaleza, Ceará, where they gathered. As Fátima Ferreira says, "popular, avant-garde and anarchist poets, even the most traditionalist authors" (ESPINHARA, 2000, p.16)⁶:

- [a. Independence from the oppressive society and its pre-established values;
- b. Independence from the government, state organs and publishing companies, not accepting interferences regarding the content and the form of theoretical or literary creations;
- c. Independence from the pressure coming from the intellectual or political environment through the imposition, standardizing or restriction of themes and forms (free expression of the writer's moments, which only his sensitivity can determine);
- d. Independence of each writer in their philosophical, theoretical, political-ideological positions, in their options for currents and literary movements, in everything that concerns the publishing, dissemination and distribution of their books;
- e. Independence from all alien cultural models to the Brazilian culture.]
- a. Independência ante a sociedade opressiva e seus valores pré-estabelecidos;
- b. Independência ante o governo, órgãos estatais e empresas editoriais, não aceitando interferências a respeito do conteúdo e da forma de suas criações teóricas ou literárias;
- c. Independência ante pressões vindas do meio intelectual ou político no sentido de impor, padronizar ou restringir temas e formas (livre expressão dos momentos do escritor, que só a sua sensibilidade cabe determinar);
- d. Independência de cada escritor nos seus posicionamentos filosóficos, teóricos, políticos-ideológicos, nas suas opções por correntes e movimentos literários, em tudo que diz respeito à editoração, divulgação e distribuição dos seus livros;
- e. Independência ante todos os modelos culturais alienígenas à cultura brasileira.

IV. THE INDEPENDENTS OF PERNAMBUCO

As one can see the Independents did not define in their "letter of principles" any new canon of aesthetic motivation, in fact, the absence of a canon is what characterized the production of the Movement. The anarchic aspect is consolidated in the politico-philosophical and, mainly, aesthetic positions. Thus, it

⁶ Our translation of: "poetas populares, vanguardistas e anarquistas, até os mais tradicionalistas dos autores"

becomes an anticipation of what R. Reis would tell us later in *O Canon* about this guiding element present in almost all the literatures, delimiting the validity of the artistic production in the name of an apparatus of the state, because, in this case, "the discourse of high culture has, more often than not, been in the service of power and of the state" (1992, p.69)⁷, emitting and conserving the relation between artistic text quality and the ideology of the intellectual elites.

On this aspect it is worth remembering what Francisco Espinhara recorded in his book *Movimento dos escritores independentes de Pernambuco* with regard to the relations between art, history and power:

[From the strangest dictionaries, the vocabulary treasure of a people, to the cold compendiums of science, an inexhaustible source of technology, books would not be possible without an evident or intrinsic history. If I were to say the opposite, that history would be possible without books, I would be incurring an untruth, for it, history, has always happened by itself, happening, even if in order to exist it needs "thinkers" to make it happen. It may seem a contradiction, but history-history, with very rare exceptions, was never told and transcribed to content, it was always the operetta of the powerful, conquerors, manipulators, exterminators, of those who made "good use" of their dictionaries and their compendiums of "sciences", the surrounding histories were stifled or neglected to groups called ethnic or ethical minorities. (ESPINHARA, 2000, p.11)]

Dos dicionários mais estranhos, tesouro vocabular de um povo, aos frios compêndios de Ciências, fonte inesgotável de tecnologia, os livros não seriam possíveis sem uma história evidente ou intrínseca. Se dissesse o oposto, que a história seria possível sem os livros, estaria incorrendo em uma inverdade, pois ela, a História, sempre se houve por si só, acontecendo, ainda que para existir precise de "pensantes" que a façam acontecer. Pode parecer uma contradição, mas a história-história, com raríssimas exceções, nunca foi contada e transcrita a contento, foi sempre a opereta dos poderosos, vencedores, manipuladores, exterminadores, daqueles que fizeram "bom uso" dos seus dicionários e de seus compêndios de "ciências", as histórias circundantes foram sufocadas ou negligenciadas a grupos chamados de

minorias étnicas ou éticas. (ESPINHARA, 2000, p.11)

Here I see a great difference between the authors of the 70s, who were already being institutionalized, and their practice of the minute and ironic poem initiated in our literature by Oswald de Andrade at the beginning of Modernism, and the anti-canonical and politicized proposal of the independent writers of the 80s, which translates in the manifest document entitled "Letter of principles" written in the event held in Fortaleza. In the thought of Espinhara and his contemporaries, we note the dislike of the relations of patronage between art, power and history, almost always unfavorable to "ethical and ethnic minorities."

For this reason, I think, the movement's "letter of principles" is long and extensive, but assumes, mainly, a libertarian ideological character of art in relation to critical studies and to state control. Here we have, among other factors, one of the reasons that surely led the critics to ignore the poetic production of the period, both locally and nationally, with very rare local exceptions, as we shall see later.

In Recife, we find, together, from the popular poets (repentistas and emboladores) from whom the Independents inherited the characterization of street movement, to even a more reclusive and cabinet sonic like Cícero Melo. Nevertheless, as in all movements, only a half dozen of participants "took the reins" of the activities developed by the Movement, among them Francisco Espinhara, Cida Pedrosa, Eduardo Martins, Héctor Pellizzi and Fátima Ferreira, who organized and executed the projects of open events, publishing and dissemination of the production of the time.

These authors formed the "embryonic group of the Movement" to which joined, among many others whose records have not yet been documented: Adelmo Vasconcelos, Amara Lúcia, Marcelo Mário Melo, Maria Celeste, Samuca Santos, Geni Vieira, Romana, Caesar Sobreira, Lenilda Andrade, Jorge Lopes, Don Antônio, Luiz Carlos Monteiro, França, Erickson Luna, Azimar Rocha, Raimundo de Moraes, Valmir Jordão, Celso Mesquita, Wilson Freire, Jailson Marroquim, Joaquim Cezário de Mello, Inaldo Cavalcanti, Cícero Melo, Jayme Benvenuto Júnior, Sérgio Lima e Silva, Lara, Pedro do Amaral Costa, Adelmo Vasconcelos, Wadson de Paula, Dôra Gusmão, Juhareiz Correia, Dione Barreto, Claudionor Loyola, Manuzé, Ricardo Antunes, Tales Ribeiro, Josualdo Menezes, Mônica Franco, Avanilton Aguilar, Sérgio Lima e Silva, Wilson Mota (Miltinho), Jorge Verdi, Marcílio Medeiros, Belmar... who saw in the irreverence of the Independents and in their power of mobilization a new stance before the literary production.

⁷ In the original Portuguese: : "o discurso da alta cultura tem, o mais das vezes, estado a serviço do poder e do Estado"

These authors saw in this new stance the rebirth of the streets of downtown Recife in what best defines them: the lyrical effusion, since at that time, besides bearing beautiful names, the streets were symbols of resistance to the odor of urine, to the remains of fruits and to the poverty on the floor that came to be confused with the beauty of Capibaribe and, consequently, of the city.

The first events were given in the bookstore **Livraria Reler**, with the support of the teacher and "famous bookseller" **Pedro Américo de Farias**, one of the few sympathizers to the ideas of the Movement in its beginning. Incidentally, **Flor Pedrosa** and **Pedro Américo de Farias** accompanied some of the Independents even before the movement itself was defined as such. They supported and edited, in the secondary school 2001, the book of poetry entitled **Momento Poético** (Poetic Moment), in which appear published the first poems by Eduardo Martins (at the time signing as José Eduardo), Cida Pedrosa, Lydia Barros, Raimundo de Moraes, among others.

V. THE INDEPENDENCE IN DOWNTOWN RECIFE

It was in downtown Recife that the Movement initiated its street recitals on the bridges, in Praça da Roda (also known as Praça do Sebo) and in front of Lojas Americanas, on Rua Sete de Setembro, every Saturday morning, at which time the poets took to the streets of the center of the city and occupied the hydrants, making spout the poetry through one of the oldest means of diffusion of the poetic art, orality.

In this way we can affirm that "the new literary work is received and judged both in its contrast as the background offered by other artistic forms, and against the background of the daily experience of life"⁸ (JAUSS, 1994, p. 53) because of the closeness that it establishes with its first critic, the common reader, receiver of this work, as well as with the diachronic process that takes place in this relation within a specific context that disregards the traditionalist reading of the text in the offices of academic criticism.

This type of event, singular for a literature that increasingly encases itself in its elitist stronghold, begins to annoy a lot of people, attracting the attention of the most unsuspecting, and even the indifferent and meager media of Pernambuco could no longer silence: THE INDEPENDENTS HAVE ARRIVED!!! They

⁸ In the original: a nova obra literária é recebida e julgada tanto em seu contraste como o pano de fundo oferecido por outras formas artísticas, quanto contra o pano de fundo da experiência cotidiana da vida

arrived and completely altered the literary scene of well-behaved Recife of the eighties, but the price would be high, very high for the generation.

Hasty evaluations compromised the knowledge of the whole literary production of the time. Yet, some opinion makers such as César Leal (Caderno Viver-DP), Lucila Nogueira (Generation of 65/UFPE), Ângelo Monteiro (Generation of 65/UFPE), Marco Camarotti (UFRPE), Paulo Azevedo Chaves (POLIEDRO-DP) and the greatest supporter of the Independents, the poet Alberto da Cunha Melo, confronted this rashness of many before even reading the production in question, a gratuitous prejudice that the young people suffered accompanied of all kinds of mistrust and senseless discrimination on the part of the holders of the oligarchic cultural power of the State in the foreground, and of the nation in the background.

We take this issue here in the view of the poet Alberto da Cunha Melo in an interview in 2000 given to 25 Brazilian intellectuals of different generations, including Alfredo Bosi, Deonísio Silva, José Nêumanne Pinto, Eduardo Martins and Mário Hélio, later published in 2012 in the book *Cantos de Contar*:

[If we make a quadruple line of communication we could align Allen Ginsberg, Jack Kerouac, William Burroughs and Gregory Corso (in the USA); Cacaso, Chacal, Wally Salomão and Ana Cristina César (in the Brazilian Southeast) and Eduardo Martins, Francisco Espinhara, Cida Pedrosa and Fátima Ferreira (here in Pernambuco), in the 1980s. (2012, p.133)]⁹

We know that the above transcript does not refer only to history or to one or another text drawn in the time and space of literary facts, but mainly to the way of reading, of giving and having knowledge of the literary production of a people as a whole through the literary production of its poets within a certain cut in time, which in fact does not occur, turning to the colonialist criticism to the studies of the works of the colonizer at international and national level.

⁹ In the original: Se fizermos uma linha quádrupla de comunicação poderíamos alinhar Allen Ginsberg, Jack Kerouac, William Burroughs e Gregory Corso (nos EUA); Cacaso, Chacal, Wally Salomão e Ana Cristina César (no Sudeste) e Eduardo Martins, Francisco Espinhara, Cida Pedrosa e Fátima Ferreira (aqui em Pernambuco), na década de 1980. (2012, p.133)

On this, and especially with regard to Brazilian literary criticism of the twentieth century, we can also establish the economic facts, which emphasized the southern and southeastern regions of the country and the cultural issues, which developed as a result of these factors, as elements determinants of the almost absolute absence, in the last fifty years, of great authors, especially poets, and of the great movements that developed in other regions of the nation, especially in the North and Northeast, where the Independent groups concentrated most of their activities.

Add to this that these poets worked against the canon or against the establishment of this as absolute truth. That is, the Independent poets ironically called themselves a "Movement", but did not have an aesthetic-formal platform that characterized them as such, much less a "guru" or "godfather" who would launch them into the mainstream media and put them in direct relationship with the general public. They probably did not even want such a thing.

In this sense, its history was built by facts created within the natural movement of the authors who participated in it, and was directly linked to the streets and the universities from which they came, given that they came from a meeting of new writers that took place during the I National Meeting of Students of Modern Languages and Literature, in Salvador, Bahia, in 1980 (ESPINHARA, 2000, p. 13).

Certainly, these facts contributed decisively for the Movement, after 30 years, to remain forgotten by Brazilian literary criticism, especially when speaking of poetry and especially of the poetry produced in Brazil in the years of 1980. We should note that this street poetry refers to the city and its spaces as a derivative of the gaze, a normally distrustful, pessimistic look even concerning these relations unleashed between the subject and her/his environment. As an example, the poems Prison Cell64, by Wilson Freyre, Geography of evil (Geografia do mal) by Eduardo Martins and Puppets(OsFantoques) by Francisco Espinhara, transcribed below, are cited.¹⁰

i

PRISON CELL NUMBER 64 , Easter rays

On your return, please stop at the fair
take the advantage and bring to me.
one meter of blue sky,
a carmine sunset
a piece of full moon

¹⁰ All the poems were translated into English by Miguel Nenevé. The original poems are included in the Endnotes.

even if it is a murim

bring me back memories of the rain
Tell the sound that I've yellowed
Take a message to the wind
Tell him I've shaken
What happens at her house?
but do not tell me what happened

and bring me in this bottle
any scent of bush
get my espadrilles
wash them in a stream
bring the sparkle of her eyes
to the dark of this room.

Please bring a whistle of a kiss
of a singing bird
take all my pain
for those who suffer a lifetime
tell me if her hope
is the last one, once dead ...

if you can
from wild animal running
wrapped in this scarf
bring me a sun rising.
if she is full of life,
don't tell her that I'm dying.

since you go there at the fair,
show me this charity.

And this poem by Jose Eduadro Martins is worth mentioning as an important piece for the movement.:

GEOGAPHY OF EVIL

Recife, thinner
of my dreams,
your water
may drown me

your wind blades
rehearse the cutting
of my respiratory
bridges

I'm in the island
surrounded by evils
from all sides.ⁱⁱ

Francisco Espinhara's "Puppets" gives the reader an impression from Recife, a city forsaken by all gods.:

:
PUPPETS

The puppets on Sete Street
They blindly follow the procession.
The daytime whore of Palma
Brings venereal soul
And a daily pit in the hand.
From Old Bridge to secular rust
Reticent to white cloud path
Eat the dais, the bow, the welt.
The forgotten poets in the alley
Mix blood with a dry drink.
They sleep like rags on the floor.
Recife, muse and curse
Dirty, treacherous bitch
Straight arrow
Enchanted dog city.ⁱⁱⁱ

This reminds of Frantz Fanon's statement in *The Wretched of the Earth* (1972) in the chapter "concerning violence" : "the town belonging to the colonized people, or at least the native town, the Negro village, the medina, the reservation, is a place of ill fame, peopled by men of evil" (WE,37). This is the Recife described by some poets of the movement

In Brazilian Northeast, the "Independent writers" reached, perhaps more efficiently, what seemed to be the pretensions of the first marginal poets of 1970, an almost absolute anonymity. This, except for very rare exceptions in our literature, only began to be broken at the beginning of the twenty-first century, when some critics and poets of national renown begin to cite part of this production in their manuals

This is the case of Professor Afrânio Coutinho, who in his *Enciclopédia de literatura Brasileira* (COUTINHO, 2001, p.1119) includes the Movement as an entry and other authors such as Alberto da Cunha Melo, Ângelo Monteiro, César Leal, Aguinaldo Gonçalves, Marcus Accioly, Marco Camarotti, Deonésio Silva, Osvaldo Duarte, Bráulio Tavares, Nagib Jorge Neto and Marco Pólo Guimaraens, who in their reflections on some works by authors of this period attribute a positive value to the literary production of the Movement, which once again characterizes our critique as laggard, whose blanks are continuous and whose injustices often create insurmountable and harmful gaps.

However, the Independents, in disregard of the critical recognition, continued and invaded the academic circles, took Pernambuco's production to universities and to schools. FAFIRE (Faculdade de Filosofia do Recife [College of Philosophy of Recife]) was the stage of several events of the Independents, as

well as UFPE and UNICAP (Universidade Católica de Pernambuco [Catholic University of Pernambuco]). The bars, the doors of the cinemas and the theaters could no longer ignore the presence of the writers.

They were in every nook and cranny, but they centralized, as we have already mentioned, in Praça do Sebo, on Rua da Roda, their collective releases, and in the bookstore Livraria Síntese, on Rua do Riachuelo, with the support and generosity of the bookseller Sueli, their individual releases, which also occurred less frequently in Tarcísio Pereira's bookstore Livro 7.

While Livro 7 was essential for the consolidation of the "Generation of 65" of poets from Pernambuco and held its importance for the Independents, Livraria Síntese, Praça do Sebo, Beco da Fome and the front of the Americanas store on Rua Sete de Setembro (whose manager made throw many buckets of water on the poets in order to stop the literary events on Saturdays) were the axis of the identity and literary citizenship of the Independent Writers along with the streets of downtown Recife.

There, the Movement went on to release 29 books in a single year, and circulated more than 10 "nanico"¹¹ newspapers, among them *Americanto*, *Litero-Pessimist*, *Contágil*, *Mandacaru*, *Cochicho*, *Lírica*, *Poética*, *Cântaro* and *Poemar*, which became better known by virtue of a more active participation of their publishers.

If newspapers and books were important for the consolidation of the spaces and the artistic production of the Movement, other fronts were organized in order to open trenches for the "battle for the poem" that the poets waged daily and which became one of the leaflets launched together by Eduardo Martins, Francisco Espinhara and Pedro do Amaral.

These activities include: book fairs, clotheslines, exhibitions of illustrated poem-posters, recitals, poetry rain, happenings and performances that took over the historic center and revitalized not their concrete skeletons but the transubstantiating essence of the city. A real apology to what in the most simple and crystalline way represents the culture of Recife: lyricism.

A true embolism of much that seemed dead in the culture of the region and that reappears with force and magic by the hands and the voice of the youth in spaces generated with the support of those who knew to receive them, among them: Sueli, from the bookstore Síntese, who had by several times the fronts and adjacencies of her establishment occupied by the Independents in releases, recitals and expositions of

¹¹, small and without much significance for the academic community

poems, in addition to others that were conquered by the Movement, such as Rua da Roda.

In this period, Alberto da Cunha Melo points out, in his column, in the newspaper *Jornal do Commercio*, the importance of the work of the Movement in regards to the rescue of the orality of our poetry. This seems to us to be a crucial point of the Movement, because it identifies it with the practices of the popular poets.

This artistic trait comes from the Northeastern culture, due to the proximity of the Group with the cordelistas and emboladores poets who occupied the Children's House Foundation of Olinda, where the Independents went on to hold two regional meetings in 1981 and 1982, respectively.

This aspect, very well represented in the group by poets such as Wilson Freire and Adelmo Vasconcelos, brought to the recitals the taste and flavor of the popular culture connected to cordel (string literature) and to the singing, although it was not the single mark of the work of these authors.

VI. DISPERSAL

The Independents Movement grew vertiginously, despite the prejudice and ignorance of those who came to doubt their existence as a Movement. It incorporated other arts like music, painting and cartoon. It opened new range of interaction, but, with the same speed with which it grew, the Movement succumbed, after the dissolution of the embryonic group, around 1987, with the departure of Eduardo and Espinhara to the state of Rondônia, Cida to the countryside of Pernambuco, Héctor to the state of Maranhão and with the estrangement of Fatima from the literary gatherings of the time.

Like all movements deprived of their minimal organizational framework and having many occasional adepts, the Independents saw innumerable of their dreams bogged down in the vastness of the mangroves of Recife and saw hitchhikers and active opportunists boast of a pseudo participation in the Movement, that many saw at first with irony, but later, when the city seemed to have assimilated its existence and its outbursts, they obtained positive references from academia and the media, giving testimony as participants or including themselves in a history that did not belong to them.

For this reason, and for much more than that, believing that the world takes its turns and that it is necessary to return to the past in its calm waters, we

VII ENDNOTES:

resolve to insist on this rescue, because the past waters, contrary to what many think, only move mills, interminable and uninterrupted, deep and agile like these winds that blow us the air of history to renew and reread these times of "youth and faith."

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ⁱ Cela 64, raio leste

Na volta passa na feira
aproveita e traz prá mim
um metro de céu azul,
traz um por de sol carmim
um corte de lua cheia
nem que seja de murim

me traz lembranças da chuva
diz ao som que amarelei
leva um recado pro vento
diz a ele que mofei
que passe na casa dela
mas não diga o que passei

e traz aqui neste frasco
um cheiro qualquer de mato
pega minhas alpercatas
lava elas num regato
traz o brilho dos olhos dela
pro escuro desse quarto.
traz num beijo um assobio
de uma ave cantadeira
leva toda minha pena
prá quem sofre a vida inteira
me diz se a esperança dela
quando morre é a derradeira...

se puder tu traz zoadá
de bicho brabo correndo
enrolado neste lenço
tu me traz um sol nascendo
se ela tá cheia de vida,
não me diz que eu tô morrendo

já que tu vai lá na feira,
me faz essa caridade.

ⁱgeografia do mal

Recife, diluidora
dos meus sonhos,
tens água suficiente
para afogar-me

tuas lâminas de vento
ensaíam o corte
de minhas pontes
respiratórias

em ti sou ilha
cercado de males
por todos os lados.

ⁱⁱⁱ FANTOCHES

Os fantoches da rua Sete
Seguem cegos na procissão.
A puta diurna da Palma
Traz uma venérea na alma
E uma cova diária na mão.
Da Ponte Velha a secular ferrugem

Reticente ao trajeto branco da nuvem
Come o estrado, o arco, o vergão.
Os poetas esquecidos no beco
Transam sangue a trago seco.
Dormem como trapos sobre o chão.
Recife, musa, maldição
Cadela suja, traiçoeira
Seta certa
Encantada cidade do cão.

Stratigraphic Sequence and Basin development of the Mishrif Formation in Selected Oil fields in the Mesopotamian Zone, Southeastern Iraq

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Abstract— The Mishrif Formation represents an important succession in the southern Iraq and has extensive distribution in the Middle East. The present study is focused upon the stratigraphic sequence and basin development of Mishrif Formation in three important oil fields in the Mesopotamian Zone of Iraq are:- Halfaya oil field (Hf-1, Hf-272, Hf-316), Noor oil field (No-1) and Buzurgan oil field (Bu-2, Bu-3, Bu-4).

There are several types of microfacies were recognized in the succession of the Mishrif Formation. Their characteristic grain types and depositional texture enabled the recognition of six facies associations (depositional environments) were distinguished in this Formation, they are: Basinal, Slope, Shoal, Biostorm, Back Shoal (restricted) and Lagoon associations facies.

The microfacies analysis and reconstructed the paleoenvironments of the Cenomanian-Early Turonian basin in the studied area; there are three stages of the deposition: -

First stage:- during this stage the basin of Rumaila Formation was continued to deposition the lower part of Mishrif within the basinal environment. The end of this basin (Rumaila basin) marked by appeared the open marine associated facies to the northwest basin which represent the mfs surface. The Highstand system distinguished by sequential the open sea facies to the shoal facies and biostorm. The first stage was finished by widespread of shoal facies in all studied area to marked a sequence boundary type II (prograde stage A).

Second stage:- is represented by the developed the basin from the shoal to biostorm dominated facies with slow sea level rise. The presence of the open marine associated facies within the biostorm-shoal sequence marked the mfs surface. The final step of this stage was shown the shallowing up-ward by appeared the lagoon/restricted association facies overlying the biostorm. At the end of this period, the lagoon/restricted facies were spread in the studied area to mark the prograde stage B as sequence boundary type II.

Third stage:- the sea level was raised from the northwest direction as open sea association facies, while to the

southeast the biostorm and shoal facies was dominated. The first appeared for the shoal facies upon the open sea facies marked the mfs surface to start the final highstand deposition within the restricted and biostorm/shoal facies. This stage is represent the prograde stage C for the Mishrif Formation, where the deposition has ended to mark the unconformable surface (SBI) with Khasib Formation.

Keywords— Stratigraphic Sequence, Basin development, Mishrif Formation and Mesopotamian Zone.

I. INTRODUCTION

The Mishrif Formation represents an important succession in the southern Iraq and has extensive distribution in the Middle East. The Mishrif Formation is deposited during Cenomanian-Early Turonian cycle as a part of the Wasia Group (Jassim and Goff, 2006). The Mishrif Formation in central Iraq reflects the continuous deposition of shallow marine carbonates. In central and southern Iraq, the Formation is represented in many oil field such as, Buzurgan, Amara, Halfaya, Majnoon, Rumaila, West Qurna, and Nasiriya as well as other oil fields (Aqrabi et al., 2010).

The aim of this study is interpreted the stratigraphic sequence and basin development of the Mishrif Formation in the three important oil fields in the south of Iraq are:- Halfaya oil field (Hf-1, Hf-272, Hf-316), Noor oil field (No-1) and Buzurgan oil field (Bu-2, Bu-3, Bu-4).

The Halfaya field is located south of Iraq in Missan province, 35 kilometers southeast Amara city (Fig.1). The structure, which is composed of two domes runs along a NW-SE direction and gentle elongated anticline about 38km long and 12km wide. The field comprises a main body of the anticline with a length of 31km, and it extends in NW direction.

The Buzurgan field is located South of Iraq in Missan province. Buzurgan is situated near the Iraq-Iran border, about 300 km Southeast of Baghdad and 40 km Northeast of Amara city . The structure, which is composed of two domes runs along a NW-SE direction (Fig. 1) .

Noor oil field is located to the southeast of Iraq about 15 km north east Amara city, Missan govermorate (Fig.1). The field is NW- SE trending anticline, and is about 18.9 km long and 5.9 Km wide.

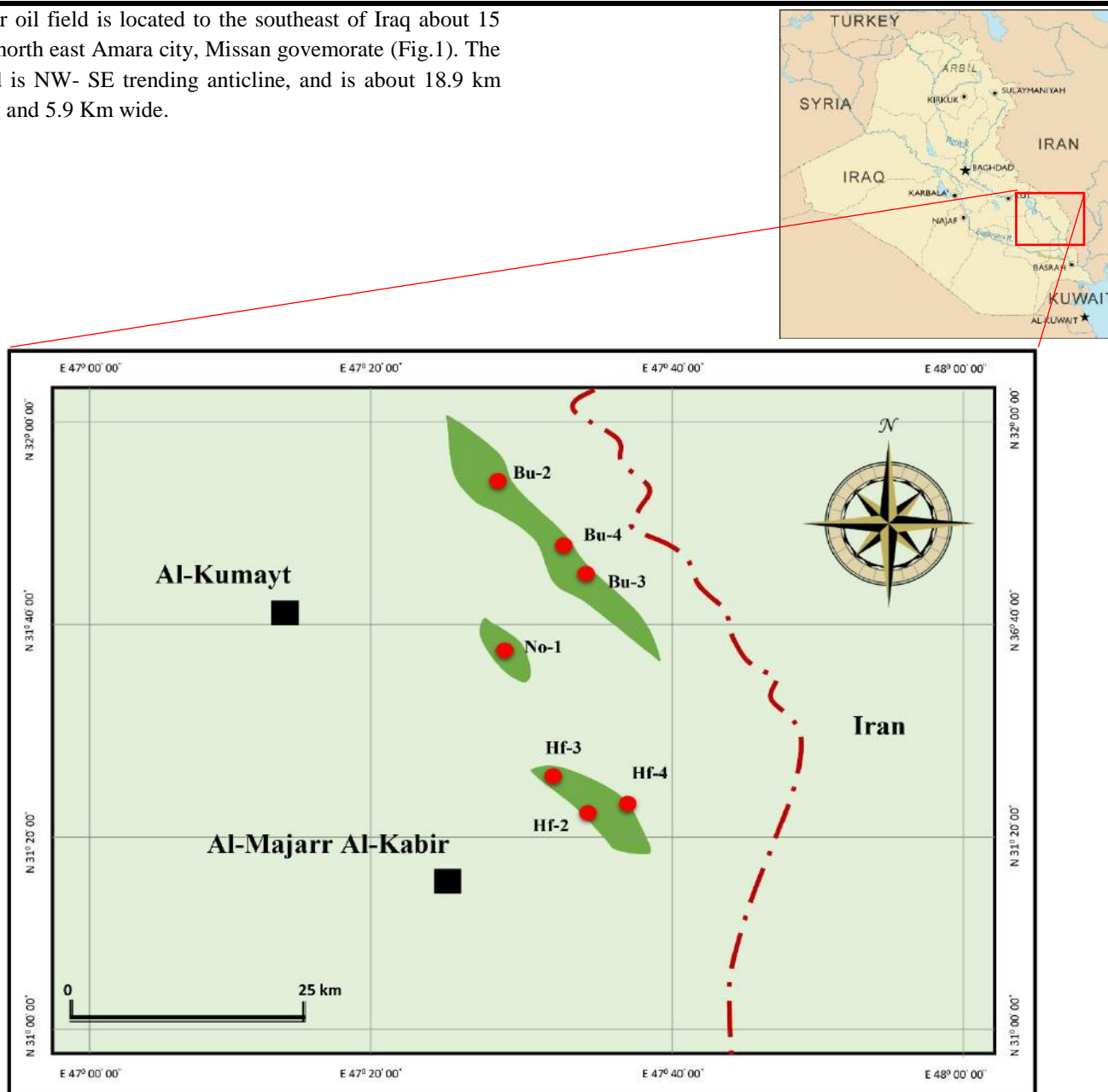


Fig.1: location map of studied area

II. STRATIGRAPHY

The lower boundary of Mishrif formation represents the change from basinal Rumaila Formation to shallow open marine facies as a conformable surface (Aqrawi et al. 2010). The upper boundary with the Khassib Formation is truncated by an unconformity surface separating the Middle from Late Cretaceous. The equivalent formations of the Mishrif Formation are Gir-bir formation in the North and the Balambo formation of the deeper eastern and intrabasinal part of the same basin of the Dokan Formation (Aqrawi et al. 2010) (Fig.2). The top Mishrif truncation forms the AP9/AP8 megasequence boundary at

~92 Million years (Sharland et al. 2001). The Rumaila/Mishrif High Stand System Tract represents the 3rd order K140 genetic sequence which is driven by both eustacy and subsidence (Aqrawi et al. 2010). The Mishrif is considered to be an overall progradational marine shelf sequence. Following the deposition of the transgressive shales and marly limestones of the Ahmadi and Rumaila Formations, rudist reefs and other related build-ups represented the deposition of the Mishrif Formation (Jassim and Goff, 2006).

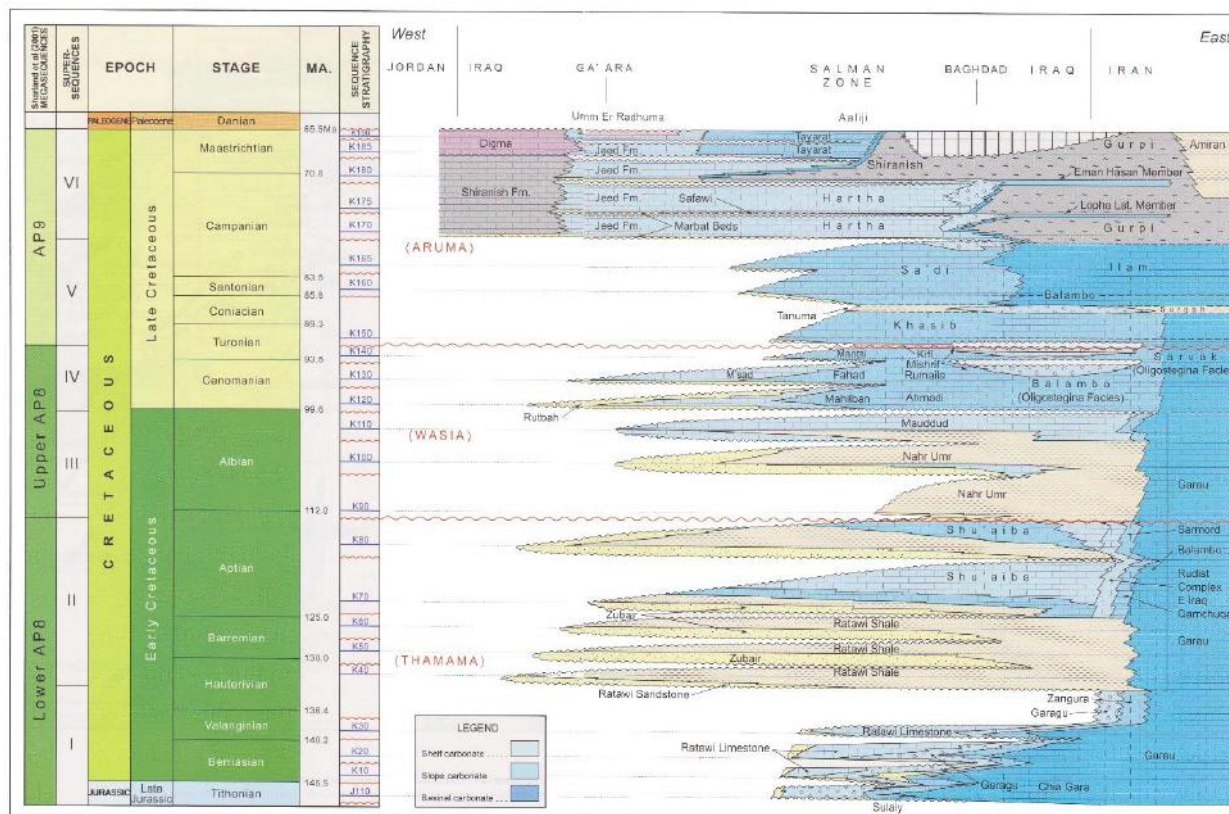


Fig.2: stratigraphic cross section of the cretaceous succession in Iraq (Aqrawi et al. 2010)

III. PALEOENVIRONMENTS AND MICROFACIES

Carbonate depositional textures of microfacies were described following the classification of Dunham (1962), and rudist-bearing facies were classified according to Embry and Klovan's classification (1971). The microfacies were compared with the models of standard microfacies and depositional environment belts of carbonates proposed by Wilson (1975) and Flugel (1982).

Facies associated with (Basin Environment): Recognized wackestone dominated "shallower sub-basinal" and mudstone-dominated "sub-basinal" sub-facies. The Facies analysis for the studied succession shows that environment is represented by the Hedbergella and Oligostegina mudstone-wackestone (Plt-1A) were founded as well as from logs analyses for wells mentioned in (Figs. 2-8) that show high gamma ray.

Facies associated with (Slope Environment): This facies association represents one of the most common facies in the Mishrif carbonates in the study area. It consists mainly of bioclastic or foraminiferal bioclastic wackestones and packstones. Other important fossils included in this facies association are benthonic foraminifera (Plt. 1-B), Calcareous algae, Coral, Echinoderms, sponge spicules, and Molluscs. It reflects low gamma ray and high porosity and the pore systems

appear to be interconnected and good reservoir quality is envisaged.

Facies associated with (Shoal Environment)

This association is made up of very coarse-grained, shelly bioclastic rudstone and floatstone containing a more diverse intact fauna than lithofacies association with shoal environment, dominated by radiolitid and caprinid rudists as (Plt. 1-C). It is characterized by low gamma ray

Facies associated with (Rudist Biostrome Environment)

According to (AlKhersan, 1975; Aqrawi et al., 1998 in Aqrawi et al., 2010) three sub-facies are recognized (rudist packstones, rudist grainstones and rudist rudstones), distinguished by the relative content of micrite and the coarseness of the rudist-derived material as in (Plt. 1-D).

Facies associated with (Back Shoal Environment)

Thin to medium-bedded, fine to very coarse grained bioclastic packstone, wackestone, and grainstone characterize this association. It consists of packstone microfacies containing benthic foraminifera mainly Miliolid sp (Plt. 1-E). Back shoal facies association is characterized by low gamma ray (Figs. 3 - 9). This lithofacies probably has moderate reservoir quality.

Facies associated with (Lagoon Environment): This facies association comprises benthonic foraminiferal wackestone microfacies and peloidal wackestone microfacies (Plt. 1-F). The lagoon environment dominates

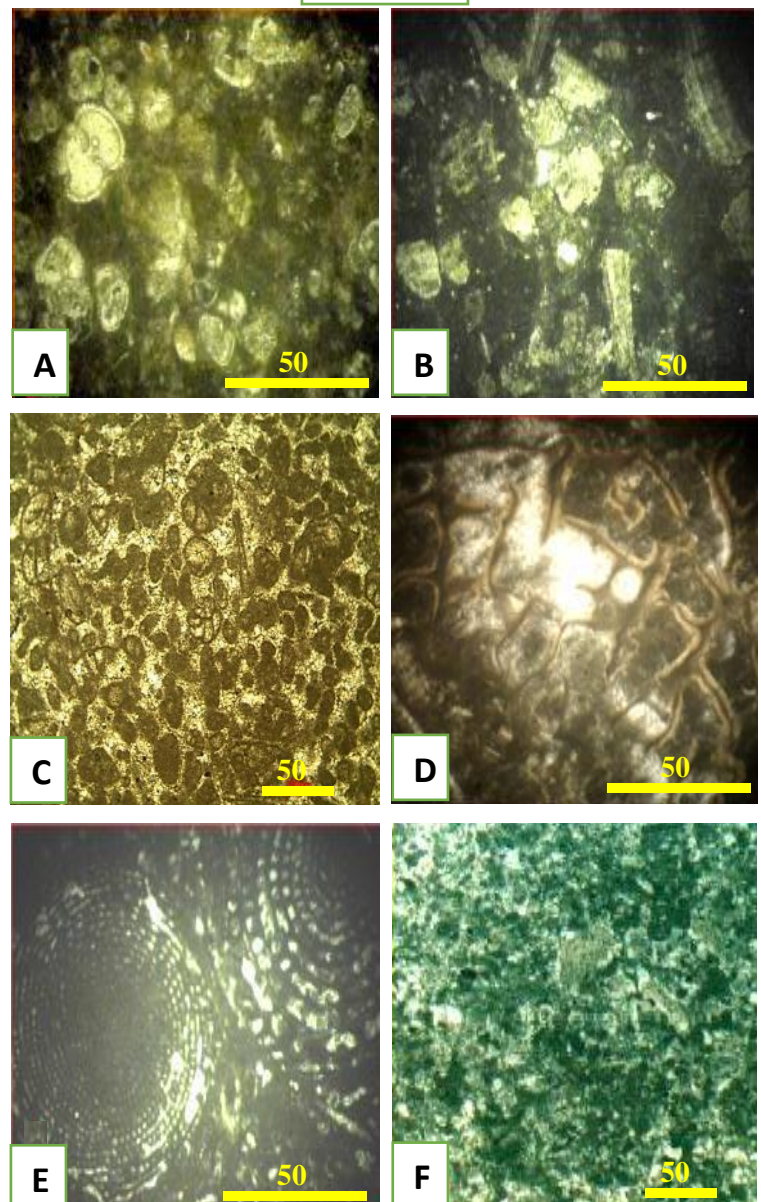
into the upper part of Mishrif succession below the upper unconformity surface that separates the Mishrif and overlying Khasib Formation, in addition to its dominance into the middle part of the Mishrif succession. These units are characterized by high gamma ray values and low porosity.

• **Buzurgan oil field:** Five microfacies were distinguished depends previous studies (Reulet , 1982), each of which represents a distinct depositional environment, and these were: (1) Deep marine, (2) open marine, (3) Rudist Biostrome, (4) Shoal, and (5) Lagoon (Dhahny,1998). The vertical stacking of these microfacies with their descriptions in the study wells are shown in figures (3,4 and 5).

• **Halfaya oil field:** Six main carbonate depositional microfacies, each of which represents a distinct depositional environment, and these were: (1) Basinal, (2) slope, (3) Shoal, (4) Rudist Biostrome, (5) Back shoal, and (6) Lagoon. The standard microfacies models and depositional environment belts of carbonates proposed by (Burchette, 1993) are shown in Figure (6, 7, and 8).

• **Noor oil field:** Six main paleoenvironments are distinguished within Mishrif Formation according to facies analysis that has been studied. These six environments are: basin, slope, rudist biostrome, shoal, back shoal and lagoon. The essential oil bearing facies are included within the rudist and shoal environments and to some extent within the back shoal environment (Fig. 9).

Plate-1



- (A) *Hedbergella* in Bioclastic Wackestones, HF-1, 3184 m.
 (B) Rudist fragments, Bioclastic Grainstone, HF-1, 2892m.
 (C) *Hedbergella* in Bioclastic Wackestones, No1-1, 3400 m.
 (D) Coral, Bioclastic Grainstone, HF-1, 2988 m.
 (E) *Cisalveolina* in foraminiferal, bioclastic packstone, Hf-1, 2908.60 m.
 (F) Pelloids and Miliolid in pelloidal packstones Hf-1, 2905m.

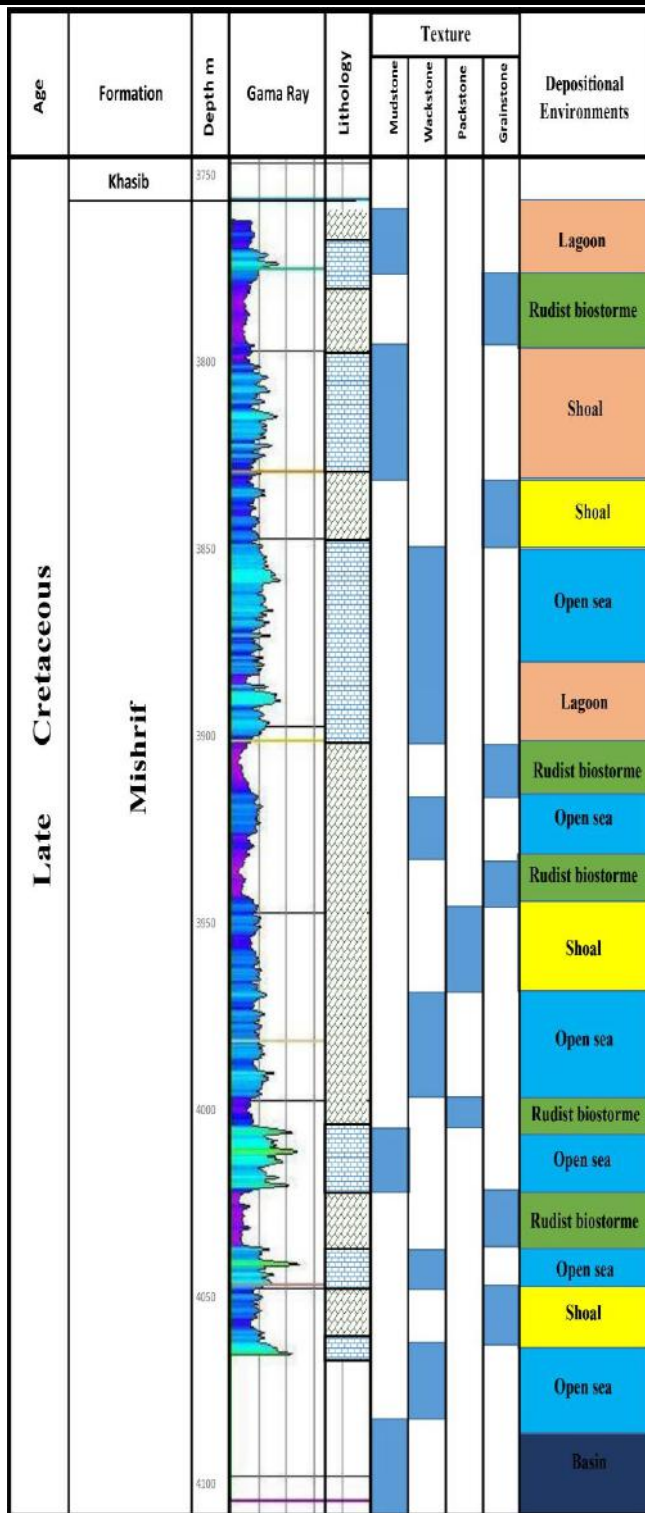


Fig. 3: Stratigraphic column of Mishrif Formation in Bu-2.

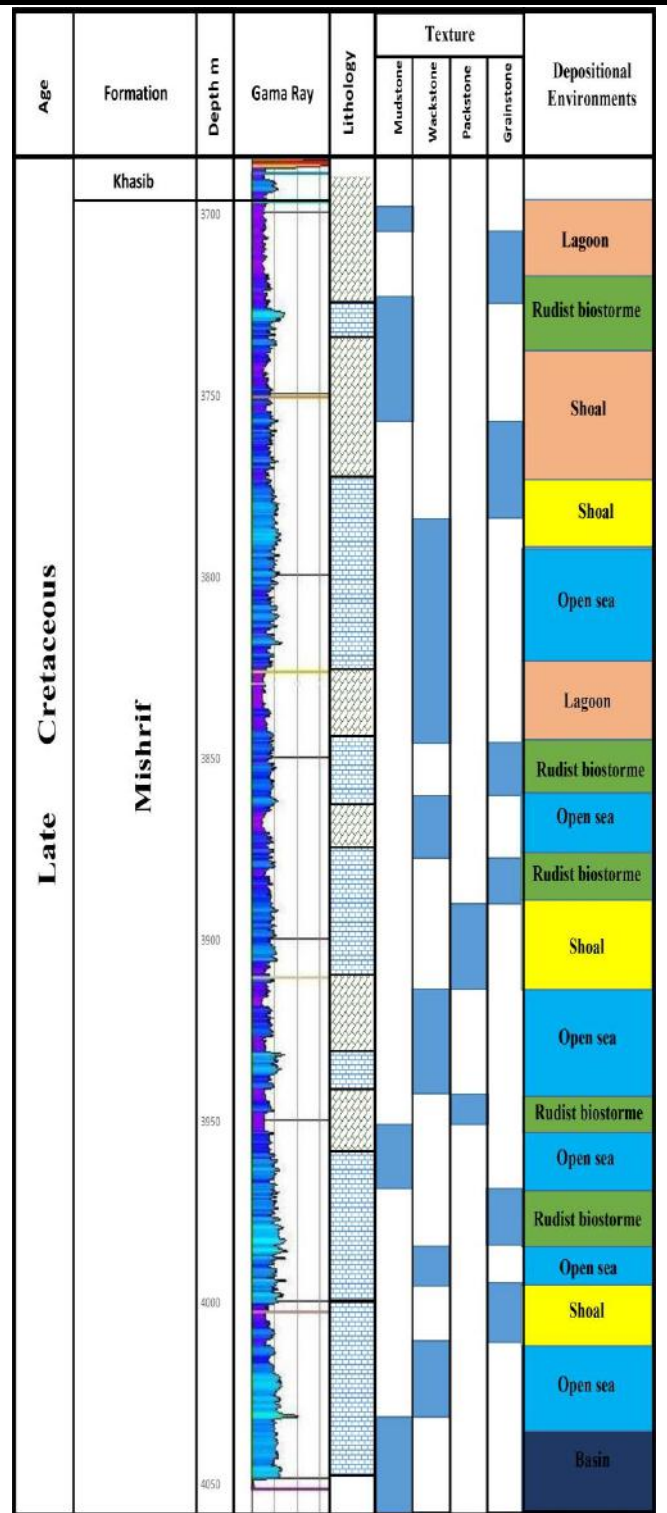


Fig. 4: Stratigraphic column of Mishrif Formation in Bu-3

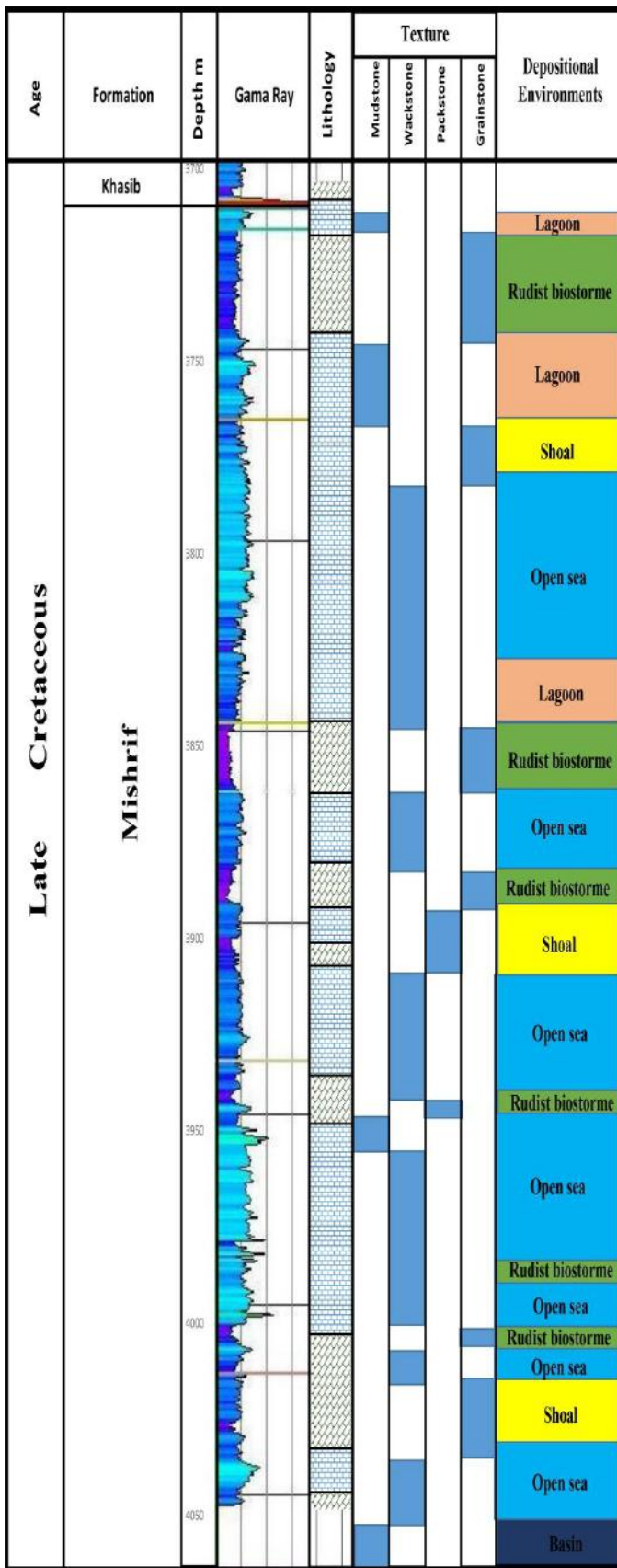


Fig. 5: Stratigraphic column of Mishrif formation in Bu-4

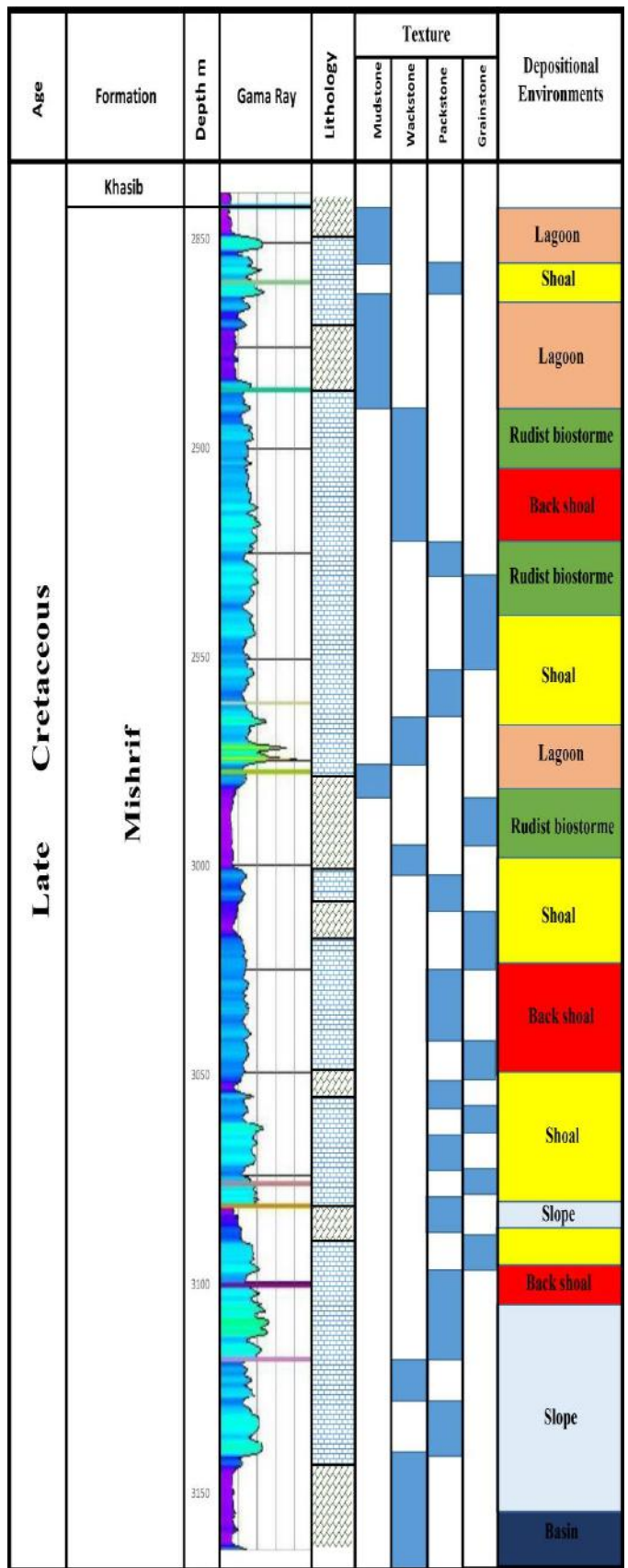


Fig.6: Stratigraphic column of Mishrif formation in Hf-1 .

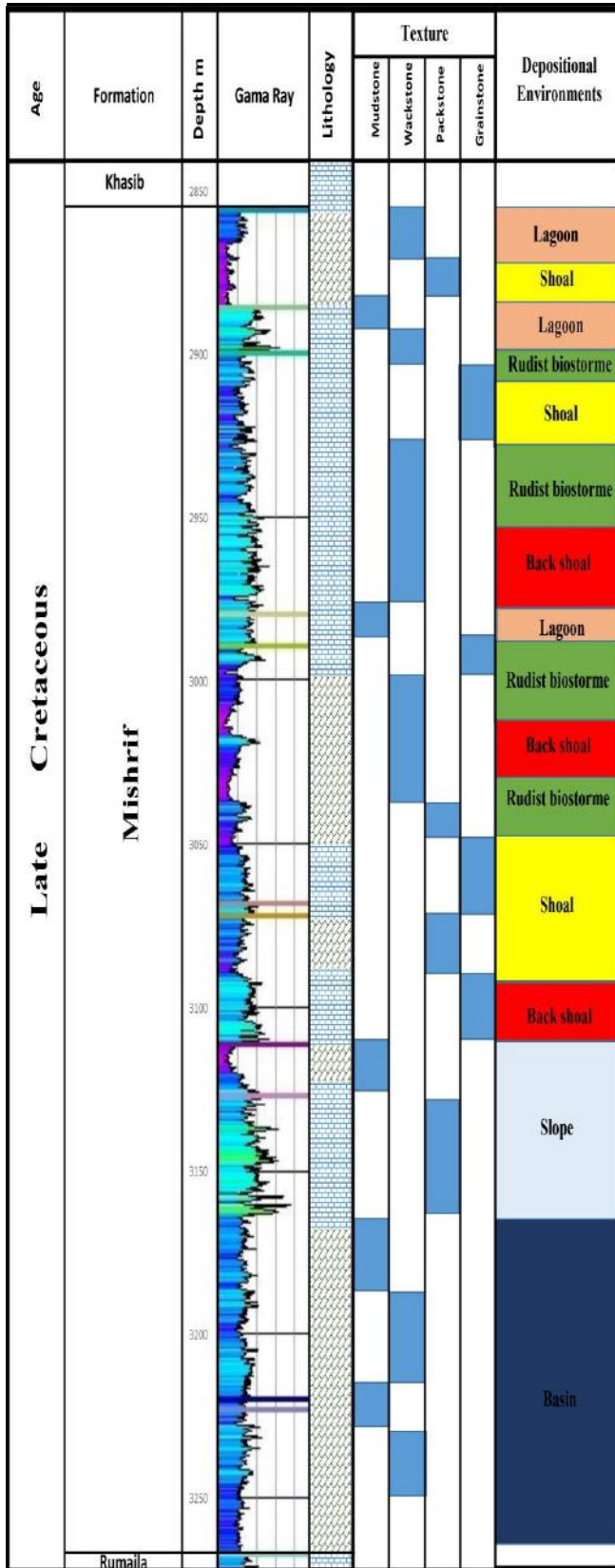


Fig. 7: Stratigraphic column of Mishrif Formation in Hf-272 .

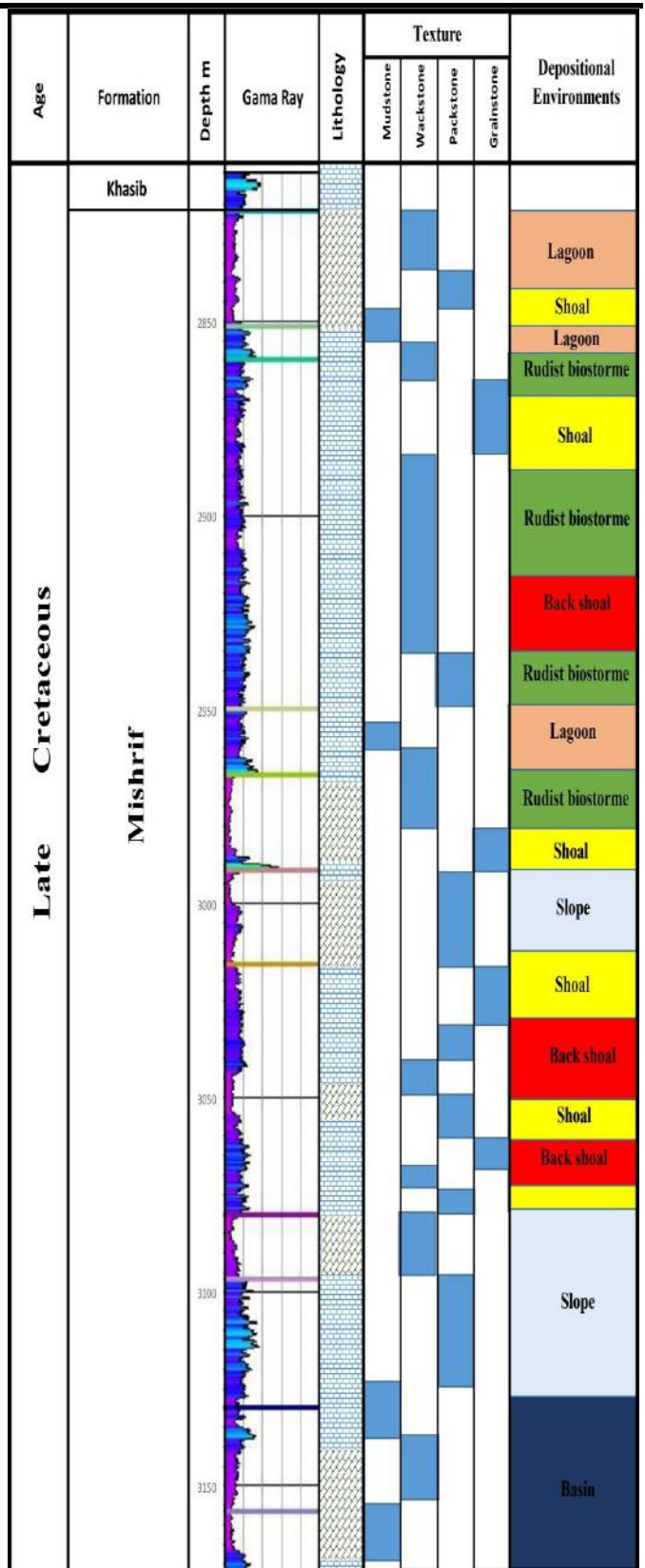


Fig. 8: Stratigraphic column of Mishrif formation in Hf-316.

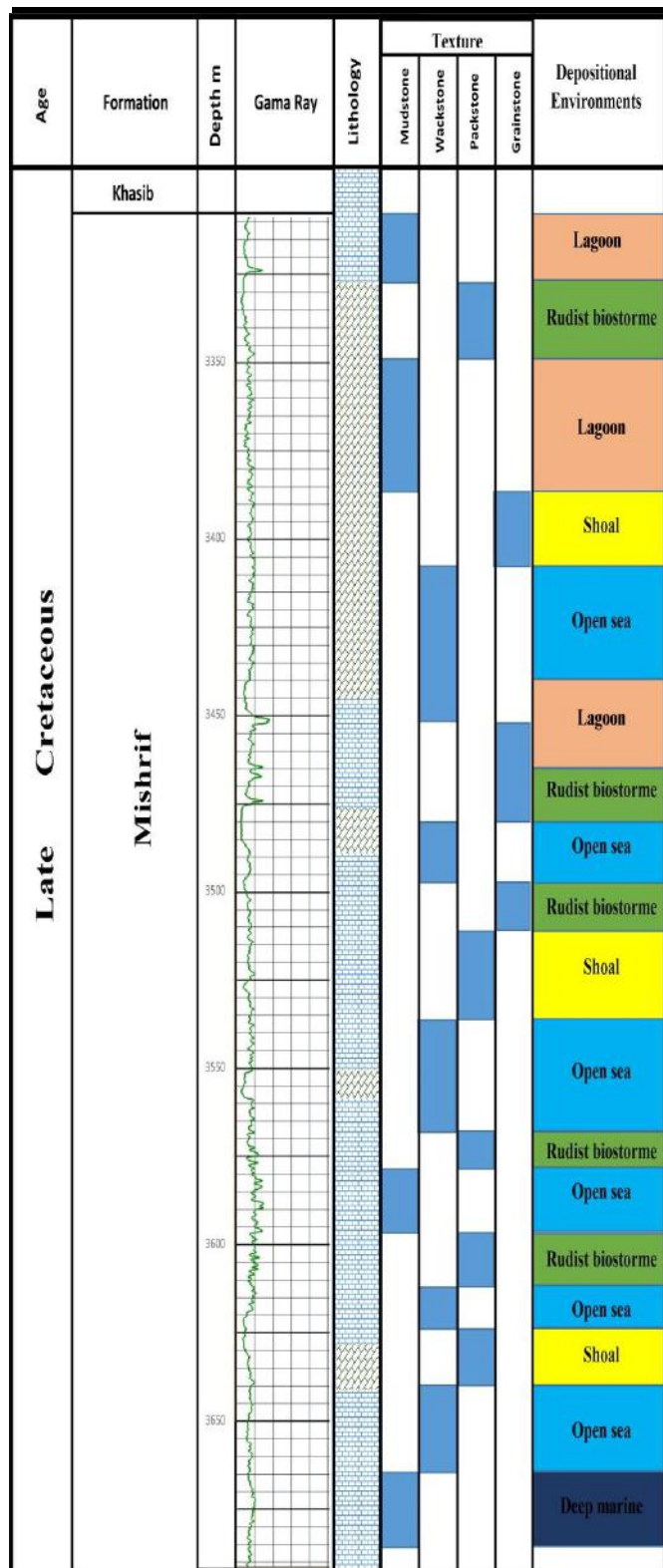


Fig. 9: Stratigraphic column of Mishrif Formation in No-1.

IV. STRATIGRAPHIC DEVELOPMENT

Sequence-stratigraphic correlation of the Mishrif Formation in the studied oil fields showing three stages of basin development during the Cenomanian-Early Turonian cycle:-

First stage:- during this stage the basin of Rumaila Formation was continued to deposition the lower part of Mishrif within the basinal environment. The end of this basin (Rumaila basin) marked by appeared the open marine associated facies to the northwest basin which represent the mfs surface. The Highstand system distinguished by sequential the open sea facies to the shoal facies and biostorm. The first stage was finished by widespread of shoal facies in all studied area to marked a sequence boundary type II (prograde stage A).

Second stage:- is represented by the developed the basin from the shoal to biostorm dominated facies with slow sea level rise. The presence of the open marine associated facies within the biostorm-shoal sequence marked the mfs surface. The final step of this stage was shown the shallowing up-ward by appeared the lagoon/restricted association facies overlying the biostorm. At the end of this period, the lagoon/restricted facies were spread in the studied area to mark the prograde stage B as sequence boundary type II.

Third stage:- the sea level was raised from the northwest direction as open sea association facies, while to the southeast the biostorm and shoal facies was dominated. The first appeared for the shoal facies upon the open sea facies marked the mfs surface to start the final highstand deposition within the restricted and biostorm/shoal facies. This stage is represent the prograde stage C for the Mishrif Formation, where the deposition has ended to mark the unconformable surface (SBI) with Khasib Formation.

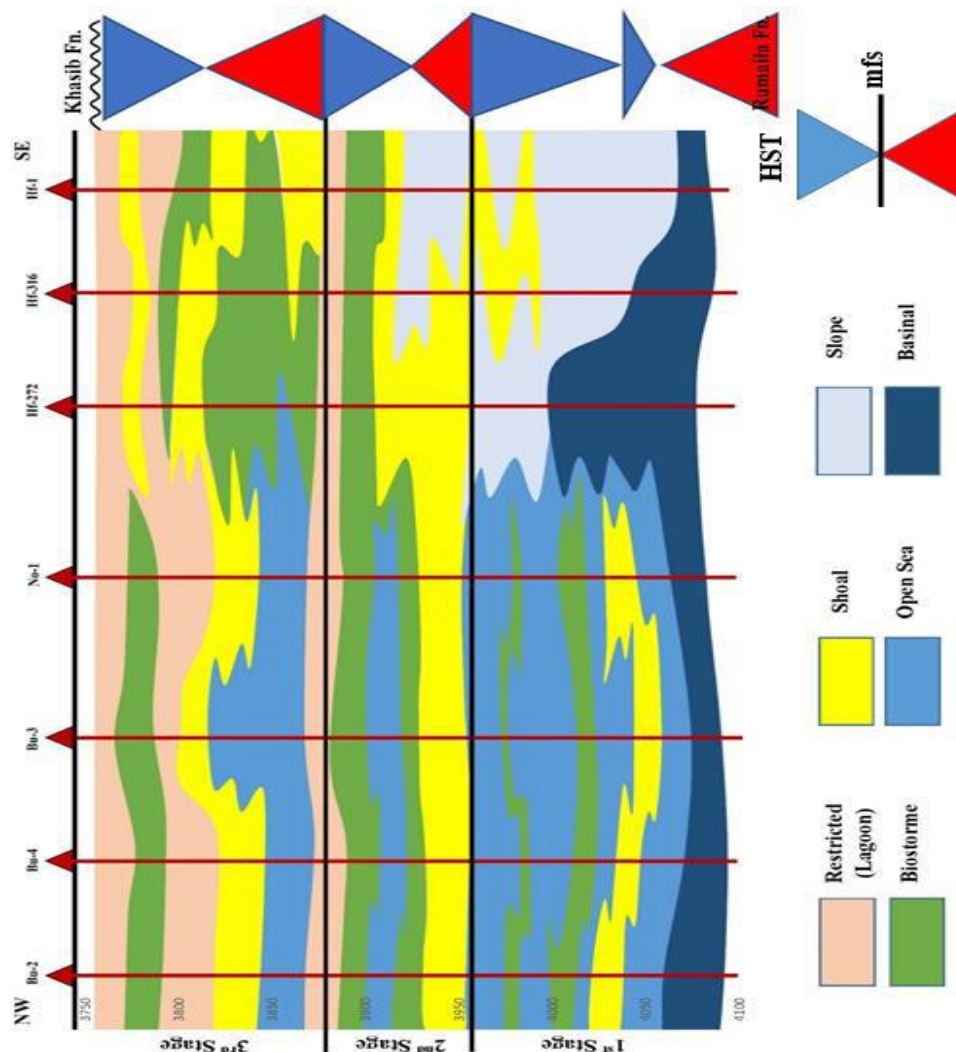


Fig. 10. Facies distribution and stratigraphic cross section of Mishrif Formation in studied area.

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Expressions of the Individual's behavior in Digital Network: Education in a Technological Society

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Abstract— *The article assumes that the behavior of expressions of individuals is related to the digital network, in which forms of human relationships are being forged in order to understand differently the process of teaching and learning with autonomy that can generate a new way of thinking, creating values and representations. This may resize behaviors in individuals and affect the perception of the subject in relation to themselves and others. New technologies, consumption and media influence shape and build the contemporary psyche. Thus, it becomes essential to consider the force with which the new messaging serving media plays in order to socialize and in the individual subjectivity. In this context, new challenges for education that allow the birth of studies and concepts, in order to explain this new reality and to contribute to the art of teaching and learning. One of these, therefore, will be part of this work, which is called Informational Normosis or Informatosis.*

Keywords— *Cyberspace, development, education, Informational Normosis.*

I. INTRODUCTION

The contemporary society has been facing day by day the changes imposed by technological evolution, that impel social and cultural transformations, and are characterized by the relations of production and consumption, permeating the social interactions.

We follow changes in the relationships established between adults and children in parallel with the emergence of a new production of subjectivity in function

of the organization of daily life by the new information and communication technologies and the way in which the experience of children, young people and adults have been transformed in the consumer society. These individuals change their interpersonal relations from the influences that new means of transmission of information and consumer culture have on them.

Today's children and teenagers have not known the world in any other way. They were born immersed in the world with smartphones, computers, televisions etc. TVs connected most of the time and the internet accessed by any age group end up playing a significant role in their construction of cultural values. The culture of consumption has shaped the social field, however, the individual transforms greatly his way of inserting himself in the world. According to several theorists, such as Bauman (1999), Lévy (1999) and Souza (2004), this new form of relation that comes from exchanges between society and the new technologies creates the cyberculture that relies on the interconnection of digital networks, as well as its technological tools, consolidating the cyberspace.

Thus, it can be understood that the access to the new media of communication and information is part of the contemporary universe and that its dynamics focuses on the cognitive development of the individual, in which when constructing it and defining itself as an "individual self", people can see themselves as beings who are endowed with skills provided by experiences in this physical and virtual environment.

These abilities indicate new parameters for the

body to be situated in the world and generate new forms of interpersonal relations, posing challenges for education and the management of the art of teaching. In view of the discussions presented, the following question arises: What challenges are presented to the education of individuals who are immersed in an information society?

We separate a part of this study to define and explain in more detail the neologism "Informatosis". This term is derived from Normosis, created by a French philosopher named Jean Leloup, and defined as the attitudes and behaviors of people which are considered normal, however, as they are repeated, in an increasingly intense way, it can generate pathological or even lethal risks to the individual.

It is believed that digital logic increasingly influences forms of human relationships, producing deeply transformed processes of subjectivation and with powers to generate a new order of thought, creating other values and representations. So, it is imperative to consider the influence with which the new means of message transmission exert on the subject's socialization and subjectivity, since digital technologies have introduced unprecedented elements, both experiential and aesthetic, in our computerized culture.

Through this "boom" of information that affects the routine of people, a new rhythm prevails, where new technologies, consumption and the influence of digital media mark, shape and construct the contemporary psyche. The relevance of the article is strictly based on the viewpoint of the changes originated by cyberspace, which are consolidated in the digital networks and in the concept of normosis, with a clipping in informatosis, that end up producing behaviors, thoughts, tastes, values, entailing new modes of sociability, in which more and more followers appear, being necessary to the reinvention of the educational scope in order to follow its cadence.

II. TECHNOLOGY AND EDUCATION: THEORIES ABOUT THE EDUCATIONAL DEVELOPMENT OF THE INDIVIDUAL IN THIS NEW CONTEXT

The canonical model of communication, also known as cybernetic model, has its main precursor the mathematician Norbert Wiener, who publishes the book "Cybernetics" in 1948, which sowed the bases for the conception of biological or mechanical living organisms and the notion of information.

Later, this work served as inspiration for countless filmmakers in science fiction. It also laid the foundation for both the development of computer science and awareness of the importance of interdisciplinarity. According to this author, cybernetics means "the art of governing" (from Greek *kybernetiké*, pilot), and during the

Second War, he had his studies directed to the direction of missiles and automatic piloting of airplanes.

The term cyberspace arises in 1984 by William Gibson, an American writer. However, there may be a greater understanding of the term in light of Pierre Levy's clarification of the virtual (LEVY, 1999). According to the researcher, the virtual is a new modality of being, whose understanding is facilitated if we consider the process that leads to it: virtualization.

The same author describes cyberspace as "(...) the communication space opened by the worldwide interconnection of computers and computer memories" (LÉVY, 1999). He postulates that it will become the main link of communication, economic transactions, fun and learning of human societies. It is there that we know the beauty that rests in the memory of the old cultures, and also that will arise from the proper forms of cyberculture, here determined as the general culture, developed in this cyberspace.

For Vygotsky (1998), human-environment interaction will always be mediated by the use of sign systems, created by societies throughout history, in order to make the development of interpersonal relations of individuals peculiar and innovative.

In other words, the subjectivity that was socially constructed is manifested in interaction, therefore, human development is characterized as an ongoing process of quantitative acquisitions and qualitative changes that occur in the psychological subject from experiences in the context of social relations. The psychological functions that emerge and consolidate in the intersubjective plane (action between subjects) become internalized, transforming to constitute the internal functioning of the individual (intra-subjective plane) (GÓES, 1991).

Thus, it can be said that the world today, compared to the previous centuries, has a very fast paced daily rhythm. Scientific knowledge and technological advances, which are factors responsible for increasing the excellence of results in the most varied sectors of life, are also those that offer conditions for human development and improvements of its existence. Technological resources can offer playful possibilities and be mediating instruments between individuals and the real world, leading us to understand that mediation is "(...) the intervention process of an intermediate element in a relation" (KOHL DE OLIVEIRA, 1999, p. 23).

According to Góes (1991), the intra-subjective plane, not being merely a copy of the external plane, is characterized by the synthesis elaborated by the subject, from "(...) strategies and knowledge already dominated by the subject and occurrences in the interactive context" (p.53). This brings up the symbolic activity, which is a specific organizing function that invades the process of

instrument use and produces fundamentally new forms of behavior (VYGOTSKY, 1998). Connected to this idea, it is known that new technologies are increasingly becoming important tools of our culture and that their use may be a concrete means of inclusion and interaction in the world (LEVY, 1999).

For Vygotsky (1998), process of appropriation is of paramount importance for human development, from the individual experiments of the present in his/her culture. The author emphasizes the importance of action, language and interactive processes in the construction of higher mental structures. In accordance with this, Lévy (1999) argues that it is impossible to separate the human from its material environment, as well as the signs and images, through which people attribute meaning to life and the world.

The changes that have been occurring in people's daily lives due to the evolution of electronic media and the revolution in the forms of communication and expression, caused by the emergence of the technologies that make up the contemporary cultural scene, are subject to constant changes. Nowadays, there are several resources available in the area of technology aimed at favoring both the learning process and interaction and communication.

From this perspective, new configurations tend to mark education in general, educational policies, school and teaching practices. According to Godoi (2010), whether through cell phone, computer or satellite TV, different technologies are already part of the daily life of students and teachers of any school. However, making these tools actually help teaching, learning, and producing knowledge in the classroom is no easy task: it requires teacher training.

For the scholar of science and education above, we have not yet been able to massively develop methodologies so that teachers can make use of these wide range of information and communication technologies that could be useful in the educational environment. The challenge is worldwide, but it may be even more severe in Brazil, due to possible gaps in teacher training and upgrading, and the structural limitations of Internet access - a problem that affects schools, teachers and students.

Appropriate school knowledge is what generally enables the student to perform well in the immediate world as well as to the analysis and transcendence of their cultural universe. In order to do this, the students' voices and experiences must be valued, welcomed and criticized. Promoting quality education depends on profound changes in society, education systems and school. In the two last situations, the following conditions are required: adequate conditions for the pedagogical work; knowledge and skills; strategies and technologies that favor teaching and learning; evaluation procedures that subsidize the planning

and improvement of pedagogical activities; democratic forms of school management; collaboration of different individuals and groups; dialogue with non-formal educational experiences; well-trained teachers (who recognize the potential of the student and who conceive education as a right and a social good) (KRAMER et al, 2007).

In Avalos's (1992) understanding, a renewed conception of quality includes to believe in both a reformed and expanded school and a less unequal and exclusionary social order. The great challenge for schools and universities is to offer teachers the opportunity to explore knowledge as they would explore a mountain, forest or sea. Only then will they develop the power to create relevant knowledge and ideas to face the needs and problems of the individuals of our time.

In an optimistic line, Lévy (1999) understands computer science as an intellectual technology that engenders a new way of thinking the world, to understand learning and relationships with this world. However, beyond pessimism or optimism, what seems most dangerous is the renunciation of recognition that there are changes and new technological devices that form and inform a generation.

Educational exclusion is articulated with mechanisms of social, racial, sexual and regional discrimination, which is the starting point for a consequent debate on technology (RAMAL, 2002). In other words, alongside the incorporation of technology, it is necessary to question the model of society that we want to construct.

Also, according to Ramal (2002) there are three scenarios for education, with regard to technology.

- The first one is the domesticating technocracy: the multiplicity of ephemeral and fragmented information make individuals slaves of technology, consequently school is replaced by other modes of instruction.
- The second one is pay-per-learn, which accentuates exclusion and prioritizes teachers with technical skills rather than criticism of the production or use of information and communication technologies. It is believed that there is education for all through the network, although the privileged students attend better equipped schools.
- In the third scenario, the integrative e-education, the school becomes hybrid, integrating man and technology. (p.41)

There are indications of the three scenarios in this historical moment. It remains to be seen whether the third

will become a possibility, more than just a desire, in the game of forces of economic and social power (MOREIRA, 2007).

Researching practices that cause changes in knowledge processes and consumer behavior of young people, Rivoltella (2007), reflects on these issues, to address the relationship between image and reality, redefining the boundaries between public and private space, work and leisure, human and nonhuman, as well as the relations between the order of vision and action.

The author advocates the formation of a professional prepared to deal with these new issues. Still in the field of technology, it is worth recording the emblematic example of the contradictions inherent in contemporary cultural practices, studied by Chartier (1999), in which he shows how new technologies (the particular computer and the internet in general), changing conditions and media, increase access to reading and modify forms of written production. On the one hand, the media favors a greater number of readers and writers and the technologies act towards democratization and inclusion, not just discrimination and exclusion.

Thus, according to Kramer et al (2007), conceiving teachers and managers as intellectuals contributes to rethinking school, training and technology, so that the construction of narratives of life histories is the goal.

III. INFORMATOSIS: TERM, DEFINITION AND CONCEPTS ACCORDING TO WEIL (2000)

Informatosis is a term which designates "(...) disorders or even diseases caused by the overflow of informational messages in relation to a single receiver, that is, to a single person". (WEIL, 2000, p.35). It is the pathological consequences of the accumulation of information or simply the use of information technology under certain conditions.

In this category, we highlight the flow of informational messages to which the network society is submitted. The cognitive dissonance between aspiration and actual information absorption capacity creates tensions.

(...) if dissonance repeats itself constantly, it can lead to stress and its psychosomatic consequences. It seems to us the case of many netizens and also of the holders of email. (WEIL, 2000, p. 60, our translation).

Pierre Weil (2000) exemplifies that in the case of Internet users, many of them are:

(...) constantly in the situation of coming across thousands of indications, references and diverse information regarding each

subject that they are researching. They are left with the constant illusion that they can all know. They spend their nights researching, in a very similar environment to casino players who never lose hope of winning and who almost never win. This hunger for knowledge already existed in the time of Simone de Beauvoir about books. At the end of her life she came to the conclusion that we cannot all know... The problem is that netizens risk exhausting their energy reserves in infernal bets. Behind this behavior are destructive emotions, more particularly attachment. (WEIL, 2000, p. 62, our translation)

The author also points out an issue known by all, to some extent, and exemplifies the subject by citing e-mails, so widespread in contemporary society. Weil (2000) believes that e-mail is bound to sooner or later lose its freedom due to the increasingly pressing expectation that the individual has an obligation to respond on time. In this way, according to the author, any postponement is worrisome or even suspect for those who wait.

This type of pressure increases proportionally to the daily number of emails, since there are individuals who receive hundreds of them per day. And, due to a cognitive organizational issue, they have to make a superficial selection and only respond the ones that are indispensable. However, Weil (2000, p. 61, our translation) notes:

(...) many are those who feel bad and guilty. And indeed, the feeling is grounded, because all unanswered e-mail risks creating disappointment and who knows hostility from the sender towards the recipient of the message. Not everyone can afford a desk ...! The problem increases even more for women who work outside the home and care for their children. E-mail takes away nights of sleep, and many end up exhausted and stressed out.

It is therefore perceived that these practices are constant and must be thought and pondered by the individuals and users of these potentialities. Weil (2000, p. 61, our translation) also adds:

(...) the reality is that we were all taken by surprise by this "shock to the future", and nobody prepared us to avoid these excesses. I believe that as we become aware of the dangers of overuse of information technology, the most informed people will

have to organize themselves to preserve their mental and physical health.

Pierre Weil (2000, pp. 62-63) also presents a list of the pathological consequences generated by this pathology that, according to the author, can cause: family isolation and dismemberment, a situation in which family members fail to notice their lack of communication and affective relationship with one another. The author questions to which the extent this intense use of technological devices such as the computer, the Internet, would affect this relationship.

The second consequence highlighted by the author would be the cognitive dissonance. Weil points out, according to psychology, the discrepancy between our level of aspiration to perform a given task and our true ability to perform it. This dissonance creates tensions and if it is consistently repeated, it can lead to stress and its psychosomatic consequences. In the case of Internet users, many are constantly faced with thousands of indications, references and diverse information about each subject they are researching and are left with the constant illusion that they can know everything. The author believes that behind this behavior are destructive emotions.

Another issue identified by Weil (2000) is the subtle computer-human link. The author inquires whether the fact of manipulating a computer for hours and day after day would not affect the nervous system of the individual in some ways and asks if this influence would be beneficial or not. According to this reasoning, the author presents a personal example, emphasizing that every night he worked with the computer, while he was lying in bed, he used to work differently; something happened as if the keyboard were part of his nervous system and there was so much interdependence, that he began to think in cybernetic terms, in a "neurocybernetic symbiosis".

A fourth consequence is also identified: Virtual Neurosis. The author comments on the fact that spending hours dealing with virtual programming completely changes the view of the world, where everything would also become virtual for the patient.

Another point that also deserves attention would be the dissemination of violence, the spread of information about violent acts by news programs on newspapers, radio and TV, as well as certain toys and video games, which may contribute to the increase in violence. "It is an informatosis, because it produces wounds, suffering and death, and it is part of considering as normal the disclosure of any information" (WEIL, 2000, p. 63).

Even in view of the broad aspects that permeate this discussion, Weil (2000) states that the pathologies described above cannot be attributed simply to informatics or technology, but to the way individuals use them. They become normotics as the behaviors that generate them are

considered normal by the majority of the population, although they are destructive to the physical and/or mental health.

To avoid being the target of the disturbances that informational normosis can cause, there must be preventive disclosure, a type of alert. In the educational context, Weil (2000) recommends including discussions that will draw people's attention to a critical view of what they watch, read, access and search the web, especially considering the benefits and dangers of information technology and NICTs in general.

It should be emphasized that the relation between normosis/informatosis and the challenges of Education is directly punctuated by the imposition on which students are obliged to comply, diversified disciplines, activities to be done outside the class hours, rules of behavior "standardized" for subjects some, etc. The school and its way of presenting the education, increasingly based on the evaluative exams, dictate a normality that sometimes are not accompanied by all the students.

IV. FINAL CONSIDERATIONS

The present text reflected on the active participation of the technological environment in the development of the individual and the challenge that it entails for the education, since they are produced new ways to relate and to behave. It also sought to present the concept of "informatosis" as disturbances or even diseases caused by the excessive flow of informational society messages, but which in the end has a pathological effect on the individual's life.

It is known the need of the diverse educational environments to follow the development of these technological devices in order to promote the real interest of the students in the acquisition of knowledge, either in the school context, or in the appropriate handling of these tools. The introduction of technology in schools combined with trained teachers has made a difference in some areas, increasing, for example, the communicative potential of students.

Teachers, on the other hand, need to be given the opportunity of continuous training and updating, so that technology can be incorporated into the school curriculum, not just seen as an accessory or marginal device. It is necessary to think how to incorporate it into the school routine education in a definitive way. Also, it is imperative to take into account the construction of innovative content that exploits the full potential of these technologies.

In this perspective, the introduction of technology in the educational area, if well used, makes the distance between teacher-student gain a new dynamic. This is because students have a great deal of familiarity with these novelties and can fit into the classroom environment in a

very different way. Thus, there is less distancing in the relation with the teacher, and consequently a greater collaborative work in the construction of knowledge.

For this, the simple distribution of equipment is not enough. Thus, it is necessary to rethink new methods that can relate education and technology, so that they can deal with this generation that "does not disconnect" or "disconnect" from these new means of communication and information. Finally, the school should not isolate the child from the world in which they live, because it is through interaction and communication that they create concrete and imaginary situations, contributing to the construction of elements specific to their cultural context. Therefore, educators should constantly learn how to exploit these new resources in a positive way, in the service of knowledge construction.

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Stephen Hawking: Black Holes and other Contributions from one of the Greatest Scientists of Our Time

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Abstract— *Stephen Hawking entered the hall of the greatest scientists of all time, alongside names like Galileo, Newton and Einstein. He was a warrior fighting a degenerative disease that deprived him of movement. Hawking made important contributions to understanding the functioning of the Universe by exploring issues such as Black Holes, Wormholes, Space and Time, and the Big Bang. The understanding of the Thermodynamics of the Black Holes caused us to approach the Relativity of Quantum Mechanics, leaving the "Theory of Everything" closer to our reality. Stephen William Hawking was born exactly on the 300th anniversary of Galileo's death and died at the age of 76 on Albert Einstein's birthday on Pi Day on March 14, 2018.*

Keywords— *Hawking, Universe, Black Holes, Big Bang.*

I. INTRODUCTION

Stephen William Hawking was a British physicist and cosmologist and one of the most renowned scientists of today. He was born exactly on the 300th anniversary of Galileo's death and died, to the 76 years, on Albert Einstein's anniversary of the birth, on the Pi Day, on March 14, 2018.

He entered Oxford in 1959, where he intended to study mathematics, but since the course was not available at that university, he chose to study physics, graduating three years later. His main interests were quantum mechanics, thermodynamics and relativity. After obtaining his doctorate at Trinity Hall in Cambridge in 1966, he became a researcher and later a professor at Gonville and Caius College.

After leaving the Institute of Astronomy in the year of 1973, Stephen entered the Department of Applied Mathematics and Theoretical Physics having occupied the

position of Mathematics professor, chair that outside of Sir Isaac Newton and Paul Dirac, having been Emeritus professor of the University of Cambridge.

Hawking is widely known for his work on quantum physics, especially with regard to the origin of the universe.

Due to his constant preoccupation in exposing the complex astrophysical theories to a lay public through several books of scientific diffusion, it has become quite famous.

II. THE STEPHEN HAWKING CONTRIBUTIONS

After a lecture given by the brilliant British physicist and mathematician Roger Penrose, Stephen Hawking extended the concepts of the singularity theorem exposed by Penrose, which he had explored in his doctoral thesis.

The innovation of the Stephen Hawking's approach lies in how he demonstrated the concept of uniqueness in physics, which includes not only the existence of singularities but also the theory that the universe may have started as a singularity, that is, a single event.

Hawking and Penrose published in 1970 a study that demonstrates that the universe obeys the theory of general relativity and that this is valid for any model of physical cosmology developed by Alexander Friedmann. In this study they develop the idea that the universe must have begun as a singularity usually dubbed "Big Bang".

Penrose-Hawking singularity theorems are a set of results in general relativity, which deal with the question of gravity to be singular. In a physical theory of gravitation, a singularity can be considered as a point in spacetime where various physical quantities, such as

curvature or energy density, become infinite, causing physical laws to be "broken."

An interesting "philosophical" aspect of general relativity is revealed by the theorems of singularity. Because general relativity predicts the inevitable occurrence of singularities, theory, in a certain respect, predicts its own ending in a finite time in the future.

STEPHEN HAWKING AND THE BLACK HOLES

After working with Penrose, Hawking discovered what became known as the second law of black hole dynamics. According to this law the event horizon of a black hole never gets smaller even if its mass is reduced. Together with James M. Bardeen and Brandon Carter, he proposed the four laws of black hole mechanics, making an analogy with thermodynamics. Although his theory of black holes had aroused a great interest quickly in the scientific community, it needed to be corrected in several points.

Hawking began noticing by astronomical calculations and scrutiny that some results contradicted his Black Hole Second Law, where he stated that the black hole event horizon could never diminish. In conjunction with this and in cooperation with Russian physicists he described in 1974 a kind of radiation that black holes emit that explained the apparent contradictions in his earlier observations, his discovery was christened in his tribute as Hawking Radiation.

Stephen Hawking proposed in 1981 that the information that is engulfed by a black hole is hopelessly lost when a black hole collapses. This statement led to a paradox that violates the fundamental principle of quantum mechanics. This triggered a heated debate between Stephen Hawking, Leonard Susskind and Gerard 't Hooft, who became known as the "Black Hole War." That same year, at a conference in the Vatican, he presented his work suggesting that "there may be no limit to the beginning or end of the universe." Working together with Jim Hartle two years later, he proposed a model known as the Hartle-Hawking State. According to this model the universe had no space-time limit before the Big Bang, that is, time did not exist and the concept of the beginning of the universe is meaningless. This greatly altered his initial idea based on the concept of singularity of the general relativity theory, replacing the classic Big Bang model with a model that can be explained by the following analogy: *"Consider that a person intends to travel to the North Pole, and begins to walk toward it. However, there is no specific boundary that determines whether or not it has reached the North Pole. The North Pole is not simply the point where all the lines that follow north come to an end."*

III. BLACK HOLES

A classic black hole is an object with a gravitational field so intense that the escape velocity exceeds the light speed, that is, not even the light can escape from its interior, even traveling at 299,792,458 m/s. The term "black" is used exactly because the object does not emit light. By attracting everything around it and not being seen (it does not emit light), it is as if there were a "hole" that worked like a large "drain". Hence the term "Black Hole".

This expression was first used by American physicist John Archibald Wheeler in an important article called "The Known and the Unknown," published in American Scholar and American Scientist in 1968. A black hole can theoretically have any size. Thus there is the possibility of Black Holes with sizes ranging from microscopic to light-days in diameter, formed by fusions of several others.

Black holes have only three characteristics: mass, angular momentum (spin) and electric charge, that is, black holes with these three equal quantities are indistinguishable in the same way that electrons possessing the same properties cannot be distinguished. There is a well-known phrase among cosmologists, which applies precisely because of this property: "a black hole has no hair."

After its formation its mass increases due to the attraction of other bodies, and its size tends to zero, due to the action of its gigantic gravitational field, causing its density to tend to infinity. Black holes, like other objects whose gravitational pull is extreme, slow time due to gravitational effects. Black holes cause a space-time distortion, related to the gravitational lens effect.

IV. ESCAPE VELOCITY AND THE "SCHWARZSCHILD RADIUS" (RS)

The escape velocity of an object is the speed that it must attain to escape the gravitational pull of a body.

The mechanical energy (E_m) is the sum of the kinetic energies (E_c) and potential (E_p):

$$E_m = E_c + E_p$$

In order that the body escape from the gravitational field, it must reach infinity, where the mechanical energy is zero ($E_m = 0$)

Thus

$$0 = \frac{1}{2}mV_e^2 - \frac{GMm}{r}$$

Applying this concept to the black hole, ie where the escape velocity (V_e) is at least equal to the light velocity (c), we have:

$$0 = \frac{1}{2}mc^2 - \frac{GMm}{r}$$

$$r = \frac{2GM}{c^2} = r_s$$

r_s : Schwarzschild ray

G : gravitational constant, which is $6.67 \times 10^{-11} \text{ N m}^2/\text{kg}^2$;

m : mass of the object;

c^2 : speed of light squared = $8.98755 \times 10^{16} \text{ m}^2/\text{s}^2$.

This radius is known as the "Schwarzschild Ray" (r_s) and is associated with the extent of the event horizon that would exist if the mass of a body were concentrated in a single point of infinitesimal dimensions. The term, which is widely used in the gravitation theory in general relativity, was discovered in 1916 by Karl Schwarzschild. It does not give the exact solution to the gravitational field of a spherically symmetrical star (Schwarzschild Geometry), which is a solution of Einstein's field equations.

An object smaller than its Schwarzschild radius is called a black hole, since its density is such that the escape velocity is greater than that of light. The sphere surface defined by the Schwarzschild radius acts as an event horizon in a static body. Neither light nor particles can escape the interior of Schwarzschild beam, hence the name "black hole."

The Sun has a Schwarzschild radius of approximately 3 km, and the Earth approximately 9 mm. The Schwarzschild radius of the supermassive black hole at the center of our galaxy is approximately 7.8 million kilometers.

V. ENTROPY

Entropy (S) is the measure of the degree of disorder of a system and it tends to increase naturally in the Universe. It is related to the Second Law of Thermodynamics.

We can, for example, observe the ice that melts. The molecules in the solid state are closer and have less possibility of movement, therefore they are more organized. By moving to the liquid state, molecules gain more and more freedom to move and with this they will become increasingly disorganized. These changes in physical state are related to energy in the form of heat.

Thus, the natural tendency is to increase the disorder of molecules, which means an increase in entropy. We can say then that in systems: $\Delta S > 0$.

The concept of Entropy began with the French engineer and researcher Nicholas Sadi Carnot. In his research on transformations from mechanical to thermal energy, and vice versa, he found that it would be impossible for a machine to exist with full efficiency, that is, there is no physical possibility of the existence of a machine with 100% efficiency.

The First Law of Thermodynamics states that "energy is conserved." This means that in physical processes the energy is not lost, it converts from one type to another. Analyzing only this Law, we could assume the

existence of a machine with 100% efficiency. The second law forbids this.

When a machine uses energy to do the work, in this process the machine heats up, that is, there is a part of the mechanical energy being degraded in the form of thermal energy. This thermal energy does not fully transform back into mechanical energy, so the process is irreversible. If we could reverse the process, the machine would never stop working.

Later the British mathematician and physicist William Thomson, Lord Kelvin, complemented Carnot's research on the irreversibility of thermodynamic processes, giving rise to the foundations of the Second Law of Thermodynamics.

The second law of thermodynamics concisely expresses that "the amount of entropy of any thermodynamically isolated system tends to increase with time until it reaches a maximum value." "It is impossible to construct a device which, by itself, that is, without intervention from the external environment, can transform the heat absorbed from a source at a given uniform temperature into work" (Kelvin-Planck's statement).

Rudolf Clausius was the first to use the term "Entropy" in 1865. Entropy would be the measure of the amount of thermal energy that cannot be reversed in mechanical energy, ie, it cannot perform work, at a certain temperature.

Clausius developed the mathematical formula for the entropy variation that is currently used:

$$\Delta S = \frac{Q}{T}$$

ΔS : Entropy variation

Q : Heat transferred

T : Temperature.

VI. HAWKING AND THE BLACK HOLE ENTROPY

The existence of Black Holes was proposed from the General Theory of Relativity. In 1974, Hawking proposed that in the event horizon, particles would escape like radiation what was known as Hawking radiation. Thus, the black hole should slowly evaporate until it disappears, making it obey the Second Law of Thermodynamics - which predicts that the entropy of a system could never diminish. If the hole only engulfed matter without giving back anything, the entropy of the Universe would be compromised.

Entropy is a measure that characterizes the number of internal states of a black hole. The Black Hole entropy formula was developed in 1974 by British physicist Stephen Hawking.

If black holes did not have entropy, we could violate the Second Law of Thermodynamics by throwing mass into a black hole. The only way to satisfy the second

law is to admit that Black Holes have entropy whose increase more than compensates for the decrease in entropy associated to the object that has been swallowed.

Through the Stephen Hawking theorems, Mexican physicist Jacob Bekenstein conjectured that the black hole entropy was proportional to the area of its event horizon divided by the Planck area.

Later, Stephen Hawking showed that black holes emit Hawking thermal radiation corresponding to the certain temperature, known as Hawking temperature. Using the thermodynamic relationship between energy, temperature and entropy, Hawking was able to confirm the Bekenstein conjecture and fix the proportionality constant in $\frac{1}{4}$.

$$S = \frac{Akc^3}{4\hbar G}$$

S: Entropy

A: The area

k: Boltzmann constant

\hbar : Normalized Planck constant

G: Newton Universal Gravitational constant

c: Speed of light in a vacuum

The black hole entropy is also the maximum entropy that can be inserted within a fixed volume.

If nothing can surpass the light speed, according to the German physicist Albert Einstein Restricted Relativity Theory, nothing can escape the gravity of a Black Hole.

There is a possibility that the event horizon is a measure of the Entropy of a Black Hole. By the Werner Heisenberg Uncertainty Principle there is no absolute vacuum. There are, then, several pairs of virtual particles (particles and antiparticles) interacting with each other around a Black Hole, in which the positive energy of one particle cancels out the negative energy of the other, and vice versa. The antiparticle would be drawn to the very strong gravity of the Black Hole and would fall into it, freeing its partner of positive energy into outer space.

The negative energy of the antiparticle inside the Black Hole would diminish part of its mass, since it would cancel part of the positive energy of the Black Hole mass. The released particle, for a distant observer in space, would seem to have been emitted by the Black Hole. Thus, this particle would not come directly from the Black Hole, as thought by the external observer, but from the outer space itself, through the "creation of pairs", thus making the Event Horizon be considered as a measure of the Entropy of a Black Hole. This radiation "emitted" by a Black Hole is called Hawking Radiation.

VII. FIREWOOD IN THE BONFIRE - EVENTS HORIZON

Stephen Hawking, one of the creators of modern black hole theory, has published an online article recently, still unreviewed by other scientists, stating "There are no black holes."

The statement puts more fire in the discussion that attempts to reconcile the relativity theory (which explains the macroscopic world) with quantum mechanics (which explains the microscopic world).

The report of the scientific journal Nature, which commented the new study by Hawking, recalls that the proposal of the radiation generated other doubts, among them what was known as paradox of the wall of fire.

By quantum mechanics, Hawking radiation would not simply dissipate, but would form a "wall of fire" around the event horizon. The problem is that it can not be one thing or another. Although scientists do not yet know how, for the world to work, the two theories (Quantum and Relativity) have to talk. Hawking proposed now, in an article on ArXiv website, that instead of an event horizon, there would be an "apparent horizon," a surface that can capture light, but it can also change shape due to quantum fluctuations, exhaust.

"The absence of an event horizon means that there are no black holes in the sense of systems from which light cannot escape into infinity," Hawking wrote in the article.

In an interview with Nature, Hawking says: "There is no escape for a black hole in classical theory." However, Quantum Mechanics "allows energy and information to escape from a black hole." To definitively solve the problem, only unifying the theories, he says. This problem has intrigued scientists for nearly a century. Thus, "the correct explanation remains a mystery."

VIII. FINAL CONSIDERATIONS

Stephen Hawking entered the hall of the greatest scientists of all time, alongside names like Galileo, Newton and Einstein. He was a warrior fighting a degenerative disease that deprived him of movement.

Hawking made important contributions to understanding the functioning of the Universe by exploring issues such as Black Holes, Wormholes, Space and Time, and the Big Bang.

The biggest challenge in detecting a black hole would be to be able to observe it if, by its very definition, it does not emit any light. In 1783, John Michell pointed out in his pioneering work that a black hole exerts gravitational force on nearby objects.

The understanding of the Thermodynamics of the Black Holes caused us to connect the Relativity and

Quantum Mechanics Theories, becoming the "Theory of Everything" closer to our reality.

Scientists suspect that most galaxies have black holes in their center, which are fed with gases, dust and stars around them. Sometimes black holes release enough energy to prevent star formation. The way stars and black holes evolve together, however, remains a mystery to scientists. The hope is that data from existing modern telescopes will enable new discoveries in this field. Thus, the number of black holes is probably much larger than imagined; which may be much larger than that of visible stars, which amount to about one hundred billion, only in our galaxy.

But, in fact, there are many mysteries surrounding the black holes that science has not yet been able to discover. For example, do they represent a passage to other universes, and allow intergalactic journeys? That would be very interesting, but for now it's just fiction, it's just imagination. We still need a lot of mathematics, physics and astronomy to understand the reality that is associated with black holes.

To paraphrase Ann Druyan, in his farewell to Carl Sagan, we can say, without resorting to mysticism that Hawking went to Heaven.

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Impacts of the “Plastic Bag Law” in the Grocery Retail in the city of São Paulo/Brazil

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Abstract— Among the waste generated by retail, the plastic bag, which has its main use for the transportation of products, is a constant component of household waste and negatively impacts the environment. In this context, Municipal Law 15,374 prohibited the free distribution of plastic bags in the city of São Paulo / Brazil, as of April 2015, and brought as an alternative the use of returnable bags and biodegradable bags in an attempt to reduce environmental impact caused by improper disposal of the plastic. Therefore, the purpose of this research was to analyze the impact of said Law on the reduction of the purchase of plastic bags made by the grocery retail in the city of São Paulo. A survey was conducted with data from two grocery retail stores in the city of São Paulo, between January and December 2015. The results showed that the implementation of the law reduced the volume of plastic bags provided by supermarkets without compromising the flow of people and financial income.

Keywords— About five key words in alphabetical order, separated by comma.

I. INTRODUCTION

One of the main segments of the economy in Brazil, the retail supermarket represents a large part of the commerce sector, leading the sale of consumer products (Winandy & Gallardo, 2014). This position gives it a series of economic advantages as well as responsibilities, demanding from its managers new ways of acting and thinking about the organization, especially in the disposal of products and the production of household waste (Ceretta & Froemming, 2013).

The supermarket sector has been changing over the years for different reasons. Among them, it is possible to mention the great social concern related to the scarcity of natural resources, which determines a more sustainable

view for industrial and commercial activities (Parente & Gelman, 2006). In this sense, the sector is assuming new responsibilities towards the final consumer, committing itself to the reduction of waste generated, as well as to the recycling and reuse of waste (Braga Junior & Rizzo, 2014).

Among the residues produced by supermarkets, there are plastic, cardboard, pallet, organic waste and others, which come from the primary packaging of the products and the operational activities in general (Dias & Braga Junior, 2016). In particular, plastic bags, although not directly produced by retail, are passed on to consumers at the time of purchase, which are then destined for landfills with other types of household waste (RÉGIS et al. , 2015). In this way, besides being a producer, retail is also a supplier of household waste products (Ceretta & Froemming, 2013).

According to Fabro, Lidemann & Vieira (2007), the economic advantages of the common plastic are the same that incorporate a serious negative environmental aspect, such as its durability and resistance to degradation. Due to these characteristics, the inappropriate disposal of the bags negatively impacts the environment, since its decomposition process can take from 100 to 400 years (Santos et al., 2012). Such fact has been the motivation for the development of public policies and laws that promote reduction of the use of the plastic bags or even its banishment.

In this sense, in May 2011, the Municipal Law of São Paulo promulgated Municipal Law 15,374, which aimed to prohibit the free distribution or sale of plastic bags to consumers in all commercial establishments in the municipality and the region. After four years of sanctions, the recognized "Law of the Sacolinha" was regulated only in 2015, by Municipal Decree No. 55,827. In addition, this

law still provides that establishments should encourage the use of reusable bags and oblige them to affix informative signs of awareness to the use of these types of bags (Prefeitura Municipal de São Paulo, 2011).

In an environment of uncertainties and discussions about the possible effects of the implementation of said Law, this research seeks to analyze the impact of the so - called "Law of the Sacolinha" in the reduction of purchase of plastic bags made by the retail supermarket in the city of. To achieve this objective, this work is divided into five parts. The first one, already presented, brings the contextualisation of the problem and the objective of the work. Subsequently, a literature review is done about the retail supermarket and the residues coming from this sector, especially on the plastic bags. In the third part is presented the methodological procedure, which adopted the multicase study. The results and discussion are described in Part Four. Finally, the final considerations of the work are carried out.

II. SOLID WASTE FROM RETAIL: PLASTIC BAG

Supermarkets produce various types of solid waste such as: plastic, cardboard, pallet, organic waste and others, which come from the primary packaging of the products and their operational activities in general (Dias & Braga Junior, 2016). Particularly in the case of plastic bags, although it is not a waste directly generated by retail, they are passed on to consumers at the time of purchase and are subsequently destined for landfills with other types of household waste (Régis et al. 2015).

The origin of the plastic bags came in the year 1970 and, due to its free distribution by the supermarkets and by the commerce in general, quickly became very popular and was incorporated into the consumer routine (Fabro, Lidemann & Vieira, 2007). A decade after its emergence, the use of plastic bags in Brazil was expanded, bringing with it several advantages of domestic utilities, due to their practicality, resistance and impermeability (Régis et al., 2015).

The economic advantages of common plastics that allow reuse, such as durability and resistance to moisture and chemicals, are the same as those that incorporate a serious negative environmental aspect (Fabro, Lidemann & Vieira, 2007). Due to these characteristics, the inappropriate disposal of the bags negatively impacts the environment, since its decomposition process can take from 100 to 400 years (Santos et al., 2012). This fact has motivated the development of public policies and laws that promote the reduction of the use of the plastic bags or even their banishment.

In this context, in May 2011, Municipal Law No. 15,374 was promulgated by the São Paulo City Hall, which sought

to prohibit the free distribution or sale of plastic bags to consumers in all commercial establishments in the municipality and in the region. After the law was established, a schedule of actions was foreseen until the banalization of the bags in the region of São Paulo. However, in February 2012, the Office of the Consumer Prosecutor of the Capital of São Paulo prepared a TAC, with legal force, in which it determined that the market networks had the responsibility to inform the consumer about the eradication of the supply of bags during the period of 60 days, deadline for the supply of the bags. After the deadline, 04/04/2012, the bags are no longer supplied. However, a little more than two months after the banalization of its supply, it was determined by the courts to return free distribution of the same to the consumers of supermarkets in the municipality, which invalidated the entire process of extinction of its use (Régis et al. 2015).

After four years of sanctions, the so-called "Law of Sacolinha" was effectively regulated in 2015, through Decree nº 55.827. This law establishes that commercial establishments should encourage the use of reusable bags instead of plastic ones and oblige them to affix informative signs of awareness to the use of these types of bags (Prefeitura Municipal de São Paulo, 2011). In addition, it is allowed to supply, free of charge or by charge, reusable bags, the specifications of which are defined by the Municipal Urban Cleaning Authority (AMLURB) in Resolution 55 / AMLURB / 2015, the permitted models of which are translated into green bags and gray bags. Commercial Association of São Paulo, 2016).

It should be noted that the use of bags produced by other materials, such as biodegradable, degradable, paper or reusable bags, is an alternative to plastic bags, however, whatever the chosen alternative, the associated environmental impact still exists. Therefore, Santos et al. (2012) argue that sustainable consumption is based on two pillars, which have less impact on the environment. The first pillar is to reduce the generation of waste in the smallest amount possible, followed by a better disposal of the same, so that they generate smaller impacts. Recycling is the second pillar of sustainable consumption.

According to Fabro, Lidemann & Vieira (2007), it is estimated that the annual production of plastic bags in Brazil is approximately 210 thousand tons, which represents 9.7% of all the garbage in the country. According to the authors, when placed in the environment, this material prevents the passage of water, delaying the decomposition of biodegradable materials and making it difficult to compel debris.

According to data from the Business Commitment for Recycling (2015), "the more developed the country is, or the higher the social class, the smaller is the proportion of compostable organic wastes and greater than that of

recyclables (paper, cardboard, glass, metals and plastics)". In Brazil, about 5% of urban solid organic waste generated was recycled / composted in 2012. These organic components account for about 50% of the weight of waste collected. While in India this index is 68%, in the United States and France, this index represents respectively 12% and 32% (Business Commitment to Recycling, 2015).

With regard to the plastic recycling index, Brazil reached an index of 21.7% in 2011, representing approximately 953 thousand tons per year. Sweden (53%), Sweden (33.2%), Belgium (29.2%) and Italy (23.5%) followed Sweden. In the United States 28.6 million tons of plastic waste were discarded, of which 2.4 million tons were recycled (Business Commitment to Recycling, 2015).

According to Marchi (2011, p.127-128), the selective collection is practiced in approximately 56.9% of the Brazilian municipalities, however, it is still not very developed and presents obstacles regarding the separation of garbage made by society. Usually, organic and inorganic wastes are mixed. Thus, it is necessary to increase investments in incentive programs and population awareness so that the separation is carried out correctly. Due to this bottleneck, recycling becomes difficult. In this context, environmental education plays an important role in raising awareness of environmental problems and, consequently, contributes to avoid the incorrect disposal of both plastic bags and other materials (Santos et al., 2012).

III. METHODOLOGY

With the objective of analyzing the impact of Municipal Law 15,374/2011 on the reduction of the purchase of plastic bags in the retail supermarket in the city of São Paulo, a multicase study was carried out (Yin, 2015). We searched two supermarkets in the city, which, under request of non-identification by the managers (interviewed), will be called "Retail 1" and "Retail 2". For these objects of analysis, the quantities of plastic bags purchased and kept in minimum stock, before and after the implementation of the law, were observed, covering the period from January to December 2015.

For the basis of this work, a bibliographical research was carried out on the topics: supermarket retail and solid retail waste, in particular the plastic bags. The qualification of the concepts, through bibliographical research, consolidates the conceptual foundation of the work, conducting an investigation on the theoretical precepts developed throughout the article (Cooper & Schindler, 2003). This research created support and validation for what was intended to be demonstrated with the practical cases and results achieved.

In this way, a qualitative, descriptive and exploratory research was carried out, based on the data provided by the

research objects. The data analyzed were the number of bags purchased, the minimum quantity kept in stock, the purchase cost and the average ticket of the supermarkets during the analyzed period. The average ticket was evaluated before and after the implementation of the Law, in order to identify if there was any change in store revenue due to the reduction of the supply of bags (Cooper & Schindler, 2003; Mattar, Oliveira & Motta, 2014).

Data were obtained through unstructured interviews with supermarket owners. These were treated and analyzed in order to make a comparison among supermarkets regarding the interference of Municipal Law 15,374 in the purchase of plastic bags. In this aspect, we analyzed the quantities of bags purchased and the cost of this purchase, which allowed us to identify whether, with the implementation of the law, there was a reduction both in the number of bags purchased and in the reduction of the cost spent for this purpose.

IV. RESULTS AND DISCUSSIONS

The supermarket sector is directly and indirectly involved in the production of urban waste and, thus, contributes to the environmental impact. Therefore, in an interview with the supermarket managers analyzed, both affirmed collaborating with environmental issues on issues related to the disposal of recycled and organic waste produced by the company. The disposal of solid waste, such as plastics and cardboard, is carried out by selling them to recycling companies. As for organic waste, specifically fruit and vegetable products, such as fruits and vegetables, are discarded with an institution that reuses them as organic fertilizer.

4.1. Retail 1

According to the definition of the Brazilian Association of Supermarkets (ABRAS), Retail 1 falls within the concept of a compact supermarket, since it contains 6 checkouts. Its physical structure is located in a less peripheral region with less population density than Retail 2, and has an average annual ticket of approximately US\$ 15.00.

As can be seen in Table 1, after the effective establishment of Municipal Law 15,374 occurred in 2015, there was a significant reduction in the purchase of plastic bags by Retail 1, from 40,000 units acquired, in the month prior to the law, to the minimum quantity of 7,000 units in the subsequent months.

From the collected data, it is identified that, in addition to a reduction in the quantity of bags purchased, there was also a gradual reduction in the minimum stock of the same, as well as in the average purchase cost. Thus, Figure 1 shows the relationship between the purchase of plastic bags, the cost of purchase and its minimum stocks of Retail 1 during the year of implementation of the Law.

Table.1: Supply of bags, cost, minimum stock and average ticket of Retail 1 - Jan. to Dec./ 2015.

Month	Supplying bags	Total Cost	Minimum stock	Average ticket
January	40000	\$352.94	12000	\$ 10.32
February	40000	\$352.94	12000	\$ 10.89
March	40000	\$352.94	12000	\$ 11.24
April	20000	\$176.47	12000	\$ 14.09
May	10000	\$235.29	6000	\$ 13.27
June	8000	\$188.24	3000	\$ 13.87
July	7000	\$164.71	2400	\$ 13.00
August	7000	\$164.71	2100	\$ 14.70
September	7000	\$164.71	2100	\$ 11.46
October	7000	\$164.71	2100	\$ 14.19
November	7500	\$176.47	2100	\$ 14.92
December	7500	\$176.47	2250	\$ 17.74

Fig. 1 shows the great reduction in the supply and the stock of plastic bags of the supermarket (Retail 1), in the order of 82% in both variables. According to the interviewee, this reduction was due to the incentive to reuse cardboard boxes instead of plastic bags, and to start selling reusable bags, which are larger and more resistant to transporting products. In addition, it can be seen that

the period of greatest fall occurred between April and June 2015, with a subsequent stabilization in both acquisition and inventory. According to reports from the store manager, the first few months after the implementation of the legislation were adaptive. For this reason, the months of April, May and June present slightly larger quantities of plastic bags.

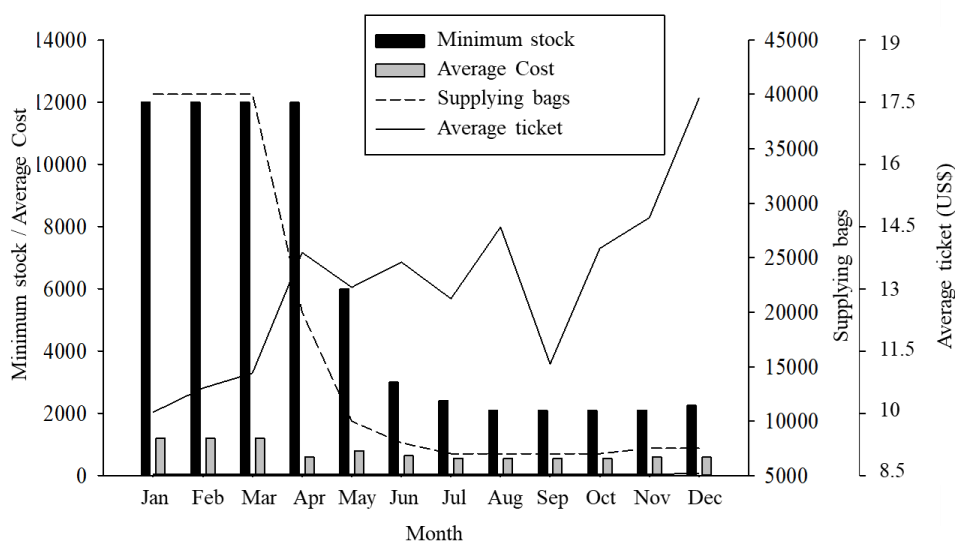


Fig. 1: Supply of plastic bags of Retail 1 - Jan. to Dec./ 2015

It can be verified that there was no relation between the value of the average ticket of the store and the implementation of said legislation. It is stated, therefore, that the implementation of the law did nothing to interfere with the sales of the supermarket under analysis. The largest fall and high variation of the average ticket occurred, respectively, in the months of September and December. According to the manager, this variation is related to the seasonality present in some months and food groups.

With regard to the cost of buying bags, it is observed that this one had a significant fall after the prohibition of the

use of bags in the retail in general. After the implementation of the law, the material used to produce the packaging was replaced by a more sustainable one, in a way that changed production processes and increased production costs. The fact was also reflected in the price of the bags, which in the period prior to the legislation was US\$ 0.009 per unit, and, as of April, started to cost US\$ 0.024, an increase of 166%.

In spite of the significant increase in the value of the plastic bag after the mandatory of the law, the total cost spent with this item by Loja 1 had a great reduction, due to a reduction of approximately 80% in the quantity of

supply. This fact contributed to the reduction of about 50% of costs, from July to October.

In summary, it was evidenced that, from the perspective of the company, the implementation of the law did not negatively impact the business, since the average ticket did not change and the costs with the purchase of plastic bags were reduced significantly.

4.2. Retail 2

With 11 checkouts, Retail 2 is in the group of conventional supermarkets, according to ABRAS definition. During the analyzed period, it presented an

average annual ticket of approximately US\$ 20.59. In comparison to Retail 1, this retail is located in a region of greater population density. Due to its larger structure, this store also presented larger quantities of bags and minimum inventory. Thus, Table 2 shows the number of bags that were supplied, the average total cost of shopping for bags, the minimum inventory and the average monthly ticket of Retail 2, comprised between January and December 2015.

Table.2: Supply of bags, cost, minimum stock and average ticket of Retail 1 - Jan. to Dec./ 2015.

Month	Supplying bags	Total Cost	Minimum stock	Average ticket
January	60000	R\$529.41	18000	R\$14.46
February	60000	R\$529.41	18000	R\$15.26
March	60000	R\$529.41	18000	R\$15.76
April	25000	R\$220.59	18000	R\$19.18
May	23000	R\$541.18	7500	R\$20.14
June	20000	R\$470.59	6900	R\$18.87
July	20000	R\$470.59	6000	R\$19.38
August	20000	R\$470.59	6000	R\$20.00
September	20000	R\$470.59	6000	R\$18.54
October	20000	R\$470.59	6000	R\$19.89
November	20000	R\$470.59	6000	R\$20.91
December	20000	R\$470.59	6000	R\$24.87

Prior to the enactment of Law 15,374, the purchase of plastic bags was stipulated by consumption trend data from the previous month. In Fig. 2, it is observed that the supply of bags decreased after the implementation of the legislation. The purchase of bags increased from 60,000 to 20,000 units in subsequent months, corresponding to a reduction of approximately 66%. The same happened with the minimum inventories of this item, which presented the same reduction percentage.

Fig. 2 showed that the average ticket did not show changes after the implementation of the legislation, since the changes in it are justified by the consumption trend and by seasonal seasons, as evidenced by Retail 1.

In relation to the average cost of buying plastic bags, it is observed that this presented a small reduction compared to Retail 1, since this was approximately 11%. This was due to the increase in the price of the bags. Considering

that the bag supplier is the same for both stores, the 116% increase in its price has had a more significant impact on Retail 2 under review. Thus, despite the reduction of more than 60% in the number of bags purchased, the average monthly costs did not show much variation, going from US\$ 529.41, before the law, to US \$ 470.59 in the months after the Law.

Due to the size of the store and the large influx of people, the amount of cardboard boxes was not enough to heal the demand in place of the plastic bags. Thus, customers should purchase the traditional bags, worth US\$ 0.024 a unit, or could invest in returnable bags, sold at US\$ 0.88 a unit. Due to the large price difference, many customers preferred to invest in plastic bags to returnable bags. Thus, the reason for the reduction in smaller proportions of the supply of bags compared to Retail 1 is explained.

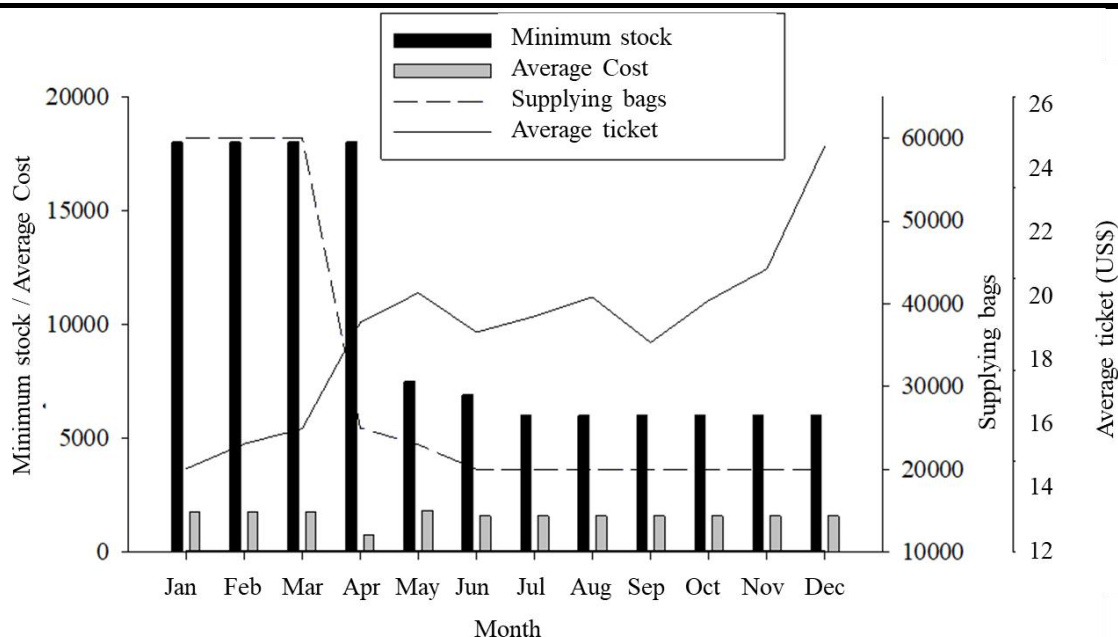


Fig. 2: Supply of plastic bags of Retail 1 - Jan. to Dec./ 2015

Finally, it can be said that although Retail 2 complied with the legislation regarding the reduction of the use of plastic bags by eliminating the free distribution of the same, the financial aspects did not present significant changes, since, to meet the demand, the retailer needed continue to acquire a large number of bags during the period of adaptation to legislation. In this way, the change in the price of them impacted more intensely in this store, due to its size and flow of customers.

V. CONCLUSION

Municipal Law No. 15,374 of May 2011, implemented by the Municipal Government of São Paulo from Municipal Decree No. 55,827, in January 2015, brought significant changes to the sector of supermarkets and commerce in general. This legislation established the effective prohibition of the sale or distribution of plastic bags in commercial establishments in the municipality of São Paulo and region, as of April 5, 2015.

During the process of adaptation to legislation, the two supermarkets analyzed showed significant changes in the supply of plastic bags, in the cost of purchasing them and in their minimum stocks, as of April 2015, the month of enactment of the legislation in question. It was identified that retailers needed to adapt sales by providing cardboard boxes and other alternatives instead of custom plastic bags.

It was evidenced that due to Retail 1 being smaller and having a smaller flow of people, the changes imposed by the legislation had a significant impact on business, but in a positive way. In this sense, it was observed that the supply of bags was reduced by 82% and the cost for

supply fell by 50%, even though there was a 116% increase in its price.

With regard to Retail 2, because of its greater physical structure and flow of people, the advantages of implementing legislation were felt with greater difficulty to the business. The reduction in the supply of bags was evident and significant, approaching 67%. However, the cost of buying plastic bags was reduced by only 11%. Thus, the increase in the price of plastic bags was more impacting in this store. This fact was due to the establishment not being able to supply the transport demand of the customers through cardboard boxes and other alternatives replacing the plastic bags.

As final considerations, it is argued, from the results of this research, that Municipal Law no. 15,374 impacted retail supermarket, according to the size of the establishment and its respective flow of people. In order to reduce the environmental liabilities generated by plastic waste, it is proposed in this work, in a complementary way, the promotion of campaigns to encourage the replacement of plastic bags, and to provide incentives to retailers, so that the replacement of the bags will benefit all types and sizes of establishments. In addition, it is stated that the strengthening of environmental education programs would also serve as a complement, since the problem of inadequate disposal of plastic bags begins in retail and ends with consumer attitudes.

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The Importance of Preventive and Corrective Maintenance in Works

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Abstract— *The present study addresses the problems brought by the lack of preventive and corrective maintenance. The purpose of this work is to focus on the importance of preventive and corrective maintenance, for the prevention and conservation of engineering works. This work will focus and indicate some guidelines and measures that must be taken to keep the engineering works in order and in a good state of repair. The importance of the implementation of preventive and corrective maintenance for engineering works will also be mentioned, as well as the importance of always having at disposal a specialized team to be always ready to attend such eventualities that may occur in the facilities of this type of service and what are the basic requirements for a good manutentor.*

Keywords— *Prevention and correction, importance of maintenance.*

I. INTRODUCTION

Preventive and corrective maintenance is something that is very important, because maintenance tends to minimize major repairs inside or outside engineering works that, when performed, tend to decrease the number of users in that environment, because they prefer to stay in a safe, quiet and comfortable place, which is not the case for an engineering project that is undergoing a major renovation, presenting risk and discomfort because of it. (COSTA, 2005).

Looking for quality in service delivery and with the intention of always keeping the clients happy with customer care, quality of the services provided, good accommodations and a physical space that provides security and convenience, and in this case, we must be always prepared for unforeseen events that may occur over time. The concern with quality is not recent, and the quality of the services rendered are fundamental for the performance and success of the venture (CASTELLI, 2001).

In the case of preventive maintenance, which is a type of maintenance and review where the components are

exchanged or remade before wearing down, through the schedule established with periods of exchange or repairs recommended by manufacturers of components and machines. It is also understood to be preventive, re-settling, lubrication, clearing, cleaning and undercutting, among others (GOMIDE, 2009).

Preventive maintenance is performed at predetermined time intervals or according to the prescribed criteria, designed to reduce the likelihood of failure or degradation in the operational lifespan of a given item. These maintenances are performed to maintain equipment and facilities under satisfactory operating conditions and to prevent adverse occurrences and helping to save resources, raise the standard of services provided to your employees and guests, and improve safety and convenience for all your users.

In the case of corrective maintenance, which generally occurs when the equipment is defective and cease to operate, and this may be harmful to the production for not being able to be programmed, and this occurs along with a cease in the production.

With a high flow of people transiting or even working in a building, logically there will be wearing and tearing of the premises of this environment, which in turn will be in need of repairs to prevent a simple problem from becoming a chaos for administrators and users of this project (CASTRO, 2007).

To avoid such embarrassment, it is necessary for the company to implement a system of preventive and corrective maintenance, to repair/correct the wearing process of its facilities, to maintain the environment in perfect conditions, and also leaving it with a safety aspect to be used by its users.

Currently, due to several factors, such as concern for the safety and comfort of the users of a facility, it is necessary to implement the system of preventive and corrective maintenance, to try to minimize the inconvenience caused by damaged installations over time and by the lack of maintenance that must be made/performed periodically through obligatory norms and

according to the required standards (PINTO AND XAVIER, 1998).

Therefore, the main goal of the present work was to suggest that, after the finished work constructions, a preventive and corrective maintenance program should be created, for the satisfaction of the users and an improvement in the facilities of the engineering work.

Having achieved successfully a good functionality of the facilities, convenience, security, obtaining a maximum productive capacity of the equipment and, consequently, a return of the investment made, always taking into account the guarantee of the quality of the service to be provided to the client (VILLANUEVA, 2015).

II. METODOLOGY

The methodology adopted in this article was to optimize the management of the activity exposed by the aforementioned theme, with the perspectives of obtaining information and to be able to perform this work, in which were used the following methodologies: a checklist where it was described the real conditions in which the facilities are found, in a detailed manner, and the need to replace and perform maintenance, such as electrical, hydraulic, painting, structural, roofing and parking. Shortly after this check-list is ready to be used, it is important to follow the steps described on its annexed schedule, for the proper maintenance to be performed (James Q. Wilson, and George Kelling, 1982).

With the definition and programming of the needed repairs, it is also necessary to mobilize a specialized team to execute the proper services with efficiency and quickness.

III. RESULTS

We have the expectative that if the works maintenance system is properly applied, the occurrences and unnecessary spending with sudden and random renovations will reduce, and the quality of services for the users will increase without any doubt and is also worth to remember the safety and convenience that the works will provide (VILLANUEVA, 2015).

The lack of maintenance generates obstacles, losses and critical problems that should be avoided or minimized, through an efficient maintenance management program, designed to avoid wearing and accidents (COSTA, 2005). Maintenance engineering has gained an increased importance due to the improvements of equipment, appliances, systems, machines and infrastructure that has been occurring constantly since the industrial revolution. Their high number and diversity require a growing set of professionals and specialized systems in their maintenance (CASTRO, 2007).

IV. DISCUSSIONS

Since the evolution of the XXI century, the maintenance system is undergoing through several transformations, since it suffered from the lack of mechanization, due to the equipment being quite rusty and oversized.

Due to these circumstances and conditioned to a still at the time precarious economy, productivity growth was not treated as priority. In consequence of these factors, maintenance was something treated with little urgency, and in this environment only extremely basic maintenance services were performed, such as cleaning, lubrication and the replacement of parts only when they were broken (PINTO E XAVIER, 1998).

The maintenance costs also began to increase sharply compared to other operating costs. This fact brought urgency in the improvement of the maintenance planning and control systems that are now an integral part of modern maintenance. Finally, the amount of capital invested in physical items, along with the sharp increase in the cost of capital, led people to start looking for ways to increase the equipment lifespan (GOMIDE, 2009).

We understand the great need and importance of having a reference model for the preparation and application of preventive and corrective maintenance, helping with clarity and detailing the work that must be done in the item undergoing through maintenance.

V. CONCLUSION

We conclude that the checklist, which will be mentioned shortly thereafter, will provide an effective condition, with the hiring of an engineering company to provide preventive, corrective and operative maintenance services for residential, ordinary and special facilities and equipment and electrical energy system at the premises of the contracting company. It follows the model used by the State Department of Infrastructure-TO, adapted for the construction of this article, where it details the checklist for performing preventive and corrective maintenance.

SERVICE EXECUTION

ARCHITECTURE AND URBANISM ELEMENTS:

Architecture conservation and maintenance services are usually restricted to replacing broken or deteriorated elements. This replacement must be performed after the removal of the defective element and the reconstitution of the original shape, if it is the case, of its base of support, adopting, then, the same constructive process described in the corresponding Construction Practices.

According to each case, it will be necessary to replace an entire area surrounding the damaged element, and, in the reconstitution of the component, it should not be

noticed stained areas with a different aspect, as well as guaranteed the same performance of the set.

If the deterioration of the element is derived from base defects or causes, it also must be replaced. Other causes arising from damaged systems of several technical areas, such as hydraulic, electrical and others, should be verified and corrected before the architecture correction.

The most common occurrences are the following ones:

Masonry and Partitions: In masonry - The coating of the entire component must be peeled or removed, leaving cracks or deteriorated areas exposed. Next, it must be performed the enlargement and verification of the cause for its proper correction. After the correction, fill it with cement and sand in the volumetric trace 1:3, until obtaining a perfect

Subsequently the coating will be applied to rebuild the finishing of the entire original component, taking the proper measures to avoid the formation of different areas of appearance and performance

In the Partitions – replacement of the damaged ones and relocation according to the layout, including the supporting metal structure and door rust.

Paintings - floor, walls and ceiling

In the occurrence of faults or stains, or even in the case of preventive conservation of any painting component of the building, it must be performed a complete grinding process of the affected area or component, treatment of the base or the cause of the appearance of the spots or faults if it is the case.

Next, it will be necessary to perform a total painting replacement in the same characteristics of the original, or with new characteristics if determined.

Coatings

The restoration of coating elements should be done whenever leaks or broken tiles are observed. It must always be performed following the manufacturer's technical manuals, and the inspection or exchange of elements should never be performed with the tiles wet.

Waterproofing

Waterproofing of coatings should be periodically remade according to the manufacturer's recommendations. It will be recommended the removal of all the coating, cleaning of the area to be treated, checking the seams, mortars, drills, and complete reconstruction of the waterproofing. When it is possible, it may be replaced by a roof cover.

Frames, Glass and Hardware

Replacement and/or recovery of doors, windows, gates and other sealing elements, in the materials usually available in the market - PVC, Iron, Wood, Aluminum.

5.1 HYDRAULIC AND SANITARY INSTALLATIONS

The services of maintenance of hydraulic and sanitary installations, will be preferably performed by professional or specialized companies, or by the manufacturer of the equipment.

COLD WATER:

I. Reservoirs:

- a) Cleaning, internal washing and disinfection;
- b) Inspection and repairs of level gauge, float cock, spillways, automatic pump operational system, foot and retention valve registers;
- c) Inspection of air ventilation of the environment and the access openings;
- d) Control of the water level to verify leaks;
- e) Inspection of pipes immersed in water.

II. Hydraulic Pumps

- a) Inspection of gaskets, manometers, air ventilation of the environment;
- b) Lubrication of bearings and others;
- c) Checking of the operation of the automatic control.

III. Valves and Discharges Boxes

- a) Leakage inspection;
- b) Adjustments and repairs of the component parts;
- c) Leakage test on valves or discharge boxes.

IV. Records, Taps and Sanitary Metals

- a) Corrosion inspection;
- b) Inspection of leakage;
- c) Cleaning and clearing services;
- d) Repair of stretches and fixings, including repainting;
- e) Inspection of the joints of the pipes x connections.

V. Drains and Sanitary Appliances

- a) Inspection of the operation;
- b) Cleaning and clearing services.

VI. Pressure Regulating Valves

- a) Inspection of operation;
- b) Repairs needed.

SANITARY SEWERS:

I. Sewage Pumps

- a) Inspection of gaskets, manometers, ventilation of the environment;
- b) Lubrication of bearings and others;
- c) Checking of the operation of the automatic control.

II. Pipes (tubes, connections, fixings and accessories)

- a) Corrosion inspection;
- b) Inspection of leakage;
- c) cleaning and clearing services;
- d) Repair of stretches of fasteners, including repainting;
- e) Inspection of the joints of the pipes x connections.

III. Drains and Sanitary Appliances

- a) Periodic inspection of operation;
- b) Cleaning and clearing services.

IV. Septic Tanks

- a) Inspection of covers and overflows;
- b) Repairs needed.
- c) Tank Cleaning

V. Collecting boxes and grease boxes

- a) General inspection;
- b) Removal of solid materials;
- c) Removal of oils and greases

RAINWATER:

I. Booster Pumps

- a) Inspection and repair of hermetic covers, pump actuators, drawer valve and check valve;
- b) Inspection of air ventilation of the environment and the access openings, periodic inspection of the cracks in the walls to verify leaks.

II. Pipes (tubes, connections, fixings and accessories)

- a) Corrosion inspection;
- b) Inspection of leakage;
- (c) cleaning and clearing services;
- d) Repair of stretches and fixings, including repainting;
- e) Inspection of the joints of the tubes x connections.

III. Drains

- a) Periodic inspection of operation;
- b) Cleaning and clearing services.

IV. Gutters

- a) Leakage inspection;
- b) Cleaning and clearing services;
- c) Repairs of stretches and fixings;
- d) Inspection of troughs and tubes;
- e) Painting of metal rails and conductors.

V. Inspection Boxes and Sand Boxes

- a) Inspection of operation;
- b) Cleaning and clearing services.

ELECTRICAL AND ELECTRONIC

INSTALLATIONS

LOW VOLTAGE

Generator and Emergency System: Emergency group maintenance should be performed in accordance with the equipment manufacturer's recommendations. The services must be performed by a professional or specialized company, or by the equipment manufacturer.

DISTRIBUTION SYSTEM

I. General Switch Panels of Force and Light:

- a) Reading of the measuring instruments and verification of possible overloads or imbalances;
- b) Verification of heating and operation of thermomagnetic circuit breakers;
- c) Checking for abnormal electrical or mechanical noise;
- d) Measurement of amperage in the feeders at all outputs of thermomagnetic circuit breakers;
- e) Verification of compliance with the maximum permissible amperage limits for cable protection;
- f) Verification of the heating in the power cables;
- g) External and internal cleaning of the frame;
- h) Verification of the general security conditions in the functioning of the Electric Box Switch Panel;
- i) Insulation of insulation and connections;
- j) Reaper of the contact screws of the circuit breakers, busbars, disconnectors, contactors etc;
- k) Verification of ground resistance, based on standard limits.

I. Magnetic Keys

- a) Verification of operation without excessive sparks;
- b) Checking and regulating of the contacts (pressure);
- c) Check the state of conservation of the fuses.

II. Breakers

- a) Cleaning of the contacts;
- b) Retighten of the connecting screws;
- c) Insulation test;
- d) Lubrication.

III. Contactors

- a) Cleaning of the contacts;
- b) Retighten of the connecting screws;
- c) Lubrication of moving parts;
- d) Cleaning the extinguishing chamber;
- e) Adjusting the pressure of the contacts.

- IV. **Lamps**
- Inspection and cleaning;
 - Replacement of evaluated parts (reactors, sockets, protection glasses and others).
- V. **Switches and sockets**
- Inspection and execution of necessary repairs.
- VI. **Bulbs**
- Inspection and replacement of burned bulbs.
- VII. **Wires and Cables**
- Insulation tests;
 - Inspection of the insulation layer;
 - Temperature and overload; the terminals.
- VIII. **Grounding Networks**
- Verification of the grounding loop, its normal conditions of use, connections, bare copper mesh etc;
 - Verification of the resistance to the use conditions of the connections between the ground and the stabilizers;
 - Verification of the ohmic resistance, based on the normalized limit values;
 - Verification of soil moisture and alkalinity indexes, based on normalized values.
- IX. **Electrical Discharge Protection System - Lightning Protection**
- Checking the conservation status of the insulation rods;
 - verification of the insulation measure;
 - Checking the continuity of the earth cable, protection tube and electrode.
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Improved Classification of Breast Cancer Data using Hybrid Techniques

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Abstract— Breast cancer is the second leading cancer for women in developed countries including India. Many new cancer detection and treatment approaches were developed. The most effective way to reduce breast cancer deaths is detect it earlier. The frequent occurrence of breast cancer and its serious consequences have attracted worldwide attention in recent years. Problems such as low rate of accuracy and poor self-adaptability still exist in traditional diagnosis. In order to solve these problems, an Ada Boost-SVM classification algorithm, Combined with k-means is proposed in this research for the early diagnosis of breast cancer. The effectiveness of the proposed methods are examined by calculating its accuracy, confusion matrix which give important clues to the physicians for early diagnosis of breast cancer.

Keywords— Kmeans, Support Vector Machine, Adaboost, Breast Cancer.

I. INTRODUCTION

In this paper we intend to present a system for diagnosis of breast cancer disease using data mining techniques. The symptoms of breast cancer include mass, changes in shape and dimension of breast. Various diagnostic tests and procedures are available for detecting the presence of breast cancer. Classification of breast cancer data is useful to identify the behavior of the tumor. Tumors can either be malignant or benign. Differentiating a malignant tumor from a benign one is a very Big task due to the structural similarities between the two. Support Vector Machine (SVM) is a classification algorithm used in various applications to classify data. But for big data and imbalanced datasets, it is not suitable to apply SVM, since it leads to computational problems and missing value scenarios. Hence it is highly important to make SVM suitable for the present scenario by modifying the algorithm to adapt to the expectations. In this method, both the training and the prediction of SVM classifiers are done using the cluster centers obtained from the k-means clustering. Misclassifications are treated equally for the entire cluster center. To enhance the accuracy of the

classification, we have implemented ADABOOST classifier algorithm. ADABOOST helps in handling the misclassification of cluster centers using the data points in each cluster as a weight. This approach of ADABOOST classifier with SVM can be implemented on imbalanced datasets as well[1]. The main objective of this research is to classify the breast cancer data with high efficient algorithms to obtain the results in a better manner.

II. LITERATURE REVIEW

M. Sewak et al.,(2007) Support vectors with RBF, polynomial and linear kernel functions were trained using a fraction of the WDBC dataset as a training set. . The classification was then carried out using the majority opinion of the ensemble. This SVM ensemble process yielded 100 percent benign tumor prediction accuracy. [2].

B Zheng et al., (2013) proposed a model that is a hybrid of K-Means and Support Vector Machine. The model is implemented on breast cancer dataset to diagnose cancer based on the extracted features of tumor. Kmeans is used for finding the hidden pattern of tumor and SVM for classification of features. There are two types of tumors: malignant (are cancerous) and benign (can't be cancerous, can be removed). The classifier separates these two types of tumors. The k-means is used for clustering the patterns of the similar tumor based on the features of malignant and benign tumors. The membership function is used to measure the similarity of the data point and the tumor. The results show that the K-means and SVM hybrid model reduces the time required for prediction with higher rate of accuracy[3].

R.K.Kavitha et al.,(2014) Data mining techniques are used to obtain useful information from the large amounts of data which can help the physician for decision making regarding the prognosis. This paper studies the performance comparison of Adaboost algorithm which classifies data as linear combination and CART (Classification and regression trees) which classifies data by constructing decision tree in predicting the survivability of breast cancer patients.[5].

Thongkam Jaree et.al.,(2008) ,proposed a method by combining the AdaBoost and random forests algorithms for constructing a breast cancer survivability prediction model. They used random forests as a weak learner of AdaBoost for selecting the high weight instances during the boosting process to improve accuracy, stability and to reduce overfitting problems. The hybrid method performance is evaluated using basic performance measurements (e.g., accuracy, sensitivity, and specificity), Receiver Operating Characteristic (ROC) curve and Area Under the receiver operating characteristic Curve (AUC). Experimental results indicate that the proposed method outperforms a single classifier and other combined classifiers for the breast cancer survivability prediction[7].

Sri bala et.al.,(2016) Machine learning provides better prediction methodologies for diseases in health care management. Ensemble learning is nothing but group of classifiers which in reality yielding better results rather than the existing results. To produce the better results we use collection of classifiers called ensembles. They have implemented ensemble methods to improve the better prediction for breast cancer to classify the breast tissue as in the form of carcinoma and fibroadinoma .Along with existing classifiers like J48Naive Bayes, random forest and SMO. We implemented ensemble classifiers like Adaboosting, bagging and stacking or blending methods with them, in reality it is showing better accuracies[10].

III. PROPOSED SYSTEM

The proposed method is designed with SVM and k-means clustering called as the KM-SVM. KM-SVM is a fast algorithm to increase the processing speed of training and the prediction of SVM classifiers using the cluster centers received from the k-means clustering. The misclassifications are treated equally in each cluster center. To enhance the accuracy of the proposed method, we introduce the ADABOOST classifier algorithm which handles the misclassification cluster centers by assigning penalties.

The SVM method along with ADABOOST can be applied on imbalanced datasets as well.

The extracted correlation features are placed in ascending order for the given data and also given in the form of SVM classifier. The misclassified data obtained from the first level of classification is samples using N sample method and then sent to the classifier again for an accurate classification

The preprocessing done with k-means algorithm by finding the cluster centers. The Benign and Malignant tumors are again checked with svm classifier in order to overcome the misclassification. Boosting is done at the end so that all the output weak learners are clubbed to form a strong learner. Boosting concentrates more on the misclassified examples or to the examples that have higher prediction errors.

A THE BASIC K-MEANS ALGORITHM

The k-means algorithm is a simple process where K initial centroid is selected. The value of K is specified by the user as the number of clusters required. Now points are selected close to the centroid and these points are the clusters of the centroid. The centroid in each cluster will be updated with the points assigned to the cluster. This process continues until no point changes in the cluster and the centroid remains the same.

B SVM

SVM- Support Vector Machines was first proposed by Vladimir Vapnik. It's a new learning method proposed for binary classification. The main objective of this algorithm is to find a hyper plane which separates the D-Dimensional data into two perfect classes. Later, SVM was introduced for kernel induced feature space that considers higher dimensional space where the data can be classified. So it's a challenge to classify data which is possible to be present in two classes of data.

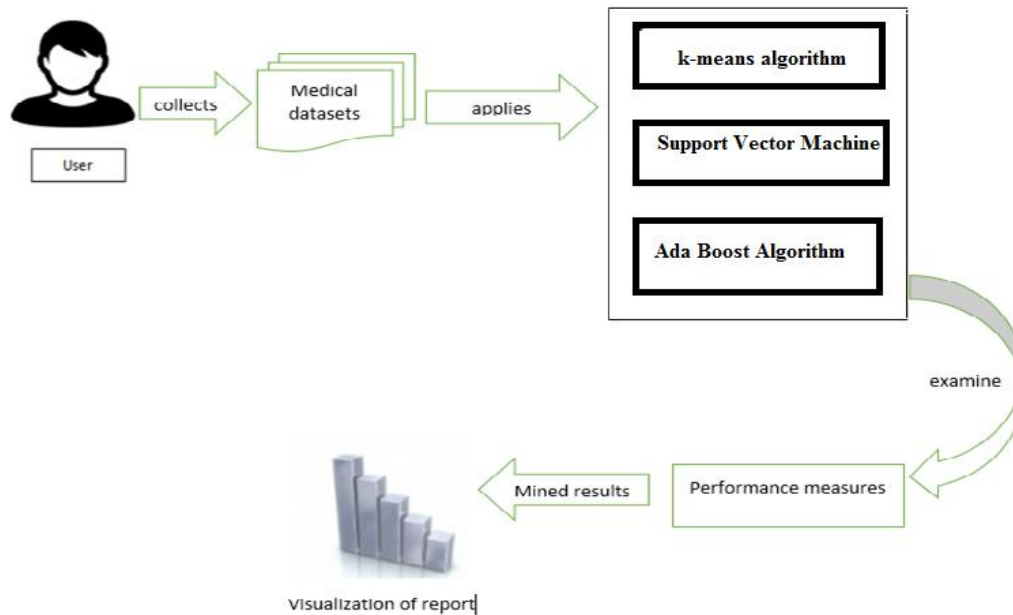


Fig.1: Proposed Architecture

C ADABOOST Classifier

Boosting is the concept of converting a weak learner to a strong learner. It is the process of combining all weak learners to form a single strong rule. Each time when the base learning algorithm is applied it generates weak prediction rules through an iteration process. After conducting several iterations, the boosting algorithm combines all weak rules to form a single strong prediction rule. Below are the steps used for choosing the right distribution:

Step 1: The base learner is applied to distribute and assign equal weight to each observation.

Step 2: If any prediction error is observed then a higher attention is paid for observations having error. Now, the next base learning algorithm is applied.

Step 3: Step 2 is repeated until higher accuracy is achieved by the base learning algorithm.

At the end, all the output weak learners are clubbed to form a strong learner. Boosting concentrates more on the misclassified examples or to the examples that have higher prediction errors.

IV. RESULT AND DISCUSSION

The basic phenomenon used to classify the Wisconsin diagnosis breast cancer data using matlab and compare the accuracy obtained using this technique with other techniques. The below table shows the accuracy comparison. The kmeans, correlation svm and adaboost combined technique used in this research yields higher accuracy when compared to other techniques.

V. CONCLUSION

The proposed novel algorithm was experimented on the Breast cancer database. The simulation results proved that the approach achieved a very high accuracy rate than the existing methods used in literature. We also demonstrated a certain level of accuracy in the classifier, and for finding accurate results there must be sufficient preprocessing of data done. Missing data, data imbalance and other peculiar cases are to be considered in order to derive an accurate result. Finally we also demonstrated that we can attain accuracy in diagnosing breast cancer disease using the K-means classifier, adaboost and Support Vector Machines. It is being applied to classify images into two sectors as with tumor and without tumor. New cases will be analyzed in the future studies.

Table.4.1: Comparison of the methods and accuracy of previous studies and this study.(WDBC data sets)

Author (year)	Method	Accuracy (%)
J.Abonyi et al., (J.Abonyi and Szeifert, 2003)	supervised fuzzy clustering	95.57
I.Gadaras et al., (I. Gardaras, 2009)	Fuzzy rule classification	96.08
Chunekar et al., (Chunekar, 2009)	Jordan Elman neural network	98.25
M.Darzi et al., (Mohammad Darzi, 2011)	CBRGenetic	97.37
L.Chuang et al., (Li-Yeh Chuang, 2011)	CatfishBPSO	98.17
Mert et al., (A. Mert and Akan, 2014)	LOO, PNN	97.01
Zheng et al., (B. Zheng and Lam, 2014)	K-SVM	97.83
Subrata Kumar Mandal(2015)	Logistic Regression	97.90
Priyanka Jain et al.,(2016)	Svm	80
This study	Kmeans+modified svm+adaboost	98.85

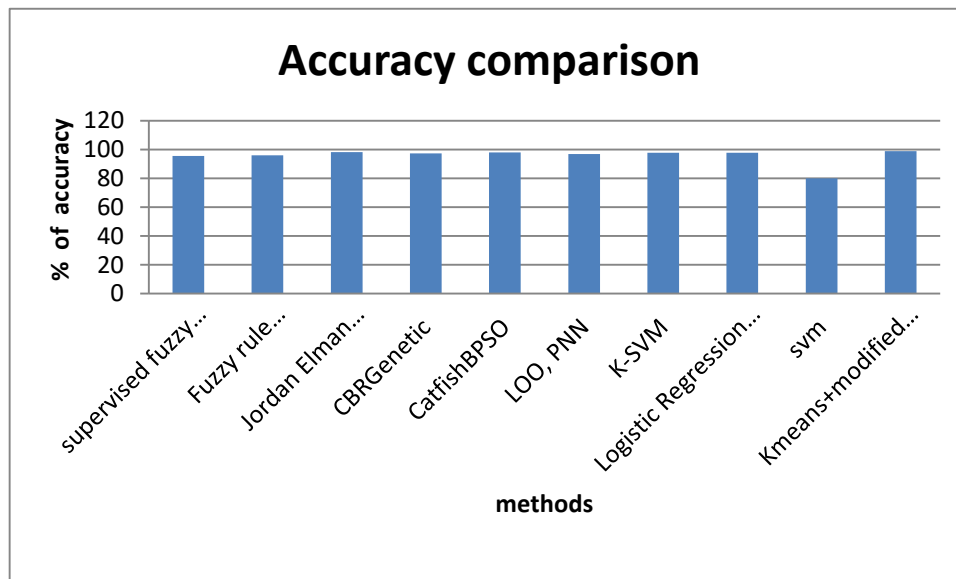


Fig.4.2: Accuracy comparison graph of Wisconsin breast cancer dataset

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Managing Organizational Learning with Focus on The Theory U

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Abstract— *The learning of the organization's employees and their perception can instruct the managerial adaptations in search of innovation of the processes. This study focuses on the Theory U, with the objective of studying the perception of stakeholders in the face of learning in the corporation. Its specific objectives are: (1) To raise stakeholders' perceptions regarding the learning tools and practices in the organization; (2) To characterize the possibility of organizational learning in the application of the Theory U; (3) Propose measures to modernize organizational learning tools and practices. The scenario is a military corporation in the Capital of Rondônia, Brazilian Amazon. The study of case method is applied, with procedures in search of qualitative and quantitative results. The collection of the stakeholders' perception was done through ethical protocol; interviews and in loco observation. A report was generated that points out the existence of a confrontation between corporate interests, indicating that managers do not promote the means to bring*

knowledge to their employees in the institution, while they become sceptical about their reality due to the emergence of a confrontation between theory and practice. The result suggests modernizing the organizational environment to support learning demands. It points that the tools and practices should be reoriented with the purpose of innovating the environment with organizational learning resizing, from now on to be integrative with new technologies, with collaborative focus, through redesigns of processes and procedures following advanced technological standards. This research is a contribution of the academy to managers who potentialize their stakeholders through organizational learning with innovative practices.

Keywords— *Learning Tools, Management Perception, Theory U.*

I. INTRODUCTION

The evolution experienced through globalization challenges individuals to pursue different forms of learning to follow the process. In organizations, this learning needs to be continued in order to avoid the institutional impoverishment that affects its performance, or the blocking of access and permanence in the competitive market. The tendency is to put into practice the theories of management that favors survival. The best way to follow today's evolution is to recognize in the learning tools the path of individual, group and institutional success. This will support knowledge updates, as well as increasing ideas for the modernization of the organizational environment.

This empirical research is developed in a military corporation, chosen because it is an organization where one can verify in detail the reality, comparing theory with practice, in a challenge for the improvement of performance, through learning. In this context, it is intended to answer the question: How is the stakeholder's perception characterized in the face of learning in the corporation under study? This work consists of topics and subtopics, with this introduction, a theoretical-conceptual review, methodological treatment, results, conclusion and references.

II. OBJECTIVES

To answer this question the general objective is to study the perception of the corporation's stakeholders in the face of organizational learning. The specific objectives are: to raise perceptions about tools and practices to increase learning in the studied organization (1); to characterize the possibility of organizational learning in the company researched with the application of the Theory U (2), and; propose measures to modernize tools and practices in the learning organization (3).

III. METHODOLOGY

As Creswell (2010) points, the choice of method will depend on the intent of the research to specify the type of procedure. However, according to Chiavenato (2003 p 20), the case study method is suitable for research in management, as it's done in this task. This can substantiate reality in order to treat it scientifically. Obviously, you will have to overcome the complexity of validation throughout the process, and thus deliver qualified results. The said method is recommended when the object of the research is outside the research center, so, data and information are collected at the locus previously identified, from where they are brought to the front for the recommended treatment. The case is a problem or a situation pending solution, which requires dissecting it, treating and offering the solution in a science field; it will reach scientific value when supported by a theoretical and conceptual body to guide this treatment, by procedures similar and related to the fact investigated. This reasoning justifies the decision done here to use the

Case Study; method of qualitative and quantitative nature, with the techniques and procedures adopted.

3.1 The procedures

The preparation of this task begins with a bibliographical survey in the embryonic stage of the task, with the selection of related topics, cataloguing and reading of texts in books, technical journals, theses and dissertations. Web consultations were carried out in specialized sites, especially those of electronic journals. At this stage, it was possible to elaborate the theoretical-conceptual body and the methodology of the work.

In the operational phase of the work was established the research environment, the task here consists of a field research. After carrying out the ethical authorization and informed consent protocol, the Focal Group was established at the headquarters of the military corporation in evidence, where a dynamic was developed with the interviewees. This technique is mentioned by Perosa and Pedro (2009) because it is a form of data collection directly through the speech of a group, which are reporting their experiences and perceptions around a theme.

3.2 Data collection and processing techniques

In addition to the reports and discourses of the stakeholders from the Focus Group, the form that allowed the direct collection of data was immediately applied. This instrument contains a compartment with the Informed Consent Term, a compartment on data from unnamed respondents, such as age group, sexual orientation, schooling, income range, length of service report on the corporation, and housing conditions; these making possible to check the current status; and a compartment with 15 affirmations grouped intentionally, all related to the confrontation between the theory and the practice endured in the environment, indicating the perception of the stakeholder in face of their own reality. A measure positioned in the header of these statements allows us to judge the degree of the perception in 1 (TD = Totally Disagree), 2 (PA = Partially agree), 3 (I = Indifferent), 4 (CA = Completely Agree).

For the treatment of the data collected Excel was applied, appropriately structured for the measurement by the Likert Scale. This scale comes to measure the perceptions, and thus verify the degree of conformity between the collected reports of the individuals, in face of their affirmations in the survey. This approach is useful in the validation of the research, given the varied perceptions of the respondents.

The details noted and observed in the surroundings were carefully confronted, confirming or denying the reality of the facts. The Likert Scale consultation demonstrates a better way of evaluating, rather than just applying yes or no responses, which may counter the truth in context. Finally, the analysis of the tabulation and graphs generated, as well as the preparation of the report, were carried out.

IV. THEORETICAL-CONCEPTUAL REVIEW

Senge (1998) points out that in order to initiate a process of learning in an organization it is necessary to make people understand that learning is important, that it requires engagement and commitment. This leads to profound changes and should be a personal challenge for stakeholders. When an organization's staff is constantly questioning the ways to solve problems in their daily activities, individuals will be collaborating to collective learning, and at the same time adding personal knowledge.

For Alves, Steil and Santos (2015, p 3) organizational learning is the process of cognitive and behavioural change. According to Amorim and Fischer (2013), when learning is properly managed, it facilitates the development of skills in organizations, resulting in a significant competitive advantage in the market where they operate. In this sense, Beker et al (2016, p 5) notes that technology can help to disseminate knowledge rapidly; according to him, the technological tool helps in the learning process. He emphasizes that these tools can be wisely applied in Customer Relationship Management (CRM), Enterprise Resource Planning (ERP), through Internet, Intranet or Extranet, rapidly by email and others, collaborative software, groupware, or groups with activities in common. And they conclude that this performance will require the specific learning of the peopleware in the workplace, or even at a distance by virtual rooms.

Meanwhile, Senge (1994) approaches a shared vision, when he emphasizes that every organization has a destiny or purpose that demonstrates its reason to be; such an approach can be facilitated by technological tools. In addition to the learning tools, it is also necessary to use certain practices so

that the knowledge is transferred between the members of the organization. Senge (2003) mentions one of these practices in dealing with the systemic vision and the ability to learn together. The author is grounded in the practices of dialogue and discussion, media that enhance the exchange of experience and has the potential to expand the relationship between team members.

According to Castillo and Cazarini (2010), another point that helps improve organizational learning is sharing and applying knowledge through the lessons learned. According to the authors, this practice maintains the continuous learning in the organization. Their study presents, as a way to support itself, the organizational learning based on the five disciplines of Senge (1999), based on Scharmer's Theory U (2010), which presents shared management as an innovation for organizational learning. corroborating significantly with the present task.

4.1 Concepts about tools and practices in organizational learning through the vision of Peter Senge

According to Senge (1999, p 7), the organizations that learn are those in which people continually improve their ability to create the future they would like to live in. He also states that these organizations have important characteristics: they have the capacity to create, acquire and transfer knowledge. Therefore, for an organization to achieve learning, the author prescribes the five disciplines as described in Table 1 and that each of these should be thought of at three levels, as shown in Table 2.

Table.1: The five disciplines in Senge

Disciplines in Senge	Meaning Description
1. Personal Domain	Encourage workers to seek and achieve their goals without fear of error, with an appeal to their evolution and concept of competitiveness.
2. Mental Models	To improve the image that each one has of the world, considering the cultural appeal and the image each person has of reality.
3. Shared vision	Elaborate principles and guidelines that will allow to reach the future, considering the collective nature of the learning exchange that contributes to organizational success.
4. Team learning	To develop collective thinking and communication, abandoning the old practices, and surpassing the expectations from the individual talents, through the adhesion of the other.
5. Systemic Thinking	Analyze and understand the organization as an integrated system of learning, which focuses on complexities, new experiences, and opposition to Cartesianism.

Source: Prepared by the authors according to Senge (1998)

Table.2: Levels of Senge’s disciplines

	Conceptual description
Practices	Something physical or concrete, of a real, palpable and measurable character; fosters the development of theory to guide individual and collective behavior.
Principles	Norms or standards of conduct that feed ideas into the new pragmatist; its basis is the essence that underlies the conduct or induces a phenomenon
Essentials	State of being of those who pass through high levels of mastery of the discipline; it still matters to be fundamental or an irreplaceable member.

Source: Prepared by the authors according to Eynng (2006) based on Senge (1999)

4.2 Concepts of the Theory U

In the literature, Tinti (2014, p 94) points out that the U Theory is a set of theories, tools and practices that help entrepreneurs, organizations and communities to face current problems not only with ideas but mainly through actions that generate innovation with quality, awareness and attention, through learning and collective change based on reflections on the relationships with the environment in which they live.

For Leão (2014), the Theory U focuses on a management method aims for change, with leadership in the process of

innovation through social knowledge. In this sense, this theory developed by Otto Scharmer on the Massachusetts Institute of Technology (MIT) in the United States of America unifies two dimensions; one is to present the points that constitute it, and the other is embodied in the significant elements for the innovation and methodological construction of organizational growth. Picture 1 shows the U trajectory as idealized by Scharmer (2010, p 30); and Table 3 demonstrates the meaning of each element of Theory U in the process of change, in a format proposed by the researcher.

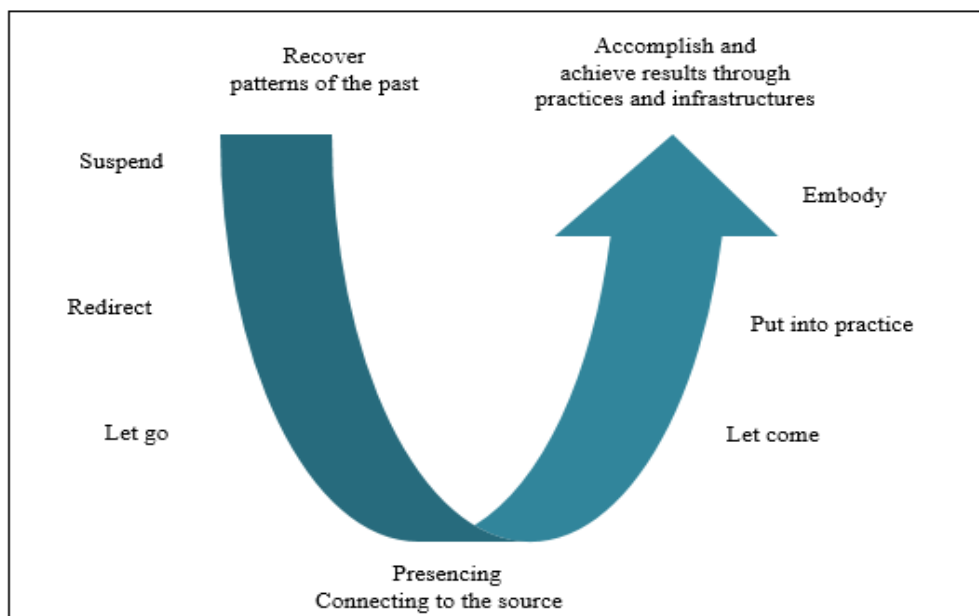


Fig.1: Representation of the trajectory of the Theory U

Source: Prepared by the authors based on Scharmer (2010)

Table.3: Representation of the meaning of U elements

U Format	Description
Down	A way to understand your mental models and how they relate to the reality in which you are inserted.
Bottom of the U	It is a space for reflection, when the individual already has a greater knowledge about himself and the environment and now has the possibility to understand the current reality and to initiate a process of innovation, that is the rise of the U.
Up	New ideas are put into practice, which does not mean the end, since the process may start again or steps be reviewed, if necessary.

Source: Prepared by the authors based on Scharmer (2010).

4.3. Concepts of innovation facing tools and practices in the organization

According to Moura and Krumholz (2010), innovation is tied to change, whether incremental, radical or revolutionary involving concepts, products, processes or organizations. According to Freitas Filho (2013, p 11), for the existence of innovation in an organization, the coexistence of three elements is necessary: knowledge, creativity and entrepreneurship. Tigre (2014, pp 74-75) presents three forms of innovation performance. According to him, innovation can occur through technological, procedural or organizational modeling.

V. RESULTS OF THE STUDY OF THE TOOLS AND PRACTICES OF ORGANIZATIONAL LEARNING

This study was elaborated in a militarized institution, whose management follows the military principles of hierarchy and discipline. Records indicate that it was founded in the State of Pernambuco and, as a strategy of the superior command was transferred to the State of Rondônia, where it operates in the Amazonian borders. Observation and interviews, point out that managers seek to keep up to date, using modern equipment, applying

concepts that value their members, while optimizing available material resources. However, the first notes point out that management is mixed between maintaining the pillars of militarism and administering human resources according to theories so that its members cooperate with organizational development.

5.1 Survey of the perceptions regarding the tools and practices to increase the learning in the organization under study.

In search of results, the respondents of the military organization entered this research. During brainstorming, they expressed opinions about the contextualized reality that were written down and dealt with. The form had 15 affirmative positions: I - The perception in the institution about the organizational learning; II - The employees' perception in the institution regarding individual learning; III - The perception in the corporation regarding the learning of its collaborators; IV - The employees' perception regarding the institution; V - The perception of the respondents regarding the tools and learning practices in the investigated corporation. Table 4 below shows the extract from this perception of respondent stakeholders.

Table.4: Result of applying the form to stakeholders

Sequence	Statements	TD %	PA %	I %	PD %	TD %	T %
1	The Institution enables you to understand the importance of learning.	0	8	8	50	34	100
2	Included in an environment that transfers knowledge among its members.	8	21	8	41	17	100
3	The institution focuses on change, always aiming at innovation in the environment in which it operates.	0	33	33	29	5	100
4	I consider myself committed and committed to institutional change.	0	9	16	59	16	100

5	I question facts to know and collaborate in what I am learning.	0	4	9	25	62	100
6	I enhance my personal knowledge in order to assist in learning.	4	4	21	46	24	100
7	Moved by the institution to seek knowledge that help for its purpose.	8	13	34	38	8	100
8	I am motivated to increase my ability to create and acquire knowledge.	8	4	13	50	25	100
9	I take part in an on-site extension course in order to integrate knowledge.	5	41	16	16	5	100
10	I am looking for learning that can contribute to the improvement of the institution in the future.	4	4	42	33	17	100
11	I try to understand how the institution works as a whole.	4	4	25	54	13	100
12	Access to up-to-date, relevant information on the institution's activities.	4	25	25	25	21	100
13	Institution shares and applies knowledge of lessons learned.	0	13	16	37	34	100
14	Practices of dialogues and discussions are used for the exchange of experiences.	0	30	12	46	12	100
15	Institution provides access to the technological tool of the type: internet, e-mail.	0	26	0	37	37	100

Percentage of Totally Agree (TA); percentage of Partially Agree (PA); Percentage of Indifferent (I); percentage of Partially Disagree (PA); percentage of Totally Disagree (TD); Total percentage (T).

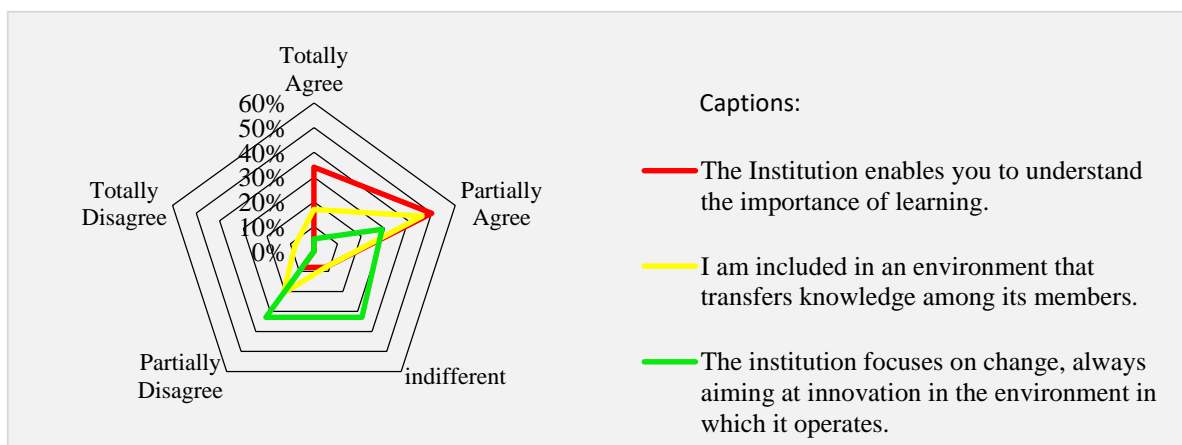
Source: Prepared by the authors.

The profile of those involved in the research can be characterized as the following: Regarding the age group, a percentage of 62.5% is between 26 and 39 years old, which reveals adults fit for the workforce; regarding sex, 95% are male, which is common in the case of a military body in Brazil. Regarding the level of education, 70% have completed high school, indicating maturity in their critical mass; regarding the income range, 70% earns between 4 and 10 minimum wages, suggesting economic and financial independence; in terms of time of service, 58% have been working for more than five years in the military corporation studied, indicating that they have professional experience. As for the number of people who live with the respondent, 87.5% lives with up to three people in their

residence, which may indicate a structured family relationship. Therefore, they are able to act as respondents with independence and reliability.

5.1.1 Perception in the institution regarding organizational learning

In order to adequately demonstrate the results obtained with the stakeholders, the radar chart is used to compare the data obtained through the application of the form to the respondents. Picture 1 below shows the performance regarding the perception in the institution about organizational learning.



Graph 1 - Perception in the institution regarding organizational learning

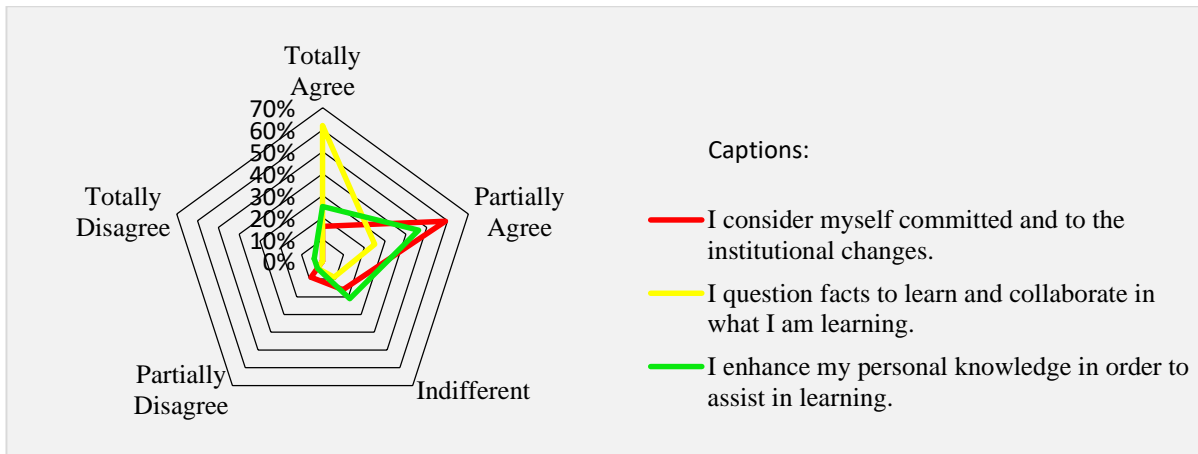
Source: Prepared by the authors according to data collected locally.

Significant management factors can lead the organization to success through skill development. This study allows us to summon an essential factor that is learning. Corroborating with Amorim and Fischer (2013), Graph 1 exposes the reality in the corporation on the importance of continuous learning. The elements presented concede us to interpret that the institution enjoys the learning premises. It is important to note that 29% consider themselves part of an organization that does not transfer knowledge to its employees, a fact that contradicts Senge's (2003) indicative, which calls for dialogue and discussion as a way

of helping to optimize the experience and improve the relationship between members of a corporation.

5.1.2 Perception of the institution's employees related to individual learning

The research brings results on the perception of employees in the institution in relation to individual learning, whose performance is in Chart 2 below. The prescription enrolls engagement and commitment, as they are basic elements necessary to engage change, and promote a personal challenge in the organization, as Senge (1998) points out.



Graph 2 - Perception of stakeholders regarding organizational learning

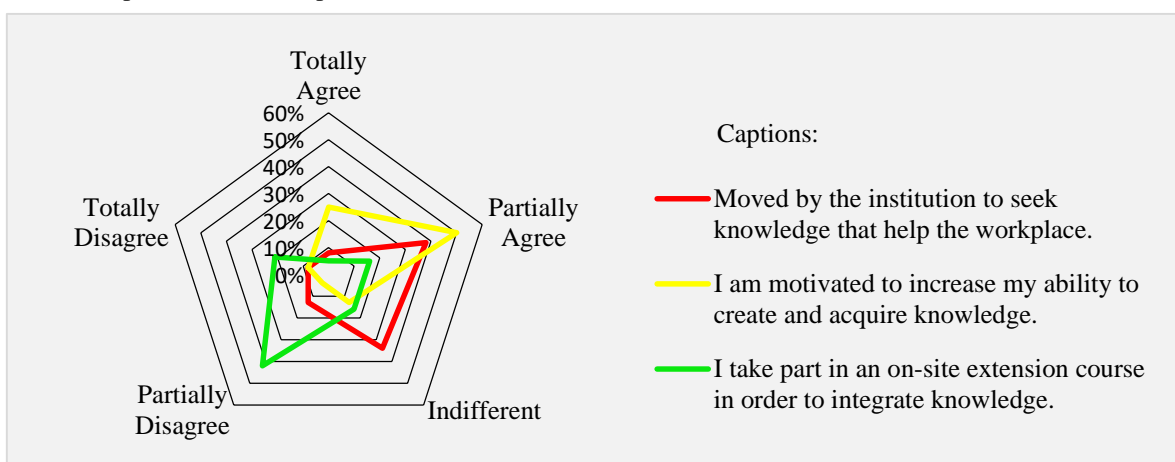
Source: Prepared by the authors according to data collected locally.

Senge (1999), when bringing the fifth discipline proposes the ideal forms of transferring knowledge, among them the stimulus to workers to seek knowledge without fear of making mistakes. Graph 2 indicates that 59% of the respondents partially agree on their commitment and dedication to institutional change; 62% fully agree with the questioning of facts related to collaborative learning knowledge. This phenomenon is made even more evident when 70% of the respondents affirm that there is an improvement of knowledge, when there is personal learning, which in particular shows possibilities for the

corporation, since this level of perception now identified points to a favorable climate for the desired organizational development in any institution.

5.1.3 Perception in the corporation regarding the learning of its employees

The research turns to the interpretation of the perception of the learning of employees in the corporation. The results of the consultation with the respondents are shown in Chart 3 below.



Graph 3: Perception in the corporation regarding employee learning

Source: Prepared by the authors according to data collected locally.

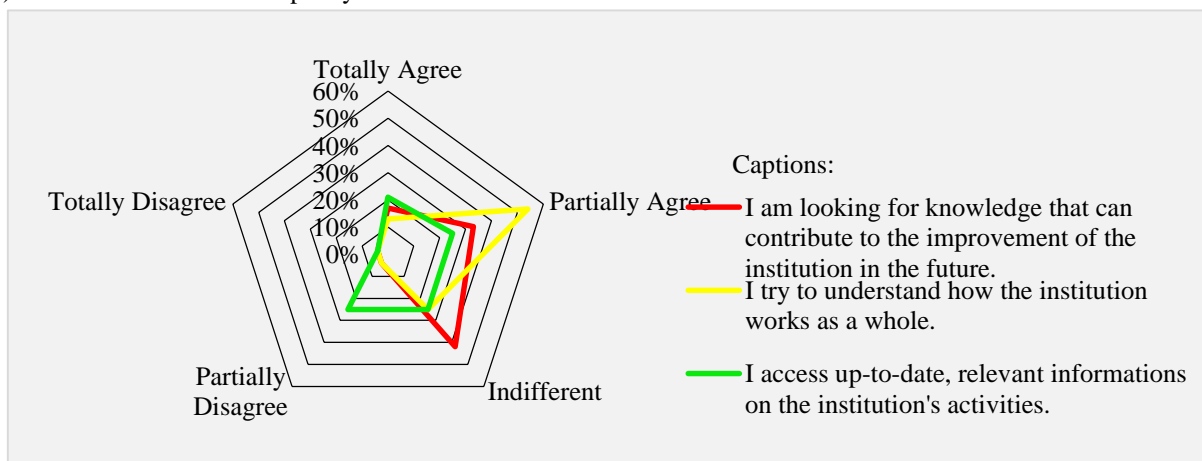
According to Senge (1999), organizations have the capacity to create, acquire and transfer knowledge, which served as a guideline for the preparation of this report, in order to interpret how the military institution under study values and encourages knowledge among its employees. The basic understanding is that the individual can absorb an organizational culture to foster learning, which will raise his concept in the branch of action, which may even be a recognition even among the possible partners in the institution as a whole at the national level.

The results indicate that, despite the incentive recognized among peers, the corporation does not promote courses or training that motivate the military to participate, especially those advanced courses that enrich the professional curriculum. The fact contradicts the prescription of Senge (1994) when it refers to the capacity of creation to see

ahead, which would only be possible with the improvement of employees so that it can transform the institution into a learning organization.

5.1.4 Perception of employees in relation to the institution

The literature indicates that learning contributes to organizational success. So much so that Senge (1999) demonstrates this with the perception of the stakeholder with reference to its institution. This facilitates the interaction between individuals and groups towards the success of all. This event in Senge (1999) suggests consulting the respondents on perceiving their position in acquiring knowledge that benefits the institutional future. Given this approach, Chart 4 allows us to measure how much the employee is willing to do in favors of the corporation, and what are their real intentions.



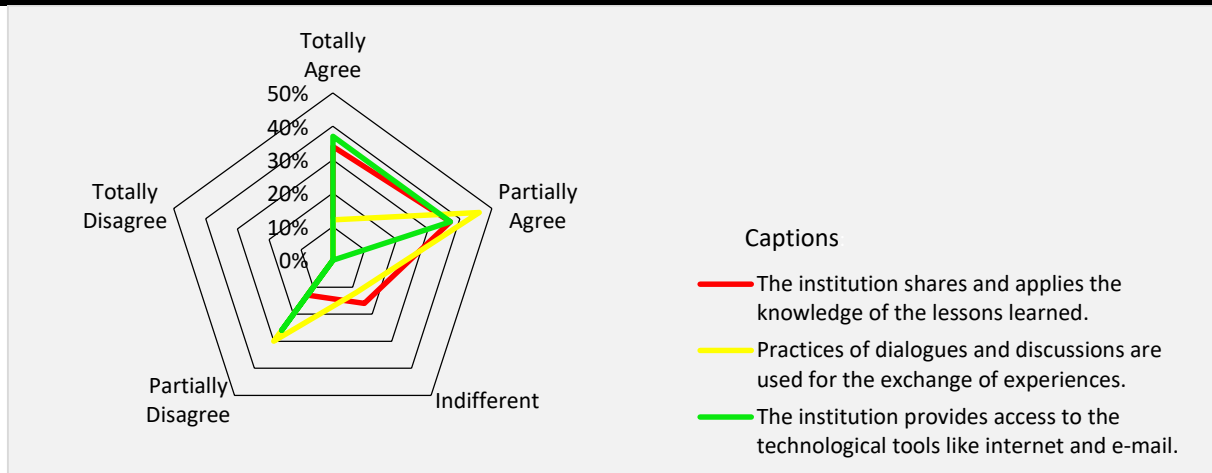
Graph 4 - Stakeholders' perception of the institution

Source: Prepared by the authors according to data collected locally.

The stakeholder's perception points to indifference concerning the search for learning that can contribute to the future of the institution; this reveals that they seek to effectively understand the functioning of the institution as a whole. A confrontation between corporate interests is evident; so, as managers do not promote the means to bring knowledge to their employees in the institution, they tend to become cynical regarding said reality, causing a withdrawal, contrary to the recommendations in Senge (1999).

5.1.5 Respondents' perception regarding the learning tools and practices of the investigated corporation.

Authors such as Beker et al (2016, p 5) and Senge (2003) consider tools and practices as determining means in the organizational learning process. Thus, technological tools, dialogue, lessons, among others are suitable means for transferring knowledge that help in the improvement and the learning. Chart 5 brings the performance of the consultation to institutional stakeholders.



Graph 5 - Tools and learning practices adopted by the institution

Source: Prepared by the authors according to data collected locally.

The results point out that the corporation does not effectively use the tools and practices for learning. In fact, Senge (2003) prescribes the exchange of experiments that overcome barriers to learning enrichment between individuals and groups. In this regard, it is assumed that an elite of individuals has access to technological multimedia; but given the percentage identified here, the corporation is positioned short of the optimum moment for the purpose of this enrichment, given the employees' perception of the unavailability of those fundamental tools required for the job.

5.2 Characterization of the possibility of organizational learning in the corporation researched based on the Theory U

A study in Alves, Steil and Santos (2015) provides support for the appropriate treatment of this topic; these authors turn to the expectation of obtaining a cognitive change of the stakeholder, as made possible in a technically equipped corporation. This provision may reflect positively on performance efficiency, with subsequent institutional success. So much so that Beker et al. (2016, p 5) indicates the application of technology as a fundamental part of this research, due to the requirement in complex platforms such as the one in evidence, in which distance courses, videoconferences and virtual participation in congresses, events and others can be applied. Picture 2 below presents a perspective of the current possibilities in the investigated institution.

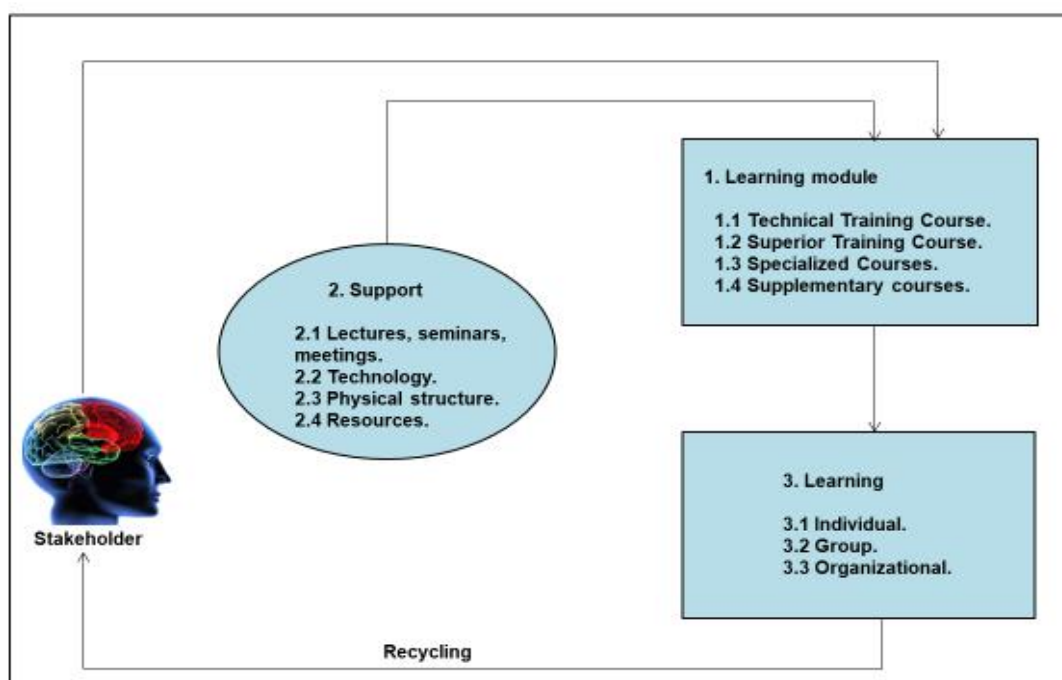


Fig.2: Basic perspective of the learning structure

Source: Prepared by the authors.

The attention one offers to a situation defines the way it will evolve this fact is related to the proposal of Scharmer (2009). The author states that several others are based on organizational learning theories based on past experiences, through experiential modeling. However, the Theory U

aims to orient the leaders to seek knowledge that leads to visionary possibilities; and, to embrace the understanding of the future in the perception of the individual, group and community. Picture 3 shows the ideal scenario with the participation of the leadership, based on Theory U.

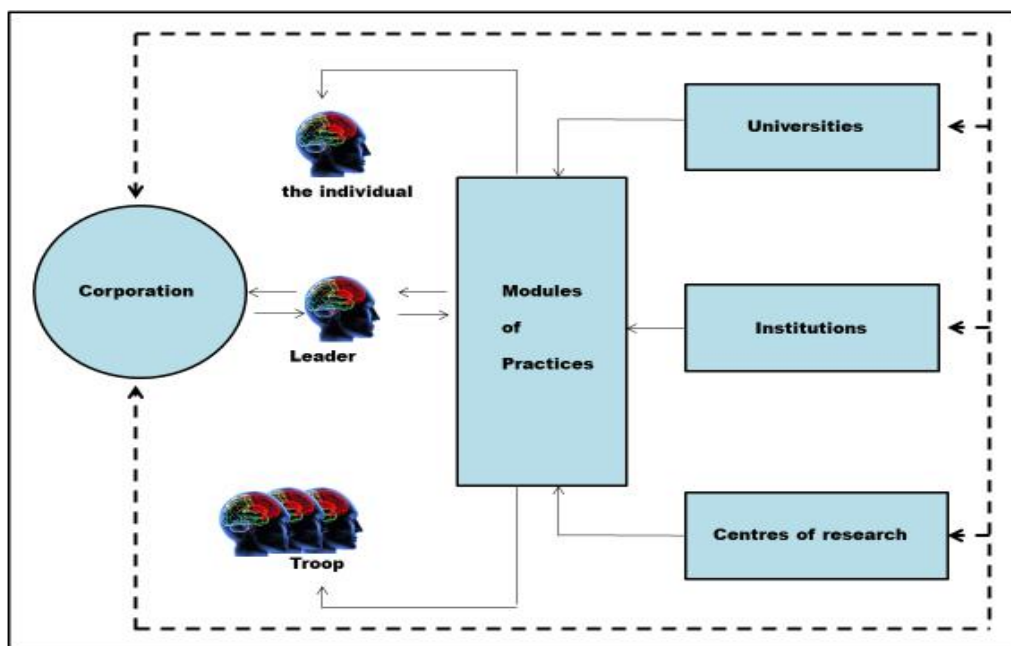


Fig.3: Scenario for learning by Theory U

Source: Prepared by the authors.

Placing the learning characteristics of the corporation with those idealized by the Theory U makes emerge a new approach with an understanding profile of all employees as active participants in the new management. It suggests that there will be the real possibility of intellectual

improvement for the individual who seemed retracted in the questions on learning, ideas, innovation and motivation. Table 5 shows how the institution can adapt to the characteristics of U Theory for the evolution of participatory management

Table.5: Characterization of the Theory U in view of the new possibility of learning

Characterization in Scharmer (2009)	Description of the new learning model
1.Restore	The practices module will work with the past characteristics that disseminated knowledge, and which today contribute to institutional learning.
2. Suspend	Leadership will address characteristics that do not match or do not meet current learning demands.
3. Redirect	The managers in the corporation will rework the adaptations, with the tools and practices of organizational learning, from the perceptions of the stakeholders.
4. Let go	The managers in the corporation will work through a guided leadership capable of listening to the members, always seeking the best scenario for learning.
5. Preconize a presencing	Those involved will act by connecting to a context of innovation that matches the new expectation of the corporation.

6. Let come	The managers of the corporation will work with the leader to promote a participative dynamic, through an integrating spirit, that values learning, and collaborates with individual, group and organizational learning.
7. Put into practice	The managers in the corporation with the leader will put into practice a new way of learning, diluting the capacity of leadership among all and strengthening the individual and the group.
8. Embody	All stakeholders will act according to the institution's doctrine, and in accordance with the new perspectives learned.
9. Make it happen	All involved will always work by recycling and absorbing more and more knowledge resulting from the evolution of the learning process configured in this task.

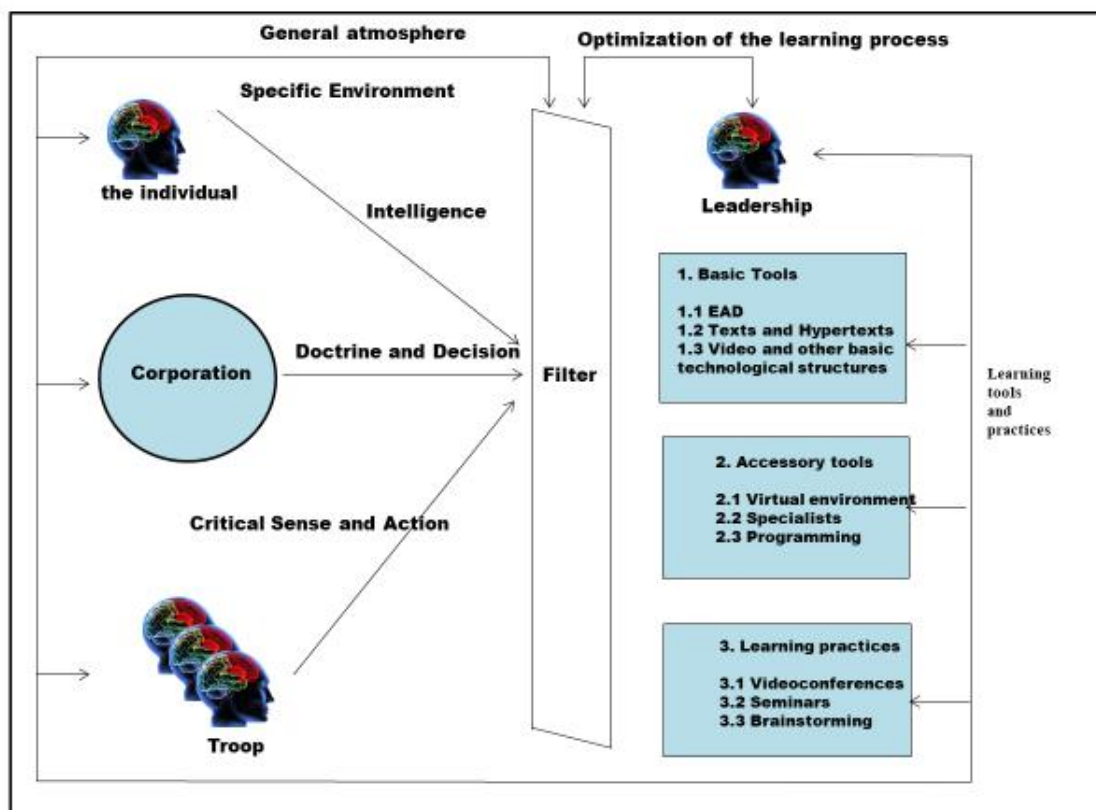
Source: Prepared by the authors based on Scharmer (2009).

In this outline, the corporation will present a new model of learning, through an articulated renewal between theories and practices. It corroborates Scharmer's (2010) precepts, the cyclical dynamics that are subject to the renewal of this process, and the resumption of ideas when necessary for the institution.

5.3 Proposal of measures to improve the tools and practices in the organization taking this study into consideration.

Tigre (2014) presents a form of performance seeking structural innovation, offering three ways to reach this new structural basis. It refers to the technological, procedural

and organizational structure. Therefore, collaborative learning is ideal, bringing together stakeholders under the influence of a leadership capable of involving everyone in an optimized process in an environment where learning is properly supported by modern tools and practices. As a result of new perceived concepts, it is possible to take the institution under study on a new scenario, now supported by tools and practices of organizational learning. After identifying weaknesses in the structure, configuration that allows the process of inclusion of knowledge is proposed, according to Picture 4, which demonstrates the real learning scenario.



Picture 4: Proposed collaborative learning for innovation

Source: Prepared by the authors.

According to Senge (1999, p 7), learning organizations are those in which people continually improve their ability to create the future they would really like to see emerge. Several tools can be applied to optimize these forms of employee improvement, and distance learning is recommended in regions such as the Amazon, which is difficult to reach and a logistical effort that makes speeding results difficult. However, the study in Melo (2016, p16) refers to the meaning of distance education, since it offers a proposal of qualified, contemporary, problematizing education that builds professional knowledge, contributing to the improvement of the service, as it comes from the study in the corporation investigated. It can be seen, therefore, that EAD is negatively influenced by bureaucratic and financial issues; however, an institutional partnership with the Federal University, Federal Institute, among others, could optimize all the troops interested in knowledge and practice.

Oliveira et al. (2016 p 567) indicates that innovations from computerized technologies have become possible thanks to hypertexts. One of the consequences was to soften the rigidity in the form of conditioned language in order to facilitate the relationship between sender and receiver in formal communication rather than slow writing that is not accompanied by the rapid human reasoning. These same limitations also hinder the performance of basic subjects related to texts and hypertexts, for example. In spite of the central body of the corporation in Brasilia has all these tools that can be made available, so that the corporation under study can make use, according to carefully designed programs. Therefore, there is a careful technical selection of these technologies to support reading so that the members of the corporation can enjoy the quality of these devices during their learning.

VI. CONCLUSION

The report of this study allows us to answer the problem of this research about the stakeholder's perception in face of learning in the corporation under study, based on the Theory U. By using the references cited throughout this research it was possible to verify that there is a confrontation of corporate interests. Managers do not promote the means to bring knowledge to their employees in the institution and these actors also become sceptical with their corporation, in a situation that may be motivating their removal from the ideal context of institutional success. Financial, structural and bureaucratic factors, common to public management, interfere with the progress of these initiatives, which obstruct the necessary dynamics in this event.

This research is a contribution to managers and institutional leaders. The results and proposals elaborated through analysis and criticism can strengthen the decision making in analogous situations. The records discussed here

are relevant for managers of public or private organizations, especially those who work in scenarios where they develop the potential of stakeholders, in the search for improvement through organizational learning, applying innovative tools and practices.

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Analysis of Public Transport System, Hatay Example: Detection of Existing System

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Abstract— Today, with the development of our cities, the population density has increased and therefore many problems have arisen due to the increase of the traffic density in the city and the existing transportation systems which were previously not planned with erroneous technical infrastructure have become unable to answer. Measurements of the decision variables related to the routes, vehicles and passengers are made in order to determine the existing public transport system. These decision variables include the number of vehicles leaving service during the day, the passenger carrying capacity of the vehicles, the starting and ending times of the laps, the length of the public transport line, the number of laps made during the day, the number of passengers per vehicle, and the total number of passengers. By using these variables, the structure of the existing public transportation system is determined. Increasing the quality of public transport services in metropolitan cities and raising the quality of users in more economical conditions is only possible by incorporating business activities into an institutional structure, integrating public transportation enterprises into one and planning and managing them in a unified way. Our aim in this study is to evaluate the existing route structures, vehicle types and travel analyzes in the public transportation system in Hatay Province and evaluate the positive and negative points in the developing urban structure and to transform them into an effective and sustainable structure.

Keywords— *Public Transportation, Route, Decision Variables*

I. INTRODUCTION

Nowadays, with the rapid and uncontrolled growth of our cities, population density has increased and caused many needs and problems to come along with them. The increase in population is accompanied by an increase in the number of cars per population and a vehicle traffic which is difficult to transport the system with the limited road capacities that the previous zoning applications have created. This situation has made traffic and transportation in our cities the most important problem to be solved.

In this study, it is aimed to evaluate the existing system in the urban structure that develops by examining the route structures, vehicle types and travel data in the public transport system of Hatay Province, which is a growing and developing city, in the districts of Antakya.

The 21 provincial municipalities, which were established with the fragmented local government structure, which has been in vogue in the 1990s in Antakya, which is the center of Hatay Province, constitute the cause of problems that are serious and reparable in terms of the development of the city. In the meantime, while the borders and centers of the Provincial Municipality and the Municipality of district generally need to be evaluated and structured as a whole, the lack of an autonomous and interdependent relationship between the relevant local governments and in particular the lack of integration between the decisions taken regarding the reconstruction of the city has adversely affected the development of the city and the urban transportation system was also irregularly structured in connection with this.

The gathering of public, social, cultural, commercial and industrial sites in the Antakya center led to the population focus of the settlements in the surrounding areas of Antakya and, together with that, the mobilization of population towards the city center. In this regard, according to population movements, besides the city center's own public transport system, it has also caused the formation of public transportation networks towards the province center rather than the borders that are almost intertwined with the city center. Transportation services to be provided in Public Transportation Systems have been transferred to the cooperatives established in the region, and the public has preferred to be in the point of regulation and control rather than the point of application of this service.

In cities where human beings exist, transportation is one of the basic needs. In order to meet the transportation needs of the people at this point, it is necessary to determine the transportation demand first. For this purpose; what kind of traffic demand will be met by means of transportation, and also how to measure the efficiency and performance of investments related to transportation is tested with models

produced through computer programs. There are management problems and irregularities in public transport systems in our cities as there is not a central authority in our country that regulates the working conditions in public transportation services and the standards that constitute the standards related to service quality. In addition to these shortcomings, transportation and traffic problems in cities are increasing, and service quality is decreasing as public transportation activities become commercialized. In public transport systems in our cities, the price and quality of service are determined to a large extent by the positive competition conditions created by the public enterprises that provide this service. The more powerful and widespread the services are provided by the public enterprises, the more effective they are in determining the price and quality.

II. DETERMINATION OF THE CURRENT SITUATION

2.1. Urban Travel Data

In order to demonstrate the characteristics of the trip in Hatay, the "Household Questionnaire" study was carried out to determine the age, gender, educational status, working status, income level, socioeconomic data were obtained. At the same time, the travel information of the person one day before was obtained by filling in the travel forms for each person living in the household (number of trips, trip start / end addresses, types of transportation used, number of trips and number of transfers etc.). This study used a random list of up to 12000 addresses obtained from the Turkey Statistical Institute. It has been noted that there is a set of 3 percent of the sample. If no one is home, an address has gone 3 times. Two substitution lists have been created to be used if there has been no interview after three visits. The household questionnaire conducted on these study lists was conducted in 12.000 households and the questionnaire study was carried out in one school period. Household work; taking into consideration the new district and neighborhood borders of Hatay, it was realized in 15 districts and 374 localities. In this study, the observation unit is the "journey".

Accurate measurement of travel rates is the most important component of transportation surveys. However, accurate measurement of travel/mobility ratios in studies with large sample sizes is very difficult due to "subject fatigue".

Table 1: Mobility Rates Determined in Household Questionnaires

Journey Aim	Gross Mobility	Net Mobility
Traveling from Home to Work	0,294	0,718
Traveling from Home to School	0,257	0,628

Traveling from Home to Others	0,269	0,656
Traveling Unrelated to home route	0,012	0,029
Total	0,832	2,031

Table 1 shows the net and gross mobility ratios obtained from household surveys. The gross mobility rate is derived from the entire population portion of the journeys made and the net mobility rate is derived from the portion of the journeys made for that purpose. Accordingly, the mobility rate in the field survey in 2016 was found to be gross 0,832.

2.2. Public Transport Data

In Hatay province Central Districts, all of the public transport services are provided by 9 cooperatives established in the city center or in the borders before the big city law. Some or close to each other are organized around a cooperative and carrying activities. All of these cooperatives, which provide public transport services, operate independently of each other and each enterprise prepares and implements its own work program.

A number of meetings were held with the president, administrators and cooperative members of the cooperatives providing public transportation services in the district in the section of Antakya districts of the rehabilitation works of the public transportation lines within the activities of Hatay Transportation Master Plan and the problems about the current structure, problems and anticipations were made. After this information has been evaluated, passenger counts have been made on the public transport lines and the number of lines, routes, number of working vehicles, number of passengers carried, operating speeds, The results of the field work were collected and tabulated.

The following data were collected via survey;

- Number of registered vehicles serviced during the day,
- The passenger carrying capacity of vehicles,
- Starting and finishing hours of the laps,
- Time-of-flight schedule,
- The length of the line,
- Number of tours in the day,
- Total number of laps
- A total time of one lap,
- Average commercial speed,
- The km per vehicle,
- Number of round trips per vehicle,
- The time of laps for vehicle,
- The total work duration of the vehicle,
- Working efficiency of the vehicle,
- Passenger number per tour,
- Passenger number per vehicle,
- Total number of passenger,

- The km per passenger

2.2.1. Travel Data and Census Results

This section has been analyzed from the point of view of the journeys within Antakya townships. Antakya district public transportation can be done on seven lines.

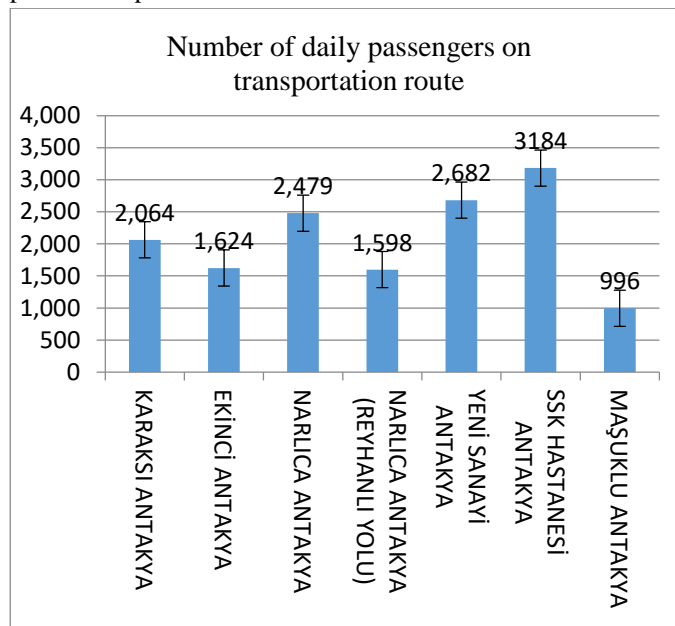


Fig. 1: Number of Daily Passengers on Transportation Route

As can be understood from Figure 1, there are big differences in daily average passenger numbers in the lines. SSK Hospital receives 3.184 passengers/day value in Antakya Central line and 996 passengers/day value in Maşuklu-Antakya Central Line.

2.2.2. Vehicles Data

In Antakya County, the average number of passengers per day is over 750 passengers/day. Public transportation services are provided by 230 different vehicles with 14 passengers carrying capacity by 6 different cooperatives. (Table 2)

Table 2: Number of Vehicles That Provide Public Transportation Services in Antakya District Lines

Name of Line	Number of Vehicles	Cooperative in public transportati on activity
Karaksı Antakya	23	S.S.112 Karaksı
Ekinci Antakya	34	S.S.105 Ekinci
Narlıca Antakya	21	S.S. 98 Narlıca
Narlıca Antakya 2	21	S.S. 98 Narlıca
Yeni Sanayi Antakya	47	S.S. 52 Yeni Sanayi

Ssk Hastanesi Antakya	55	S.S. 103 Ssk
Maşuklu Antakya	29	S.S. 134 Maşuklu
Total	230	

2.2.3. Age of Vehicles

The average age of vehicles providing public transport in the district is 14.77 and the ideal fleet, which is considered as 6 years according to European Union standards, is more than 2 times higher than the average age.

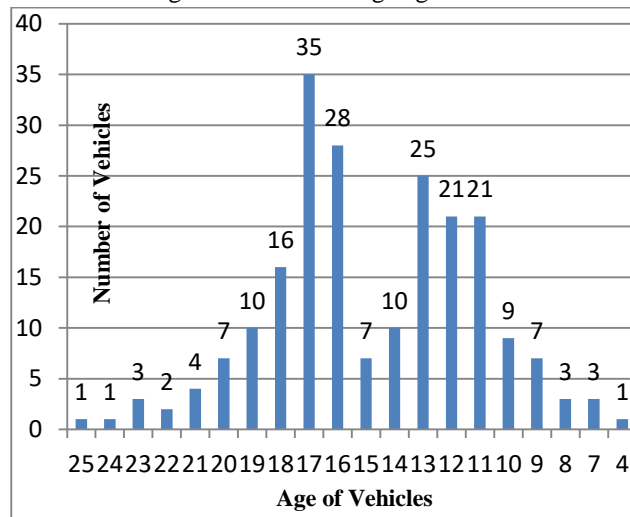


Fig. 2: Public Transport Vehicles Age Distribution

0.5% of the vehicles in the fleet are under 5 years old. The proportion of vehicles over the age of 11 completing the economic life in the system is 89.3%.(Fig.3)

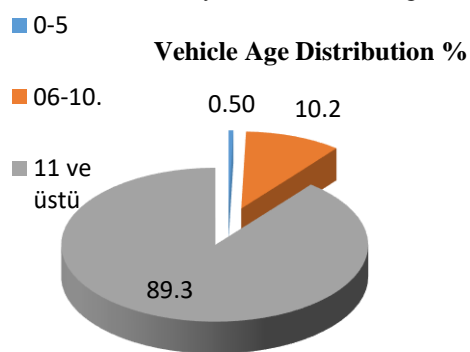


Fig. 3: Age Distribution of Public Transport Vehicles

The average age of minibuses that provide public transport services in the province of Antakya is higher than the average age of buses that provide public transport services in Istanbul, Ankara and Izmir. In other words, most of the vehicles that provide public transport services are made up of old vehicles that have completed their economic life.

2.2.4. Vehicle Capacities

A large part of the vehicles that provide public transportation services in Antakya district lines are 14 passenger capacity and there are small number of 15, 16 and 17 passenger carrying capacity vehicles.

2.2.5. *Vehicle Comfort*

The comfort of public transport vehicles in our cities has been greatly increased in recent years. Automatic gearbox, Euro 5-6 engine, air conditioner, low floor, electronic line indicator, GPS applications, etc. has become the standard for mass overflow vehicles. A large part of the public transport services, especially in our big cities, have these facilities. In Antakya there is no such equipment in most of the vehicles that provide public transportation services. The service quality of minibuses is also very low. Most of the services are provided by neglected, poorly equipped old vehicles. This greatly reduces the comfort of the transport services provided by the district.

2.3. *Performance Values Of The Lines*

Data showing performance criteria such as the number of passengers carried, the kilometers made per vehicle, the number of passengers transported per kilometer and the frequency of service were collected and analyzes related to the performance of the cooperatives providing public transportation services in the Antakya District were prepared.

2.3.1. *Number Of Daily Passengers Carried Per Vehicle*

Table 3: Number of Daily Passengers Carried Per Vehicle in Antakya District Lines

Name of the Lines	Average Number Of Passengers Per Day	Number of Vehicles	Daily Moved Per Vehicle Number of passengers
Karakşı Antakya	2.064	23	90
Ekinci Antakya	1.624	34	48
Narlıca Antakya	2.475	21	118
Narlıca Antakya (Reyhanlı Yolu)	1.602	21	76
Yeni Sanayi Antakya	2.682	47	57
Ssk Hastanesi Antakya	3.184	55	58
Maşuklu Antakya	996	29	34
Toplam	14.627	230	64

The number of passengers carried per vehicle is low because of the large number of vehicles providing public transport services (Table 3).

2.3.2. *Km Per Vehicle*

One of the most important indicators of productivity in public transport operators is the km values the vehicles make during the day. It is desirable that public transportation vehicles are in constant motion throughout the day and that they produce higher value services. The fact that the vehicles that provide public transport in the city have a low capacity during the day shows that there is an idle capacity. The lengths of the lines and the number of laps were determined during the data collection phase. By evaluating these data, the kilometers of the vehicles during the day are calculated and evaluated. As can be seen in Figure 4, roads between 35.05 km and 123.76 km are made per day on the lines and the average km per vehicle running on the lines is 62.74 km. When these data are evaluated, it is seen that the vehicles make mileage far below the standards when the daily mileage values per vehicle are taken into account.

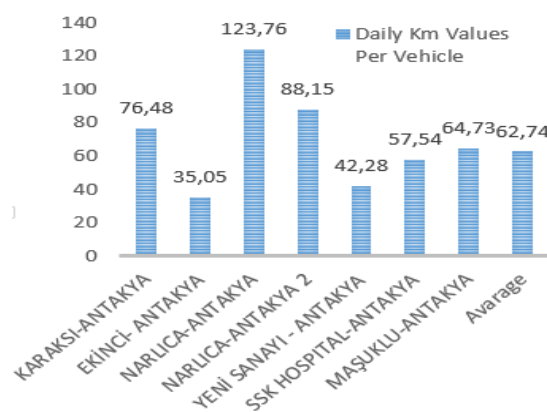


Fig. 4: Km Value Made Per Vehicle in Antakya District Lines.

Taking the 62,74 Km value per vehicle during the day, Antakya shows that the minibuses that provide public transport services in the city have an idle capacity of up to 75% due to vehicle overage.

2.3.3. *Number Of Passengers Per Kilometer*

One way of evaluating the number of passengers and thus their income is the number of passengers carried per kilometer. The low number of passengers carried per kilometer is an effective situation for income and productivity. During the collection of data, data such as the length of the lines, the number of laps, the number of passengers carried per day were obtained and the passenger counted per kilometer for the lines was calculated. Economically, sustainability requires passengers to carry passengers on a per-kilometer-per-kilometer vehicle in a minibus-based public transport service for a business.

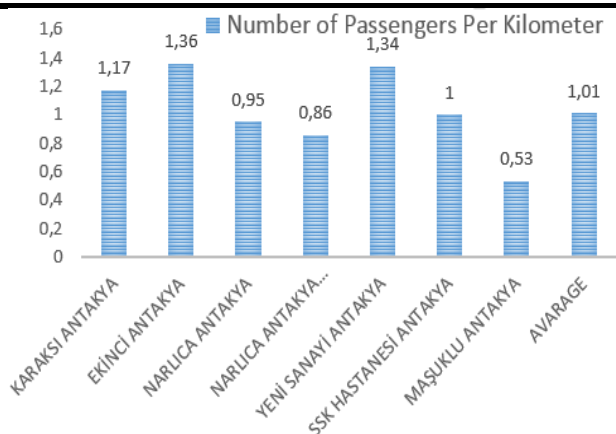


Fig. 5: Number of Passengers per Kilometer in Antakya District Lines

When the number of passengers carried per km is taken into account, the commercial potential of a part of the lines is low. (Figure 5)

2.3.4. Number of Tours per Vehicle

Due to the high number of vehicles on the line, the number of tours the vehicles make during the day is low.

Table 4: Number of Tour per Vehicle

Name of the Lines	Number of Vehicles	Number of Tour	Number of Tours per Vehicle
Karaksi-Antakya	23	60	2,61
Ekinci-Antakya	34	80	2,35
Narlıca-Antakya	21	102	4,86
Narlıca-Antakya 2	21	104	4,95
Yeni Sanayi-Antakya	47	180	3,83
Ssk Hastanesi-Antakya	55	160	2,91
Maşuklu-Antakya	29	76	2,62
Total	230	762	3,31

As seen in Table 4 and Figure 6, Ekinci-Antakya Central Line has the highest value with 2.35 rounds per vehicle and the lowest Narlıca-Antakya Central Line with 4.95 rounds per vehicle in terms of number of laps per vehicle on the district lines. The average number of laps per vehicle per day on the lines is 3.31.

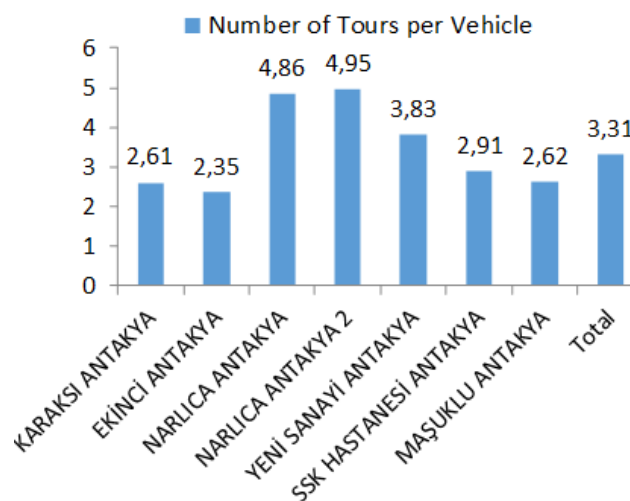


Fig. 6: Number of Tours per Vehicle

2.3.5. Average commercial Speeds

The average commercial speed of Antakya city buses varies significantly according to the lines they serve.

Table 5: Average commercial Speeds

Name of the Lines	Line Length (Km)	Travel Time (min)	Commercial Speeds (Km/h)
Karaksi-Antakya	29,32	34,2	25,71
Ekinci-Antakya	14,9	29	15,41
Narlıca-Antakya	25,49	27,97	27,34
Narlıca-Antakya 2	17,8	29,15	18,31
Yeni Sanayi-Antakya	11,04	21,55	15,36
Ssk Hastanesi-Antakya	19,78	30,46	19,48
Maşuklu-Antakya	24,7	27,2	27,24
Avarage			21,26

As you can see in Table 5 and Figure 7, the commercial speed at Narlıca-Antakya Central Line is 27,34 km/h and it is worth 15,36 km/h in Yeni Sanayi- Antakya Central Line. The average commercial speed on the lines is 21.26 Km/h.

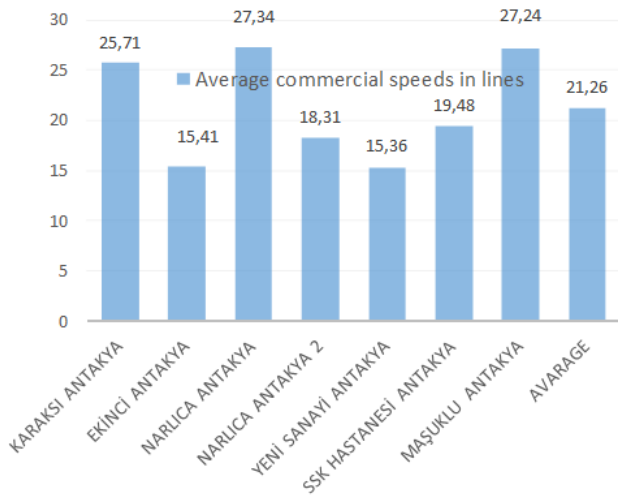


Fig. 7: Average commercial Speeds (Km/h)

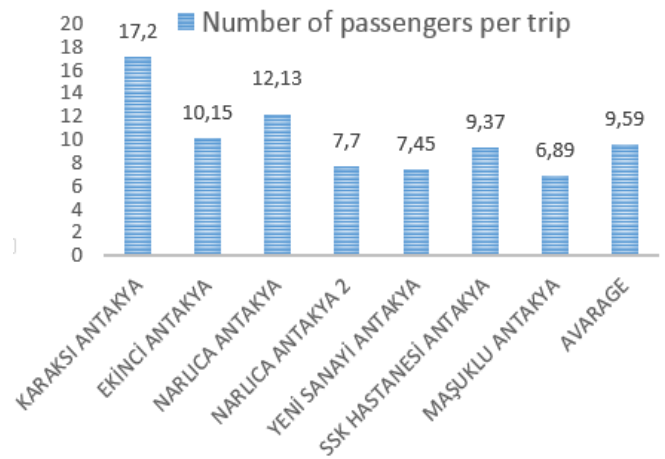


Fig. 8: Number of Passengers Per Trip

2.3.6. Number of Passengers Per Trip

The number of passengers carried by vehicles that provide public transport services within the city of Antakya is given in the table below on a line by line basis.

Table 6: Number of Passengers per Trip

Name of the Lines	Average Number of Passengers per Day	Number of Trip	Number of Passengers per Trip
Karaksi-Antakya	2.064	120	17,2
Ekinci-Antakya	1.624	160	10,15
Narlıca-Antakya	2.475	204	12,13
Narlıca-Antakya 2	1.602	208	7,70
Yeni Sanayi-Antakya	2.682	360	7,45
Ssk Hastanesi-Antakya	3124	320	9,37
Maşuklu-Antakya	996	152	6,89
Total	14627	1524	9,59

The average number of passengers carried per trip in Antakya district lines is 9.59. (Table 6)

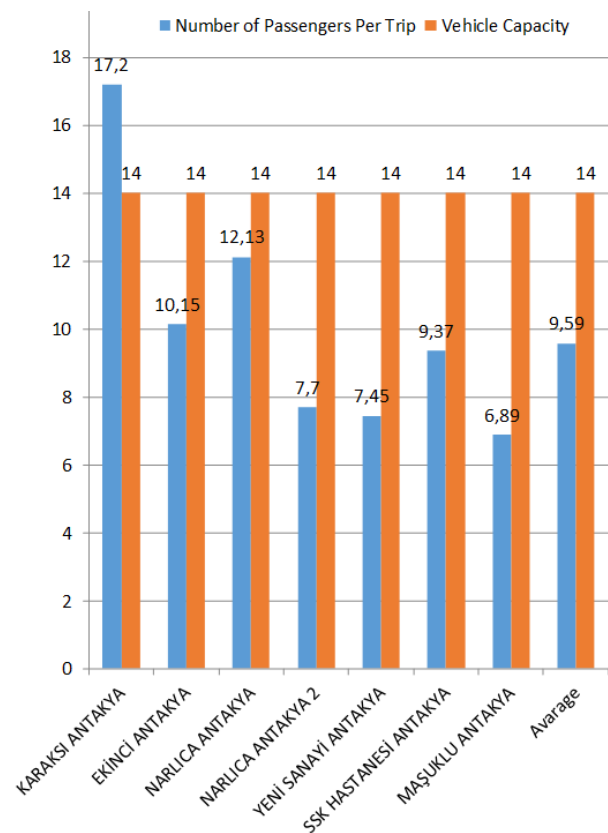


Fig. 9: Number of Passengers per Trip - Vehicle Capacity Comparison

As shown in Figure 9, the number of passengers carried on the Karaksi-Antakya line is higher than the average passenger carrying capacity of public transport vehicles. There is a need to increase flight numbers in terms of user satisfaction.

2.3.7. The Capacity Utilization Rate

The most important performance criterion that shows the capacity utilization rate in public transport vehicles is the km that it carries during the day. Capacity utilization ratios

are taken out on the basis of line making 250 km of each vehicle during the day and the table below is given.

Table 7: Operational Efficiency in Lines

Name of the Lines	Km per Vehicle	Operational Efficiency in Lines %
Karakı-Antakya	76,48	30
Ekinci-Antakya	35,05	14
Narlıca-Antakya	123,76	50
Narlıca-Antakya 2	88,15	35
Yeni Sanayi-Antakya	42,28	16
Ssk Hastanesi-Antakya	57,54	23
Maşuklu-Antakya	64,73	25
Total	62,74	28

Some vehicles cannot be operated during the day because of the excessive amount of vehicles. In addition to this, the vehicles are still operating with low performance during the day due to the high number of vehicles on the lines. The average efficiency of the lines is 28%. (Table 7 and Figure 10).

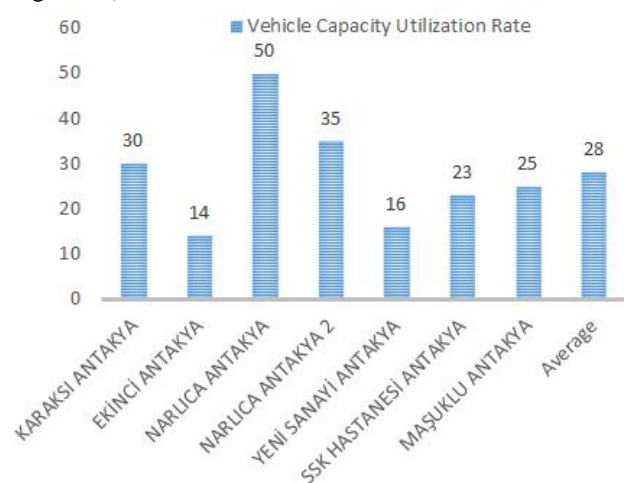


Fig. 10. Vehicle Capacity Utilization Rate in Lines

III. CONCLUSION

To expand public transport services in metropolitan cities is possible only by increasing the quality of the services and bringing them to the users on more economic conditions by integrating the business activities into an institutional structure, integrating public transport enterprises into one and planning and managing them in a unified way. Where public transport activities cannot be incorporated into an institutional structure throughout the city, hundreds of individual operators operate without any coordination between them. For this reason, efficient

operation of system, lines and vehicles is not possible. In order to get rid of the clutter and inefficiency of the public transport system in Hatay, it is necessary to plan and manage the public transportation related management, investment, auditing and business activities in a single institution and to plan and manage them from one hand. For this reason, public transport systems with different status, business model and vehicle capacity within the public transport system should be incorporated into an institutional structure and operated in a system integrity. In Hatay, collective transportation activities should be planned and managed from one hand, transportation statistics should be collected on system, corridor, line, vehicle basis and transportation planning should be done in order to ensure co-operation between public transportation types in order to provide business integration in public transportation system in Hatay. Hatay should have a sufficient number of specialized personnel and technical equipment in order to carry out the organizational structure planning, management, auditing and operation activities that will ensure the integration of the public transportation system.

The main problem in terms of public transport in our cities is that it is impossible to develop an integrated public transport system that takes into account existing facilities and ensures cooperation between the species preventing competition. In Hatay, where almost all of public transportation services are provided by private operators, it is suggested that the priority in solving public transport problems should be given to the rehabilitation of the private operators that constitute the existing mass transportation system.

For the rehabilitation of the existing public transport system in Hatay, firstly;

- To reduce the number of vehicles providing public transport services,
- The integration of enterprises,
- The establishment of the Public Transport Hierarchy,
- In order to ensure wage integration,
- Regional pools there needs to be created.

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Analysis of Box Culvert to Reduce Stress Values

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Abstract—At the time of construction of roads, highways a structure is placed (commonly used) to transfer the traffic, rain water, drainage from one side to another of the road is called a culvert placed beneath the road. Due to the structural use, multiple loads are placed on the box causing various types of stress which occurs on it. The paper tries to reduce the stress occurred in the box by flaring the box partially.

Keywords—Box culvert, flared portion, pressure cases, side walls, staad pro.

I. INTRODUCTION

Culvert is an underpass provided beneath the high way which under goes various types of loading .It helps to facilities the flow of water, provide cross drainage, roadways or railways, to take electrical or other cables from one side of road to another side of the road . due construction of these high load bearing components various stress and shear gets generated in very high values the paper objects to reduce the values of the stress which have been generated for various cases.

II. TYPES OF CULVERTS

1 On basis of shape:-

- 1.1 Pipe culvert
- 1.2 Pipe Arch culvert
- 1.3 Box Culvert (single/multiple)
- 1.4 Arch culvert
- 1.5 Bridge culvert

2 On basis of material used:-

- 2.1 Concrete
- 2.2 Steel
- 2.3 Plastic
- 2.4 Aluminum
- 2.5 High density polyethylene

III. CASES TO BE SOLVED

For the purpose of design, culverts are subjected to following cases:-

Case-1:Dead Load, Live Load and Earth Pressure Acting from Outside, no Water Pressure Acting from Inside.

Case-2:Dead Load, Live Load and Earth Pressure Acting from Outside, Water Pressure Acting from Inside.

Case-3:Dead Load and Earth Pressure Acting from Outside, no Water Pressure Acting from Inside.

IV. PARAMETERS USED

- 1 Plate thickness= 0.30m
- 2 Length =10.50m
- 3 Width =3.80m
- 4 Flared width= 1.05m
- 5 Support= Fixed Type
- 6 Live Load on top slab= 6420kg/m²
- 7 Earth Pressure Load from bottom slab= 7860kg/m²
- 8 Earth Pressure Load on side walls= 1900-4180kg/m²(case 2)
- 9 Earth pressure Load on side walls= 400-2280kg/m²(case 3)
- 10 Water pressure Load on inside side walls= 0-3800kg/m²
- 11 Coefficient of Active Earth pressure = 1/3
- 12 E= 2.17185e+007
- 13 Poisson= 0.17
- 14 Density = 25
- 15 Damping=0.05
- 16 Strength FCU = 25000

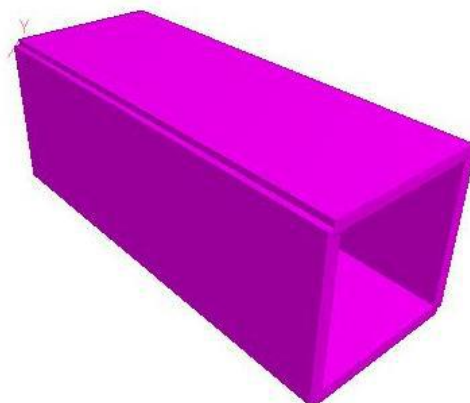


Fig.1: 3-D View of Flared Box Culvert

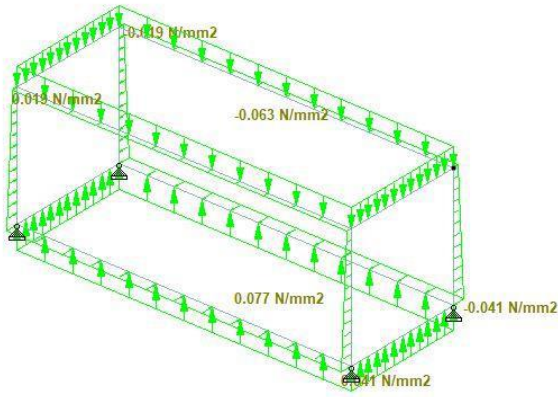


Fig.2: Case -1 of Box Culvert

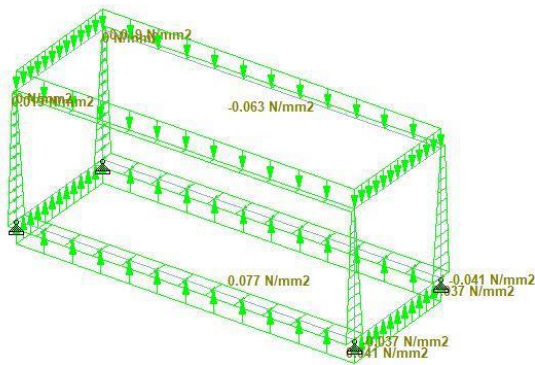


Fig.3: Case -2 of Box Culvert

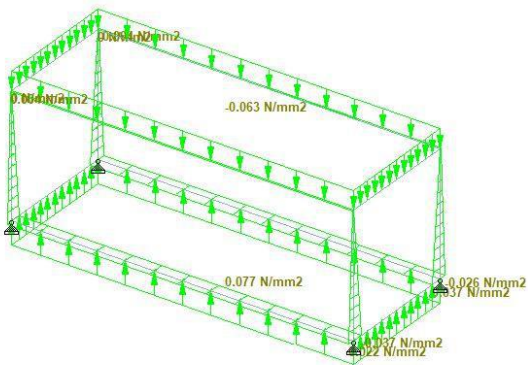


Fig.4: Case-3 of Box Culvert

V. RESULT AND DISCUSSIONS

1. PRINCIPAL TOP values declined in case 1 by 49.36% when there is an increase of flared portion from 0mm to 70mm.
2. PRINCIPAL TOP values declined in case 2 by 71.36% when there is an increase of flared portion from 0mm to 70mm.
3. PRINCIPAL TOP values declined in case 3 by 95.80% when there is an increase of flared portion from 0mm to 70mm.
4. TRESCA values declined in case 1 by 25.75% when

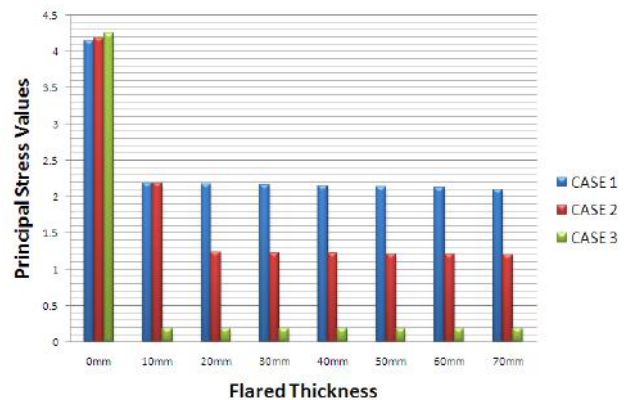
there is an increase of flared portion from 0mm to 70mm

5. TRESCA values declined in case 2 by 37.97% when there is an increase of flared portion from 0mm to 70mm
6. TRESCA values declined in case 3 by 52.55% when there is an increase of flared portion from 0mm to 70mm
7. VONMISS values declined in case 1 by 30.62% when there is an increase of flared portion from 0mm to 70mm
8. VONMISS values declined in case 2 by 40.81% when there is an increase of flared portion from 0mm to 70mm
9. VONMISS values declined in case 3 by 49.24% when there is an increase of flared portion from 0mm to 70mm.

Detailed values are described in tables shown below:-

Table.1: For Analysis of Principle Top in Box Culvert

FLARED PORTION	PRINCIPAL TOP(KN/MMSQ)		
	C1	C2	C3
0MM	4.147	4.19	4.243
10MM	2.185	2.185	0.179
20MM	2.171	1.228	0.179
30MM	2.157	1.221	0.178
40MM	2.142	1.215	0.178
50MM	2.128	1.208	0.178
60MM	2.114	1.201	0.178
70MM	2.1	1.2	0.178



Graph 1- Principle Stress Values v/s Flared Thickness

Table.2: For Analysis of Tresca in Box Culvert

FLARED PORTION	TRESCA IN (KN/MMSQ)		
	CASE1	CASE2	CASE3
0MM	6.519	6.125	5.67
10MM	4.983	4.983	2.738
20MM	4.959	3.866	2.728
30MM	4.936	3.849	2.719
40MM	4.913	3.832	2.71

50MM	4.891	3.816	2.701
60MM	4.867	3.8	2.69
70MM	4.84	3.8	2.69

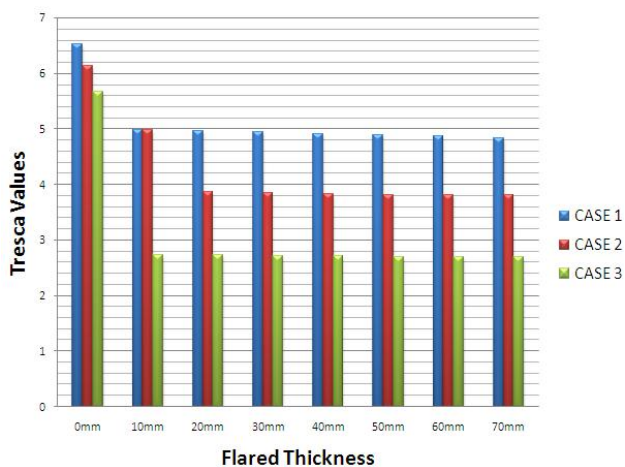
- Principal stress declined and gave a positive response for structural change.
- Tresca values also dropped.

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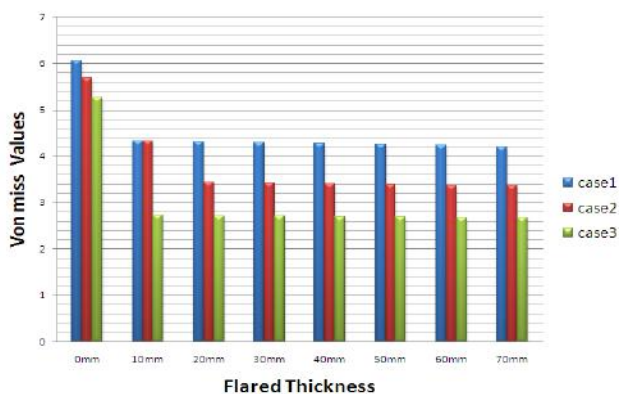
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Graph.2: Tresca Values v/s Flared Thickness

Table.3: For Analysis of Von miss in Box Culvert

FLARED PORTION	VONMISS IN (KN/MMSQ)		
	CASE1	CASE2	CASE3
0MM	6.054	5.689	5.266
10MM	4.326	4.326	2.717
20MM	4.306	3.423	2.709
30MM	4.286	3.409	2.7
40MM	4.266	3.395	2.691
50MM	4.246	3.381	2.682
60MM	4.227	3.367	2.673
70MM	4.2	3.367	2.673



Graph.3: Von miss Values v/s Flared Thickness

VI. CONCLUSION

- By usage of Staad pro software analysis of structure was thoroughly done.
- Shear values decreased on increment of flared portion.
- Vonmiss values decreased very fast and remained constant on further increment of thickness.

Investigation of Daily Macronutrient intakes by Sri Lankan Managerial Level Employees working in the Private Sector

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Abstract— With changes of lifestyles and social values in the food culture, many individuals working as managerial level employees in the as private sector are seemingly selecting more improper daily meal combinations. This study was designed to determine whether this occurrence can have a severe impact to imbalance the daily nutrient intakes by the individuals in the mentioned social segment, which increase the tendency of having nutrition related chronic diseases. In a hierarchy range from junior executives to CEOs of private sector organizations, 800 individuals were selected by disproportionate stratified random sampling. Selected individuals are interviewed using a structured questionnaire to assess their daily food combinations and their consumed portion sizes. Frequently consumed meal combinations were then analyzed for their macronutrient composition, to compare with world Health organizations' (WHO) Reference Dietary Intake (RDI) levels of nutrients. The results reveal of significantly ($p < 0.05$) higher daily fat (45.3 ± 1.7 g/day) and protein (65.2 ± 1.4 g/day) intakes than the WHO recommendation levels and significantly ($p < 0.05$) lower in dietary fibre (22.3 ± 1.1 g/day) contents by selected participants. Carbohydrate intake (133.1 ± 2.2 g/day) was higher than reference levels but was not significant ($p > 0.05$). This indicates of a considerable risk for many individuals in the concerned social segment, of having non-communicable diseases, if observed dietary patterns are continued.

Keywords— dietary fibre, protein, fats, carbohydrates, Managerial-level-employees, Private-sector

I. INTRODUCTION

With increased urbanization, energy-rich diets containing higher amount of fat and sugar, which also provide less dietary fibre and essential micronutrients are being frequently consumed, particularly by high income groups. In addition, the urban population is turning to be more sedentary with little physical activity. Consumption of

alcohol, providing empty calories, and tobacco use is also common among them. Hence, prevalence of disorders like obesity, heart disease, hypertension (high blood pressure) diabetes and certain types of cancers is on the increase.

Managerial level employees who are recognized to be spending a more sedentary lifestyle with higher stress conditions (Jayasinghe *et al.*, 2015), are seemingly highly susceptible for the above mentioned health risks. Therefore, this study provides valid information about their current macronutrient intakes, in aim to organize daily meal plans in a proper way, as this valuable social segment in the country could prevent nutrition related chronic diseases in future.

II. MATERIALS AND METHODS

2.1 Community survey

A community study was carried out to identify the portion sizes, varieties of selected foods regularly consumed by employees in the private sector who are positioned in between Junior Executive level and CEO in the hierarchy. The study was included randomly selected 800 private sector managerial level employees in the age range 25 yrs. – 54 yrs., covering all provinces of the country, elected according to the “disproportionate stratified random sampling technique”. Individuals were questioned broadly according to a questionnaire structure prepared. The sample population contained. Among the districts, the sample sizes were determined according to their population ratios. As the UK National Nutrition and Dietary Survey (NDNS) collected dietary details from 1724 participants from a population of 60 million (Nelson *et al.*, 1997), it was assumed that the sample size of 800 used in the current study is within adequate limits.

Managerial level employees were mainly selected from the private sector in urban areas, aiming to reveal the realistic impact of changed lifestyles in nutrient intakes. The approximate grid made for the sample selection in

the survey is indicated in the figure 1. As shown, it has covered more urban areas than rural.

2.2 Questionnaire formation

Major aim in designing the questionnaire was to assess the realistic nutrition intake Managerial level employees working in the private sector. This included sections to put information about the frequently consumed food varieties, their processing / cooking methods and also the portion sizes.

2.3 Data collection

The field level implementation was carried out by colleagues volunteered to help as surveyors in this research project. All of them were associated with government Universities island-wide who have completed at least B.Sc. level qualifications. Questionnaires were filled by surveyors while interviewing candidates. Broad explanations were given about how to answer the questions properly. Among the different provinces of the country, numbers of volunteers was selected, considering the relative population sizes of managerial level employees. Not more than one member from a family was interviewed and hence, all the individuals represent different 800 households. Activities undertaken by each surveyor included: conducting interviews and collecting completed questionnaires. If there were any missing information in questionnaires, relative volunteers were contacted again and relevant information obtained.

2.4 Training of surveyors

An informative practicing session was conducted at first focused on field data collection procedures, and management of other aspects of the survey. The training agenda included inputs on purpose of the study, responsibilities of each member of the survey team. Training in interviewing techniques was carried out through detailed explanation of the contents of the questionnaire, mock interviews and checking of data to ensure the completeness of the questionnaire.

Need to ensure quality of data collected was emphasized throughout the training including conduct of quality checks at the field level.

2.5 Interviewing at the organizational / household level

Administration of the questionnaires was done by the trained surveyors. The questionnaire included several sections, some of which relate to household demographics, and socioeconomic characteristics. Major questions were designed to thoroughly understand the lifestyle impacts on dietary patterns and the variety of frequently consumed foods cum their regular portion sizes. The 24 hour dietary recall was done for 4 days, but altogether dietary assumptions were reported considering an years' time period back. When there were incredible deviants of frequent meal combinations consumed in the entire year rather than the 4 days considered for the recall,

those combinations were included for the identified diet lists. The names of respondents and identification data on the organizations and households were kept strictly confidential.

2.6 Determination of proximate compositions of macronutrients

Homogeneous mixtures were made using the most frequently consumed meal combinations consumed by individuals. Then nutrient contents of actual portion sizes were calculated. Proximate analysis was done for moisture, digestible carbohydrates, insoluble dietary fibre, soluble dietary fibre, fat, protein, Vitamins and minerals. Obtained values were indicated in dry weight basis.

2.7 Statistical Analysis

The results of the nutrient compositions were analyzed by the two tailed unpaired T-test using Microsoft Excel 2013 at 95% confidence level. Mean percentages of macronutrient contents were calculated with their standard deviation values. Two tailed paired t-test was performed to investigate of any existing significant differences between the Reference Dietary Intake Guideline (RDI) values of nutrients provided by the World Health Organization (WHO) and actually consumed food combinations. Average nutrient contents of test foods identified from each district was compared separately with RDI s. The Q-test was performed to identify the existing outliers among the volunteers.

III. RESULTS AND DISCUSSION

The daily dietary fibre content taken by were significantly ($p < 0.05$) lower (Table 1) than the daily requirements and it may result in severe bowel disorders and other non-communicable health disorders if continued in this habit (Mathur *et al.*, 2005).

Significantly ($p < 0.05$) excessive daily protein intakes by participants was visible (Table 1), where it alarms a severe threat to the physically least active individuals.

Carbohydrate intakes were found to be higher than the RDI (Figure 2), but the difference was not significant ($p > 0.05$).

Daily fat consumption was significantly high ($p < 0.05$) in managerial level employees (Figure 2). The population sample represented the ones who are mainly working in urban areas, where fast food outlets were common, which can be assumed for one of the main reasons for this occurrence. During the interviews, 71.5 % of them mentioned that due to the mental stress they undergo during the long hours of work, they repel balanced, nourishes diets and go for the 'tasty' fast foods to satisfy their minds. Another main reason was the convenience due to lack of time for food consumption in working days. Overall, 44.1% of participants mentioned the selection of fast food as a matter of convenience

There was another hindered factor revealed during the interviews after questioning the individuals, which revealed that; due to the socio-trend pressure, 36.2% of the individuals, are going for the famous branded fast food outlets located in urban areas frequently.

The major outbreak of with respect to revealed factors of the macronutrient consumption rates was seen regard to dietary fibre, which was significantly low ($p < 0.05$) in daily intakes with a minimal p value (Table 1 and Figure 2). The change of lifestyles was identified as the main reason, which has lead them to consume processed foods and fast food rich in fat, proteins and carbohydrates but lack in fibre.

Another main factor affected was the unawareness of the abundant rich dietary fibre sources which are readily available. Overall, 53.4% were only considering quite a few sources as rich in fibre such as *Lasia spinosa* (Kohila) and *Cartica papaya* (Papaya), not being aware of many other fibre rich sources which are abundant in the local market. The change of attitudes in the society has changed the food culture in a great deal in urban as well as sub urban areas, where valuable natural sources have been replaced by convenient processed foods.

Our observations were supported by previous research findings of Jayewardene *et al* (2012) which showed low mean daily intake of fruits and vegetables among Sri Lankan adults (2.16 portions) compared with the USA (3.0) and France (3.6).

Although we care less about the nutritional and health requirements of the common social segments, they are the ones who are mostly vulnerable non-communicable diseases at some part of their life. Therefore, it is necessary to prevent that by providing them necessary guidelines. When life is normal, people are less concerned about the nutritional needs, and lead in to severe diseases with time, without intention.

IV. FIGURES AND TABLES

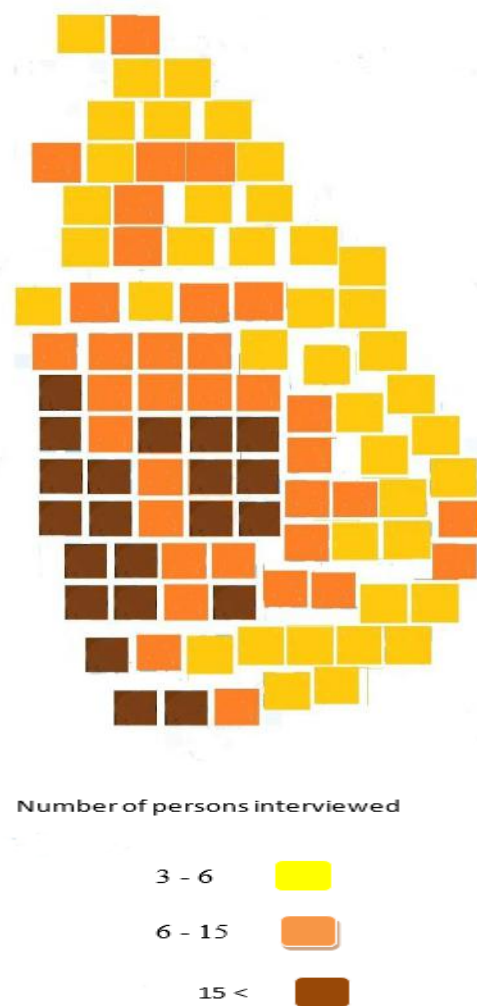


Fig.1: The grid; Sample population of selection

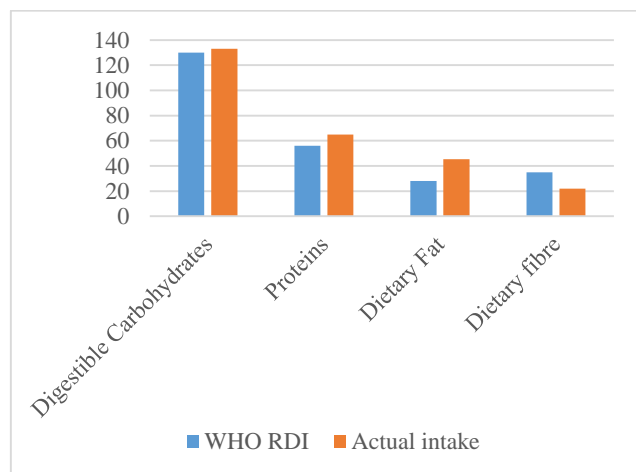


Fig.2: Macronutrient intake comparison with WHO RDI values

Table.1: Comparison of Macronutrient intakes with WHO Reference levels

Nutrient	WHO RDI (g)	Actual intake (g)	P Value
Digestible Carbohydrates	130	133.1 ± 2.2	0.22
Proteins	56	65.2 ± 1.4	0.03
Dietary Fat	28	45.3 ± 1.7	0.006
Dietary fibre	35	22.3 ± 1.1	0.005

V. CONCLUSION

Most frequently consumed meal combinations by local managerial level employees in the private sector are significantly ($p < 0.05$) higher in fat and protein contents than the WHO recommendation levels. Those were significantly lower in dietary fibre contents. This alarms of possible high number of nutrition related chronic disease occurrences among individuals in this particular social segment in future.

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Fear Heuristics in Forced Settlements and the Socio-Environmental Crisis

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Abstract— *The heuristics of fear refers to the negative motivation which awakes as one responsible action, to adopte wise choice to do care with attention for life today and in future. The question to be answered is how is the ethical involvement regarding the social-environmental insecure in the settlement in Porto Velho at Nova Mutum Paraná? As argumentation, apply the U Theory and Eco-development Theory. The principal objective of this article is to analyze the heuristics of fear in a social system in the settlement established in Nova Mutum Paraná, City of Porto Velho, Rondonia, Brazil; and the specific objectives are the following: seek the cause-effect phenomenon of the fear in the social system in the Novo Mutum Paraná settlement (1); establish the social-environment responsibilities due to the settle (2); and indicate the possible convergence in perspective of the U Theory (3). Apply the study of cases method and its procedures. As consequence of the ethical implications of social-environmental unsafe in the settlement is delineated by the legal responsibility and the ethical responsibility. The innovation in the hyper-complexity of the system which causes eviction, deterritorialization requires the ability to operate from the deepest fields of social emergency and activates the sources of social fields. Should be adjusted (tuned) in every single involved, as following: open mind, open heart, and open goodwill; educate to be prudent with the heuristic of hope. This article will be the concern to researchers and other people involved on theoretical*

questions to delineate investigations about applied social sciences.

Keywords— *Forced settlements. Heuristic of fear. Socio-environmental responsibility. Theory of Ecodevelopment. Theory U.*

I. INTRODUCTION

The heuristic of fear refers to the fear that awakens to action with responsibility for life today and in the future, where fear and respect for being are the fundamental and inalienable conditions for the formulation of the ethics of responsibility. With the implementation of the Jirau hydroelectric plant, a municipality in the state of Rondônia, there was a deterritorialization of the local inhabitants of the village of Mutum Paraná, which led to the consequences and losses that compensatory means will never provide. The question to be answered is: how are the ethical implications of socioenvironmental insecurity characterized in forced settlement in the municipality of Nova Mutum Paraná in Porto Velho?

This research aims to study the heuristic of fear in the social system of forced settlement located in Nova Mutum Paraná, municipality of Porto Velho, State of Rondônia. Specifically, it aims to: raise the cause-effect phenomenon of fear in the forced social system in the settlement of Nova Mutum Paraná (1); characterize the social and environmental responsibility resulting from

forced settlement (2); and point the way of convergence possible in the face of the application of Theory U (3).

This work, after this introduction, is divided in the theoretical-conceptual revision dealing with the main approaches raised in the literature, the preparation methodology, the results according to the objectives presented, the conclusion answering the research question, and the references of the works accessed who supported this study.

II. THEORETICAL-CONCEPTUAL REVIEW

Concepts of fear heuristics and forced settlements in the municipality are considered essential, since in the municipality of Porto Velho, in the state of Rondônia, there is a specific social and environmental crisis in the settlement of displaced persons due to the construction of hydroelectric plants, which was forcibly generated. In order to substantiate the object under study, Ecodesign Development Theory and Theory U were inserted, which seemed the most adequate to enable the recognition of the causes of existing problems and the way of convergence to solve these problems.

2.1 Concepts on the heuristics of fear, ethics and forced settlements in the municipality

Decisions and answers can be complex, difficult or not, because the human being uses mental shortcuts called heuristics, techniques of thought and behavior inherent to the human being that reacts, almost intuitively, trying to find immediate and easy answers to their concerns, no matter whether right or wrong. For the forced settlement Nova Mutum Paraná, decisions were made that caused socio-environmental effects in the municipality of Porto Alegre, which now need solutions.

2.1.1 Concepts on heuristics of fear and ethics

According to Abramovay (2016), individuals are led to close over their social reference groups, to persist in the legitimacy of their lifestyles, and to deny changes in their habits; a conclusion of studies of human behavior from the angle of culture, psychology and ethics. Studies in Moreira (2016), based on the principle of the responsibility of the philosopher Hans Jonas, address the concept of ethics as guiding human actions in this contemporary reality, warning of an ethics of responsibility, capable of stopping huge progress with good sense, hindering the power of men to self-destruct, a concept that will permeate this work.

In studies by Pereira (2016) the effects of the modern rationalization process, such as the two World Wars, are approached when philosophers questioned the project of modernity and its consequences, identifying two positions: those who look favorably and those who point to risks and limits. The author compares statements by

philosophers Zygmunt Bauman and Hans Jonas that warn of the risks in human existence. For Bauman the project of modernity comes down to establishing an artificial social order by means of a systematic distance from what escapes from the rational order, and this project is contradictory, since what it denies constitutes the force that puts it in motion, that is, ambivalence (contingency). Zolet (2016) discusses Hans Jonas that presents the limit situation that leads to the modern rationalization of the immediate solutions presented by the technique to the daily problems; man goes so far as to endanger existence. Bauman and Jonas converge on the process of rationalization of modernity and its negative consequences.

When fear is a responsible fear, it becomes an invitation to action and not to stagnation; this is necessary and positive. Therefore, it becomes a question of ethics of responsibility towards future generations; affirmations of Battestin and Nogaró (2017). Nodari (2014) corroborates that this positive kind of fear that is rethought by having the will of the worst is avoided is essential and leads to an ethical attitude that is fundamental, making it possible to reflect and act on the tomorrow of humanity.

Therefore, the heuristic of fear does not refer to the pathological fear, but to the one that awakens to action with responsibility. It is not the unfeasible fear of the future, but a responsible choice to have zeal and care for life today and in the future. Zolet (2016) argues that for Jonas, fear and respect for being are the fundamental and inalienable conditions for the formulation of the ethics of responsibility and that this heuristic of fear (fear) is imbued with hope of avoiding greater evils, transforming - in heuristics of hope.

2.1.2 Concept of forced settings and its social system

According to Nascimento (2017), with the advent of political states there are, historically, forced settlements; those where the state and / or different and stronger social groups have forced other groups to vacate their spaces for others, by the force of the state in favor of enterprises that aim at the profit or improvement of an entire nation; such as the construction of large hydroelectric plants, such as the forced settlement of Nova Mutum Paraná. The author affirms that there is no way to deal with the subject Mutum Paraná without understanding that there is a specific territory, fundamental in the construction of the subject, its identity and, also, its subjectivity, space of reception of the population that develops social life there, economic activity and political organization; there is a social dynamic in motion that characterizes territoriality. Therefore, the full valorization of the territory is natural and inherent to the local inhabitant.

Ribeiro and Moret (2014), when dealing with these relocated communities, address the negative reflexes in economic and cultural conditions, and the confrontation

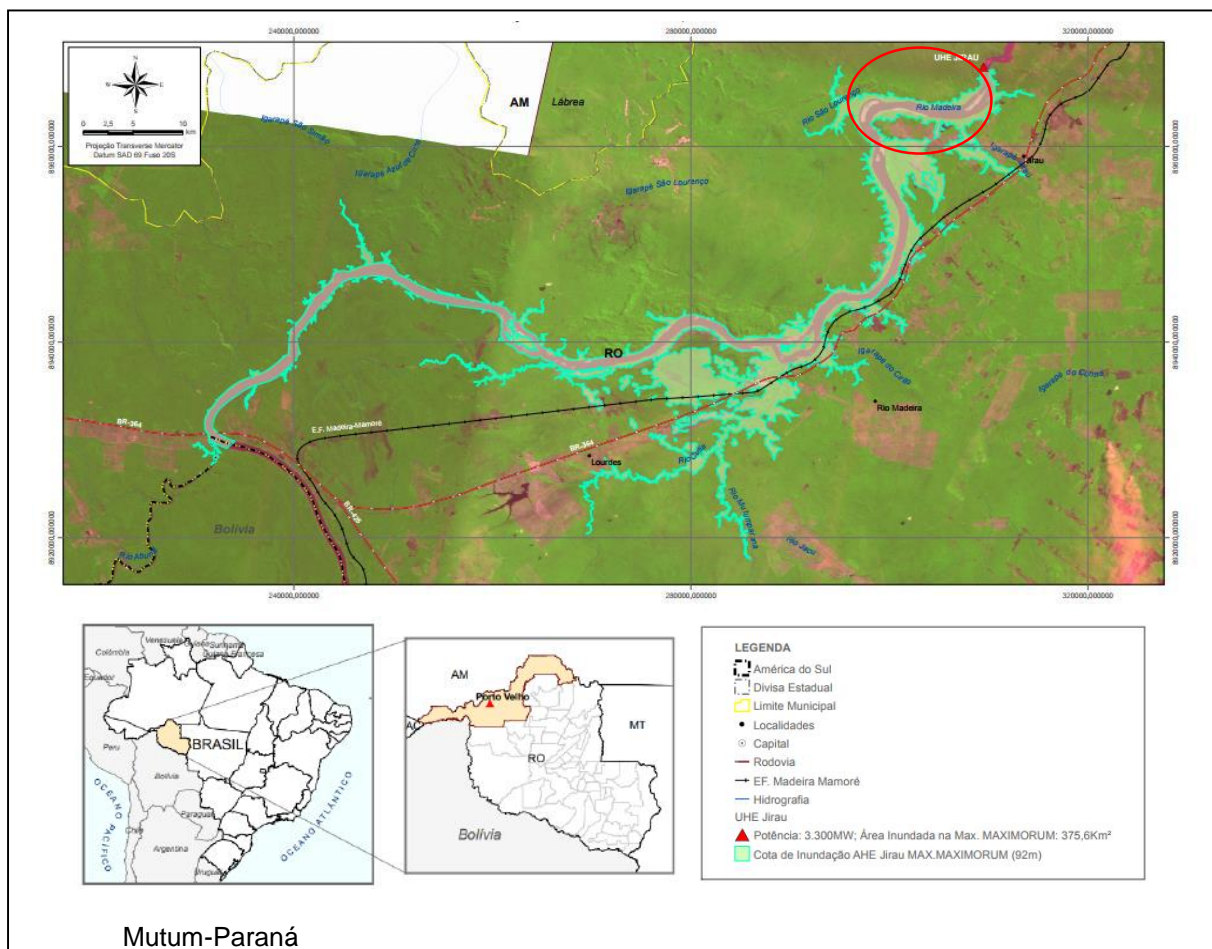
in routines unrelated to their traditional knowledge, aggravated by the lack of structural unemployment and the demobilization of the workforce of the construction of the Hydroelectric Power Plants that started to swell the settled community.

Nascimento (2017) affirms that in the capitalist conflict, capital and labor collide, there is a movement in search of conditions of production with low cost, aiming profit; not infrequently, leading to the destruction of geographical landscapes and the forced displacement of peripheral populations; the greed for productivity and profitability that has led companies and states to co-opt, to the detriment of populations with no power of action; was what happened with Vila Mutum Paraná. As a consequence of the implantation of the Jirau hydroelectric plant, there was a deterritorialization of the local inhabitants that implied in sufferings, since the individual felt the loss of what was built for years and that constituted his own reality where was articulated its structure, its functionality and its values symbolic. The change implies adequacy to the new environment, satisfying the basic needs of maintenance,

housing and sociability, including religious practice, human dignity, family and child rearing; constitutional right.

Legally, the principle must be that of submission of the State to the Law. The author goes on to say that the problem lies in the lack of sufficient demand for extensive work to raise awareness of the population, uninteresting with the public power, once the people are clarified of their rights and how to act to obtain them. It becomes a real threat to the ruling political class and manipulates its own economic and power interests. In this case, socio-environmental education depends on the performance of: government, family, school and society bodies. Public authorities should legislate and provide the entire population with the necessary environmental education; which has been standardized for decades, and it is the duty of the State to adopt measures for the preservation of the environment, as well as the recovery and restoration of degraded areas, punishment of violators and awareness of society. Next, in Map 1, the Jirau Hydroelectric is presented in the area of the municipality of Porto Velho.

Map 1: Jirau Hydroelectrical Power Plan in Porto Velho, Capital of Rondônia, Brazil



Source: Adapted from Agência Nacional de Energia Elétrica [ANEEL] (2007).

At the time the population of the Village of Mutum Paraná revolved around a thousand and six hundred inhabitants who lived for months the expectation of removal to the new village that came to be denominated of New Mutum Paraná. Map 2 shows the location of the old village of Mutum Paraná.

Map.2: Mutum-Paraná District location map



Source: Adapted from Moret and Ferreira (2009).

Nascimento (2017) states that these families were almost without the historical record of their memories, except for some articles and scientific works, which means to tear a collective identity that had its beginning in the middle of the eighteenth century, by the arrival of rubber tappers and gold diggers. The Madeira Mamoré Railway and BR 364 crossed the old village, times of expectations of progress; today, with hydroelectric plants, expectations continue for the nation and end for the people of Mutum Paraná.

2.1.3 Municipality concepts

In studies by Pena (2017), there is a difference between concepts of city and municipality: one refers to human occupation and the other to territorial delimitation by foreign exchange. Municipality is a legal division of a certain territory, part of a State, administered by a city hall. Already, city is the urban area of a municipality, delimited by an urban perimeter and that separates between the city (urban area) and the countryside (rural area). The municipality, by legal provision, may have other smaller cities besides the host district. They do not have sufficient political autonomy for emancipation. They are the villages, the towns, the districts and others.

In Pena (2017) approach, cities exist that occupy every area of the municipality and thus are city and municipality at the same time. There are also cities that are

physically linked to other cities, sometimes separated by a street; though different, form a continuous space called a conurbation. When a large city has several conurbations, it means that several cities are linked to a larger city. This is called the metropolitan region, which has a functional character, and is intended to integrate into the organization, planning and execution of public functions of common interest, as Mendes (2016) treats.

Mendes (2016) states that municipality contains a concept of jurisdictional power, that is, limited by a legal jurisdiction granted by greater power. This power is applied through laws and policies developed so that a given geographic space is governed; concerns a municipality whose municipality is part of the administrative division of one State and both of a country. The municipal power is restricted to a specific territory and refers to organizations and institutions that allow certain governmental measures to be carried out within a specific municipality and which consequently obey state and federal laws. The municipal power is dependent on the state government and both of the federal central power.

2.2 Concepts on Theory of Ecodesenvolvimento

Studies in Silva (2013) on the precepts of Ignacy Sachs, author of ecodevelopment theory, this one deals with the conservation of biodiversity, respect and territorial management as an ethical ideal and care for future

generations to stay on this planet. Silva (2013) states that, for Sachs, the creation of forest reserves represents self-defeated politics from the point of view of environmental preservation; since it violates the right to life because it entails the withdrawal of the population living in it and dependent on certain natural spaces and natural resources, as the only means of survival for the ecodevelopment.

Studies in Pedro Filho (2015) point to the tense dualism in the 1970s, in Stockholm, which persists to this day, between developmentalists at any cost and those who defend the environment, above development. At that time, economic development theory, interpretive of capitalism, disregarded environmental components, renewable or not; there was not the pressure of human activities on the environment reached a critical state.

The consequences of the economic development of life and human health, according to Sachs (1981, p. 14), are a work nature. way to join the futures of this generation and all future companies the possibility of developing; What for Hans Jonas, in Moreira's studies (2016), is the Principle of Responsibility, where all feelings are direct, with nature, with the life and future of children and other generations, collectively: Imperative Ecological ethical of Jonah; Differently from Kant's categorical imperative, restricted to individual (private) behavior.

The Ecodevelopment Theory was launched by Maurice Strong in the early 1970s. The concept of ecodevelopment, as discussed by Pedro Filho (2013), does not allow the separation of the environment and development, concomitantly requires to obey three fundamental criteria: equity social, ecological prudence and economic efficiency; good sense in the use of local resources without exhausting nature, reconciling economic growth with increased productivity of resources, reduction of processed materials, allied to conservation of the environment and income redistribution, Sachs precepts in the mid-80s, addressed in Pedro Filho (2015).

In this work, the forced settlement of Nova Mutum Paraná, in the municipality of Porto Velho, State of Rondônia, is studied from the perspective of the Ecodevelopment theory at the confluence of Theory U, in the face of the heuristic of fear produced in the population settled unilaterally.

2.3 Concepts on innovation based on Theory U

Developed by Otto Scharmer, Adam Kahane, Peter Senge and Joseph Jaworski, Theory U has been used in different ways involving the organization or the entire production chain of a country; makes it possible to recognize the causes of existing problems and provides appropriate innovations to solve them, affirms Maia (2013); it is divided into three phases: Feeling (1), witnessing (2) and performing (3); this leads to the creation of prototypes and practical action, where there is the possibility of making feedback and new adjustments. The

author continues to affirm that Theory U provides the individual to walk a path so that he can understand his own mental models and their insertion in the lived reality, leading him to reflect and understand reality in all its extension, being ready to initiate a positive innovation; new ideas emerge to be put into practice. The whole process needs to be restarted and revised, if necessary; propitiating change in the way of seeing and perceiving the world, maintaining this understanding while carrying out its activities.

III. METHODOLOGY

To reach the results, a causal relationship involving a vulnerable community based in the Western Amazon was used, focusing on ethical responsibility. The research has a qualitative and descriptive approach; it is followed by the rite of investigations in the axis of the social sciences applied to the socio-environmental management, treating the secondary data; the Case Study Method and compatible procedures were applied. According to Siena (2011), it is a method that leads to learning from its parts and detailed information, quite usual in dealing with issues in Administration.

Siena (2011) conceptualizes procedure as the process of collecting, processing and analyzing data. In this study, a theoretical-conceptual review was performed based on available literature, with updated collections and academic manuals, visits to websites and others. made it possible to understand, treat and explain the causal relationship in response to the research problem. It was also used research responses made to families residing in the settlement studied in Nascimento (2017).

IV. STUDY OF HEURISTICS OF FEAR IN THE SOCIAL SYSTEM OF FORCED SETTLEMENT

The forced settlement, object of this study, is based on the municipality of Porto Velho, Capital of the State of Rondônia, located in the Northern Region of Brazil, which is part of the Western Amazon. According to IBGE (2010), the population was estimated for 2017 in 519,436 inhabitants; poverty rate is 21.89%, HDI is 0.736 and a non-literate population is 5.21%. The same body reports 7.5% of the unemployed, and an average wage income of 3.5 minimum wages. The Gini coefficient is 0.47 and the resident population suffers from a severe crisis in public security, with a 21.2% crime rate (robberies, robberies, murders, rapes) recorded in the last statistic. Searches at specialized sites reveal disasters related to natural disasters in the last five years, such as the historic flood of the Madeira River in 2014.

According to Ribeiro (2011), with the advent of the recent construction of two hydroelectric power plants, the population increased by approximately 45 thousand inhabitants, while the public power does not supply the

safety, education, health, transportation and other services required for mister; As a consequence, the injury exceeds the tolerable level that the individual could absorb: violence was out of control, traffic became chaotic, services became more saturated, there was an increase in the average waiting time for hospital admission (40 days), in addition to patients in hospital and lying on the floor of the city's main emergency room.

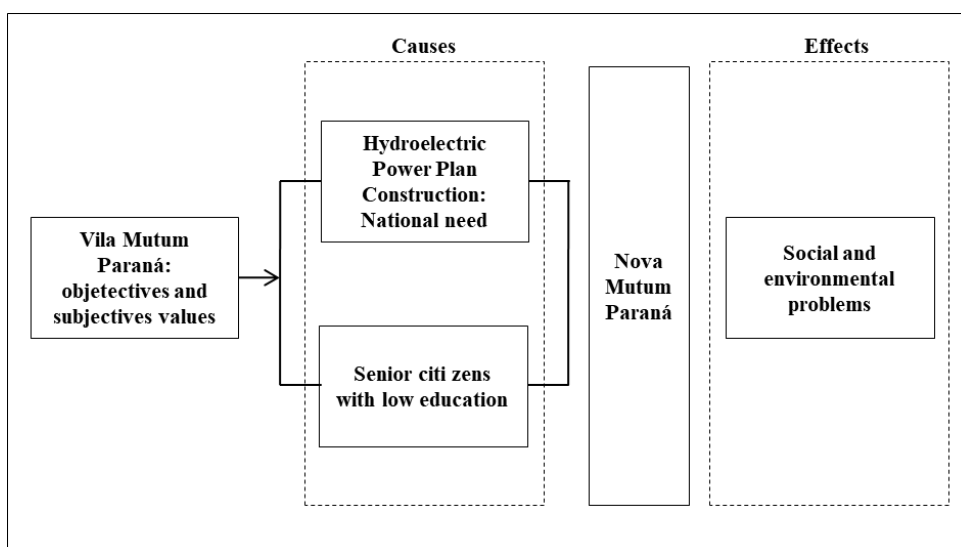
This framework of degradation reaches the resident in a spurious logic that points to the logic of extreme poverty experienced by the majority, especially those individuals thrown to the edge of the periphery, as treated in Lima (2017). Within these highlights there is a forced settlement called Nova Mutum Paraná, which came with the displacement of an entire population of a village called Mutum Paraná, where the heuristic of fear was clearly brought to the forefront of the uncertain future in the New Village.

4.1 Survey of the cause-effect phenomenon of fear in the forced social system

This subtopic will deal with the cause-and-effect phenomenon, having as its object the fear in the forced social system and the Porto Novo settlement of Nova

Mutum Paraná as a locus, as a result of the disorganization of the local logic of the village of Mutum Paraná, whose population had identity with objective values such as : family, house, plantations; and subjective as: emotional, sentimental, according to studies in Nascimento (2017), demonstrating the heuristic of fear among the settlers. As causes: the construction of hydroelectric power plants, in order to provide Brazil with the electrical energy infrastructure necessary to enable its development with greater security; search for productivity and profitability, to the detriment of populations with no power of action. As a result of the deterritorialization of the local inhabitants, resulting in the settlement Nova Mutum Paraná, whose population of age, with no difference between men and women, had low educational level where approximately 50% had incomplete first degree and 15% no schooling; and only 2.5% with higher education, these being men. Most of them had their own homes and lived the fear of monetary loss with the indemnities, as well as fear of not being compensated, also expressing sadness about leaving the village and fear of missing something they would not have in the New Village (subjective fear) latent in the life of the residents of the old Vila Mutum Paraná. Figure 1 below refers to this cause-effect relationship.

Fig.1: Relationship cause-effect of fear in the social system of the Nova Mutum-Paraná forced settlement.



Source: Prepared by the authors.

The national need coupled with the low level of formal education has caused the population of Vila Mutum Paraná to be afraid of: moving to the forced relocation of Nova Mutum Paraná, starting a new life, problems such as unemployment, inadequate housing, insecurity and violence. This population, for lack of education, was susceptible to fear of the future. As a result, we have the socio-environmental effects. In the hydroelectric reservoir and surroundings, nature has changed: the climate has

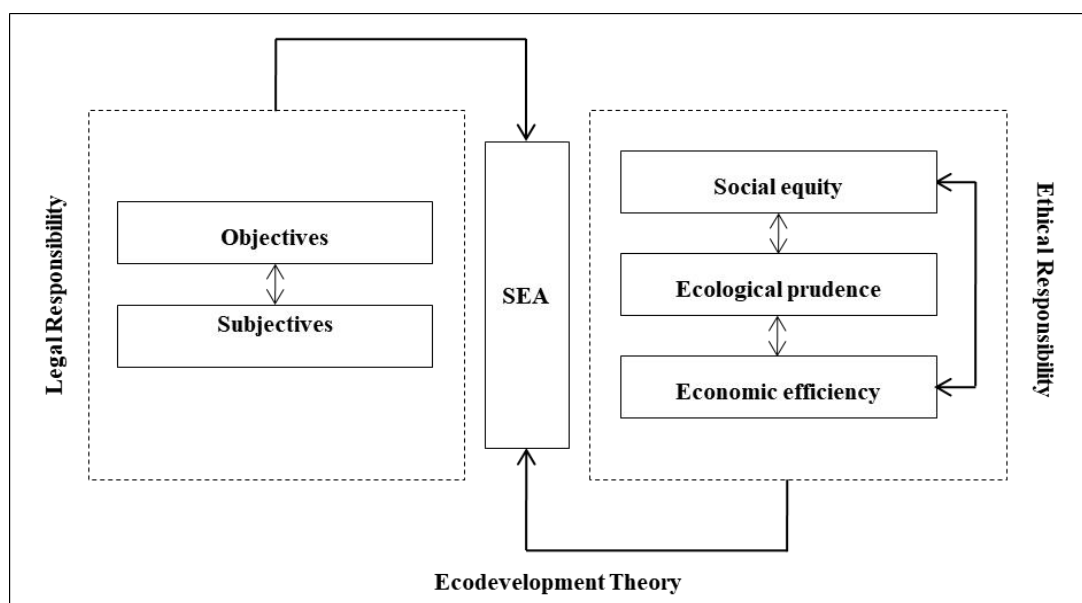
changed, species of fish have disappeared, animals have fled to dry refuges, trees have turned rotten wood under the flood; there was a social impact as people left their homes and livelihoods and needed to start over without prospects, loss of community ties, separation of families and communities, destruction of sacred sites, and others with unprecedented consequences. insecurity, and violence. This population, for lack of education, was susceptible to fear of the future. As a result, existing socio-environmental

effects. In the hydroelectric reservoir and surroundings, nature has changed: the climate has changed, species of fish have disappeared, animals have fled to dry refuges, trees have turned rotten wood under the flood; there was a social impact as people left their homes and livelihoods and needed to start over without prospects, loss of community ties, families and communities separation, sacred sites destruction, and others unprecedented consequences.

We next proceed to the characterization of social and environmental responsibility resulting from the forced settlement of Nova Mutum Paraná, a permanent commitment of private institutions, governments in all instances, different social groups and individuals; a question of ethics of responsibility where social and environmental impacts must be prioritized, before thinking about economic development, according to Figure 2.

4.2 Characterization of social-environmental responsibility resulting from forced settlement.

Fig.2: Characterization of social-environmental responsibility (RSA) resulting from the Nova Mutum-Paraná forced settlement.



Source: Prepared by the authors

Table.1: Description of Social and Environmental Responsibility, according to figure 2

Social environment Responsibility (SEA)	Description	Detail
Legal Responsibility	Objectives	Security, housing, indemnification, health, education, compensation of the Energy Consortium, among others.
	Subjectives	Archive and historical memory of the village of Mutum Paraná, beliefs, social ties, among others.
Ethical Responsibility	Social equity	It implies that all individuals in society have the same rights and opportunities. It aims to destroy the barriers that result in exclusion, inequality.
	Ecological prudence	It means acting responsibly, realizing the unknown and potentially dangerous consequences, acting in a way that minimizes the effects of human activities.
	Economic efficiency	It relates to the more balanced way of using inputs for production, producing more with less resources, without waste.
Ecodevelopment Theory	Environment and development	Environment and development can not be dissociated; should be treated according to the content, modalities and use of growth.

Source: Prepared by the authors

4.3 Path of convergence in the face of the application of Theory U.

In the context of forced settlement Nova Mutum Paraná, after a decade, few were the changes. So that new projects aimed at development and profitability do not lead

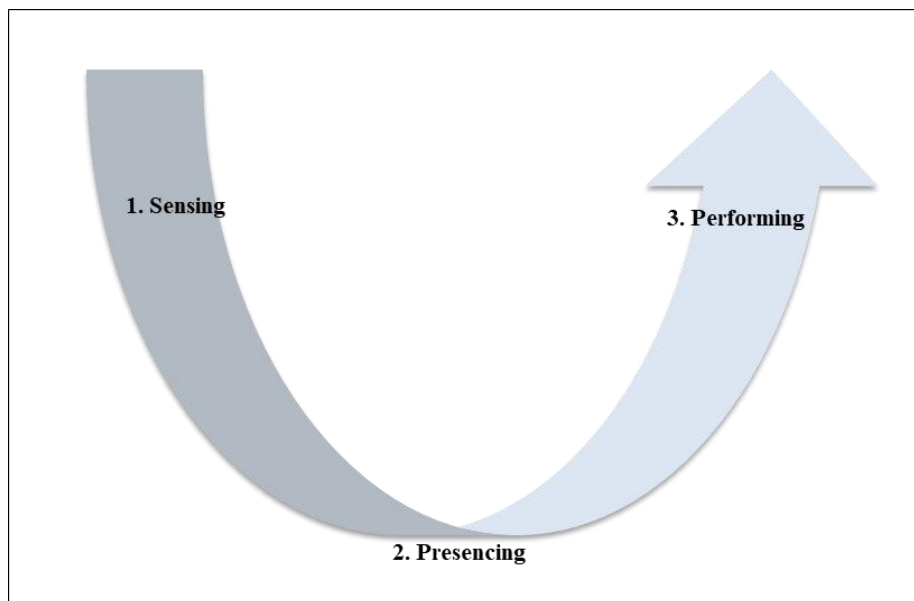
to an increase in poverty, degradation of the quality of life and consequent social inequality, there is a great need and urgency for public policies that guarantee, not simply the basic rights for displaced persons: it is education, which does not mean the establishment of a traditional school, but

a school that is liberating and proposes a rupture with any existing neoliberal perspective. In order to do this, Theory U brings innovation so that the leaders involved can act effectively, changing their mental shortcuts to the heuristic of hope.

Genuine innovation in the hypercomplexity of a system that causes displacement, deterritorialization, requires the ability to operate from the deeper fields of social emergency; which requires a process that integrates three movements: opening up to contexts that matter (costing), connecting to the source of stillness (co-

presencing) and prototyping the new (co-creation); necessary to access and activate the deeper sources of social fields. Three instruments must be adjusted (or defined) in all involved: the open mind, the open heart and the open will. Going through the U and attaining Realization requires a commitment to serve the whole and the ability to reintegrate the intelligence of the head, the heart and the hands, which becomes achievable through education. Figure 3 and the respective table 2, demonstrate the path to be covered after the barriers have been overcome.

Fig.3: Points of Theory U



Fonte: Adapted from Scharmer (2010)

Table 2: Descriptive of the points of Theory U, according to figure 3

Inflection Point	Steps	Descriptive	Barriers
1. Sensing	Suspending	Suspend judgments so that it is possible to visualize the objective reality with which the individual is confronted; realize the reality of the displaced people settled in Nova Mutum Paraná and the effects caused by the construction of the power plants.	Without the ability to turn off (or suspend) the voice of judgment, there will be no progress to access creativity and it will hardly reach the deepest levels of the U.
	Redirecting	Return the attention of the object to the process in order to help the leaders see the system from a perspective that allows them to understand how their own actions contributed to the problem (s).	Emotions of disconnection, such as cynicism, arrogance, and coldness are impediments to redirection; will not allow them to understand their actions.
	Letting Go	Identify the models used (which previously seemed to be caused purely by external forces) and perceive internal influences. Steplet go oftheoldmodels.	The fear of: letting the self and the known world go; move on; surrender in the space of nothing; to dissociate from old ineffective educational models.
2.Presencing	Presencing	Bottom point of U marks the movement of withdrawing and reflecting; which includes the stage of Presencing, where silence occurs to perceive the occurrence in the descent, allowing the	Prevent Presencing; do not prepare for this phase, discarding the "Sensing" step.

		inner knowledge to emerge into the new.	
3. Performing	Letting Come	It consists of anticipating the new from the future that seeks to emerge; new direction from the external mode to the interior mode of seeing, visualizing new ways of promoting education for innovation among the settlers in Nova Mutum Paraná.	It requires a commitment to serve the whole and the ability to reintegrate the intelligence of the head, heart and hands.
	Enacting	The development of the inner mode of seeing to transform inner vision into outer action; stage where the new is put into practice. Plan the possible practice for transforming education to the settlers of Nova Mutum Paraná and to the municipality of Porto Velho.	Stagnation; fear of not being able to plan the possible practice for this liberating education.
	Embodying	Transform the new into actions, infrastructures and practices; incorporate the new in the educational context in the ecosystem.	Fear of non-acceptance of new educational paradigms, lack of commitment to serve

Source: Prepared by the authors

Educating for prudence with the heuristic of hope will make it possible to co-create the emerging future for the evictees of Vila Mutum Paraná, for other forced settlements already existing in the municipality and for others to come. Batestin and Nogaro (2017) argue that transformative education, while still silent, grounds the practice of actions aimed at the welfare and defense of life. The path of change necessarily passes through behavioral relations, not just physical or economic aspects.

The state, the consortium, and the universities should study and implement an education project for every settlement before deterritorialization actually took place. Not with the intention that the future settlers learned to fight for their rights only; but especially so that they would feel prepared to face the new life in the new settlement with more concrete perspectives of more qualified work. It is a legitimate concern with a type of education that contributes to the effective formation of human beings who are aware of their potentialities as historical subjects. The main objective of this kind of education in the settlements would be the real implantation of schools that were instruments of social transformation. Schools where there was an educational proposal that provided knowledge and also concrete experiences of transformation of reality where the settlers could be prepared critically and creatively to be inserted in the real process of changing their realities.

Nova Mutum Paraná is reality; the old village is gone. People continue and what one has to consider is that the acts of doing and carrying out actions are a consequence of a balance between values and feelings; these, together and balanced, personify a highly transformative potential when used openly to any innovations without pre-judgments. Mind, heart and hands

need to work in the same direction, in the same focus, allowing the emergence of innovations.

V. CONCLUSION

Living with impartiality and doubt about everyday projects is challenging; the more so in view of grandiose projects such as the construction of hydroelectric plants, whose consequences, catastrophic or optimistic prognoses are a constant. This does not exempt the establishment of criteria, rules and regulations in the face of any responsibility assumed by all (or anyone) involved, namely: public power, private institutions, population, religious, family and educational institutions. All should establish criteria of precaution, prudence and ethical responsibility.

The heuristic of fear, Jonah's perspective, is visionary, for by anticipating dangers one can guide and take a prudent and responsible stance, protecting the generations to come. However, education is vital and has much to contribute in the process of alertness and precaution for the dangers of the technique, being able to make possible the interconnection of technical-scientific knowledge with a responsible ethical knowledge, along with adjustments in all involved: the open mind, the open heart and the open will, a philosophical reflection that goes from the radicality of the old paradigms to the effective innovation (Theory U). Liability as a mediating criterion, besides helping to form systems capable of increasing prevention capacity, can increase the dimension of care with life, thus representing an extremely educational role in the expansion of knowledge about the consequences of actions of each individuals, especially those that directly impact the environment (Ecodevelopment Theory coupled with Jonas' affirmations).

There is a solution for the forced settlement of the displaced people of Vila Mutum Paraná in Rondônia, as well as for other forced settlements, it is important to educate so that apparently inevitable disastrous consequences are replaced by new and pleasant ways of living the development for the whole Nation, from process of deep and effective innovation (Theory U).

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Petro physical Evaluation and Reservoir Characterization of the Zubair Formation in Majnoon oil field, Southern Iraq.

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Abstract— The Barremian succession in the present study is represented by the Zubair Formation which the most significant sandstone reservoir in Iraq. The area of study is located in the Southern part of Iraq at Majnoon oil field, within the Mesopotamian basin. The thickness of the Zubair Formation is about 450 m in the studied area. It is divided into three lithofacies: The upper unit is composed mostly of shale layers, the middle unit is consisting of thick layers of sandstone rocks and the lower ones is consisting mainly of Shale with less sandstone layers. These units are characterized by three types of petrophysical features according to total porosity/effective porosity: High-moderate effective porosity rocks (type I), moderate effective porosity rocks (type II) and low-non pores rocks (type III). The upper unit of the Zubair Formation at Majnoon oil field is characterized by two horizons. The first is showing high resistivity-high gamma ray which represent the upper part, while the lower part show low resistivity-low gamma ray. There is a good reservoir horizon with high oil saturation (low water saturation) in this unit at the Majnoon oil field is appeared as a non-continuous horizon. The middle member is dominated by low resistivity-low gamma ray. The high percentage of water saturation in this unit caused the lack of clarity of the oil saturation, which appears in a narrow band. The lower member of Zubair Formation is distinguished by shale dominated rocks and poor sorted sandstone. This shows high resistivity-high gamma ray. There are many sub horizons as bands within the lower horizon as high resistivity-low gamma ray. There is a good reservoir horizon with high oil saturation (low water saturation) in this unit.

Keywords— Petrophysical evaluation, Reservoir characterization, Zubair Formation, and Majnoon oil field.

I. INTRODUCTION

The Zubair Formation was introduced by Glynn Jones in 1948 from the Zubair oil field and amended by Nasr and Hudson in 1953 (Bellen et al., 1959). It is the most significant sandstone reservoir in Iraq, is composed of fluvio- deltaic, deltaic and marine sandstones.

The study area is located in the Southern part of Iraq at the Mjnoon oil field, within the Mesopotamian basin at the stable shelf. The studied oil fields are located in Southern Iraq approximately 60 Km. Northwestern of Basra city, close to the Iranian border and extending North to Missan province "Fig. 1".

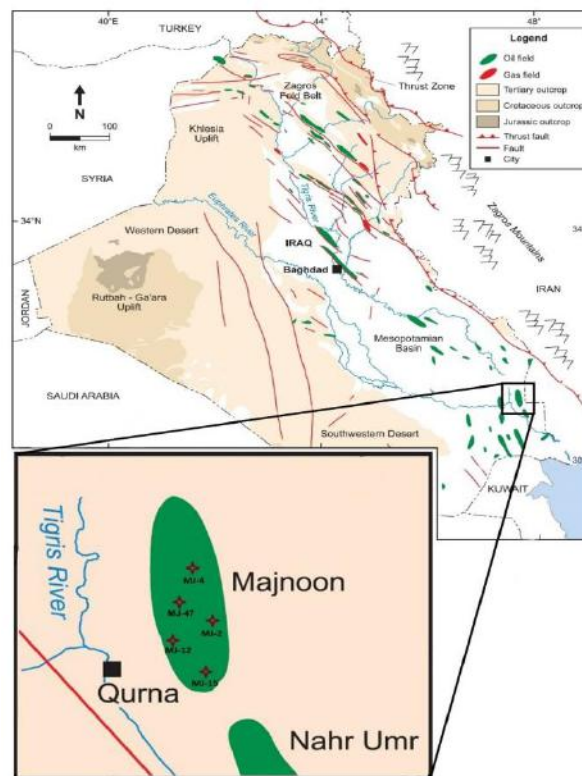


Fig. 1: Location of the study area (Modified after Abeed, et. Al, 2013).

The Barremian succession represent a part of The Late Tithonian-Early Turonian Megasequence was deposited in a large intra-shelf basin contemporaneous with a new phase of ocean floor spreading in the Southern Neo-Tethys. Differential subsidence (and resultant thickness changes) occurred across transverse faults. The axis of the intra-shelf basin shifted towards the eastern

Mesopotamian Zone into the Tigris Subzone from its previous position on the Salman Zone and western Mesopotamian Zone (Jassim and Goff, 2006).

The progradational Zubair/Ratawi clastic shelf was covered by the Shu'aiba Formation carbonates following backstopping of the Zubair and Ratawi Formations "Fig. 2".

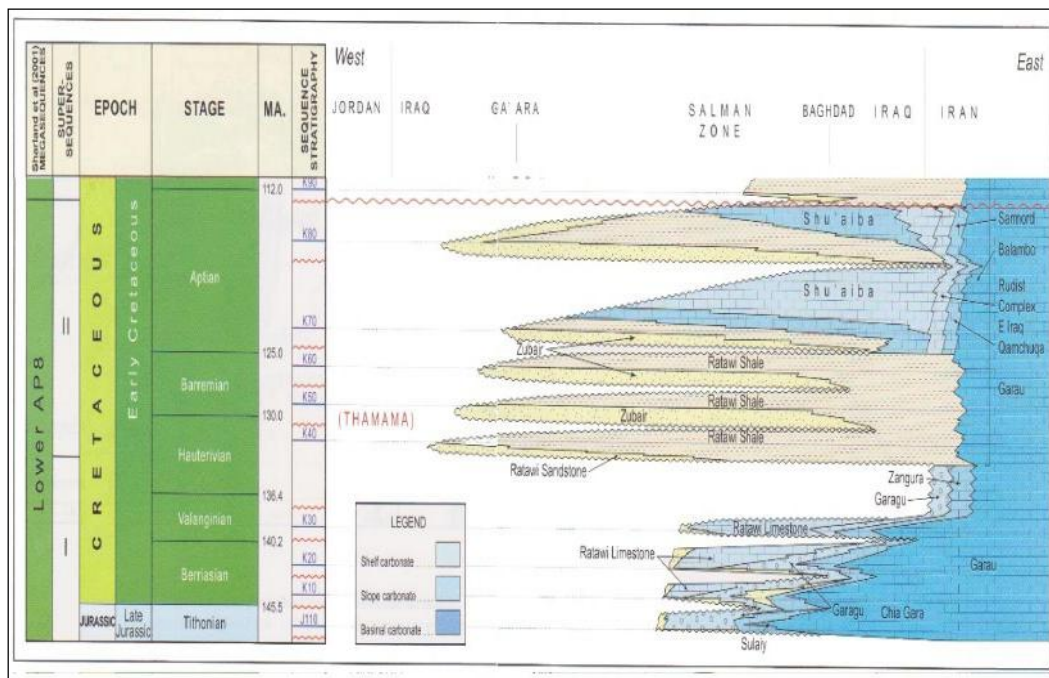


Fig. 2: Early Cretaceous chronostratigraphic section (Aqrawi, et al. 2010).

Jassim and Guff (2006) suggested that the Zubair Formation depocenter was located at the eastern limit of the Salman Zone, as illustrated by the isopach of the Zubair Formation (Ali and Nasser, 1989 in Aqrawi et al. 2010) "Fig. 3".

The upper contact of the formation with the Shuaiba Formation are mostly gradational and conformable. The lower boundary is, however unconformable with Ratawi Formation (Buday, 1980) and this unconformity is described by Douban and Al-Medhadi (1999).

II. METHODOLOGY

- Study of available well logs and relate the log response to facies and diagenetic changes for the studied succession intervals "Table 1".
- Digitizing well logs using Didger software.
- Using interactive petro physical software IP (V3.5) and petrel (V.14) for the environmental correction, lithology and mineralogy identification and logs interpretation.
- Study of the well logs and relate the log response to facies and diagenetic changes.
- Building petro physical models, Facies and structured maps reconstructed and the petro

physical properties were distributed throughout well correlation in Zubair formation.

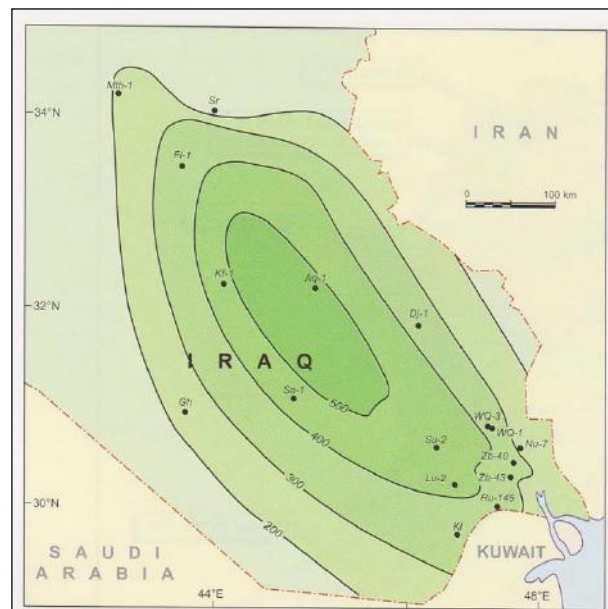


Fig. 3: Isopach map of the Zubair Formation (After Ali and Nasser, 1989 in Aqrawi et al. 2010).

Table.1: Zubair Formation subdivisions thickness and occurrence.

Well no.	Formation	Top (m)	Bottom (m)	Longitude	Latitude
MJ-2	Zubair Fn.	3452	3665	E751906.1	N3436141.1
MJ-4	Zubair Fn.	3465	3650	E749948.3	N3444259.2
MJ-12	Zubair Fn.	3524.5	3725	E747940	N3436300
MJ-15	Zubair Fn.	3478	3690	E752574.3	N3432726.8
MJ-47	Zubair Fn.	3373	3615	E747650	N3449300

III. LITHOFAICES UNIT OF ZUBAIR FORMATION

The thickness of the Zubair Formation is about 225m "Table 2". It is divided into three lithofacies units by using GR & SP logs in Petral Software.

Table.2: Zubair Formation subdivisions thickness and occurrence.

Field Name	Well No.	Formation	Units	Top	Bottom	Thickness (m)
Majnoon	Mj-2	Zubair	Upper	3452	3450	2
			Middle	3450	3509	59
			Lower	3509	3665	156
Majnoon	Mj-4	Zubair	Upper	3465	3477	12
			Middle	3477	3525	48
			Lower	3525	3650	125
Majnoon	Mj-12	Zubair	Upper	3524.5	3530	5.5
			Middle	3530	3593	63
			Lower	3593	3725	132
Majnoon	Mj-15	Zubair	Upper	3478	3487	9
			Middle	3487	3542	55
			Lower	3542	3690	148
Majnoon	Mj-47	Zubair	Upper	3373	3405	32
			Middle	3405	3485	80
			Lower	3485	3615	130

The upper member is composed mostly of Shale layers. The middle member consists of thick layers of sand rocks. The lower member consists mainly of layers Shale with less sandy layers. "Fig. 4" shows the correlation of facies distribution for Zubair Formation in the wells (MJ-47, MJ-2, Mj-4, MJ12 & MJ-15) in Majnoon oil field.

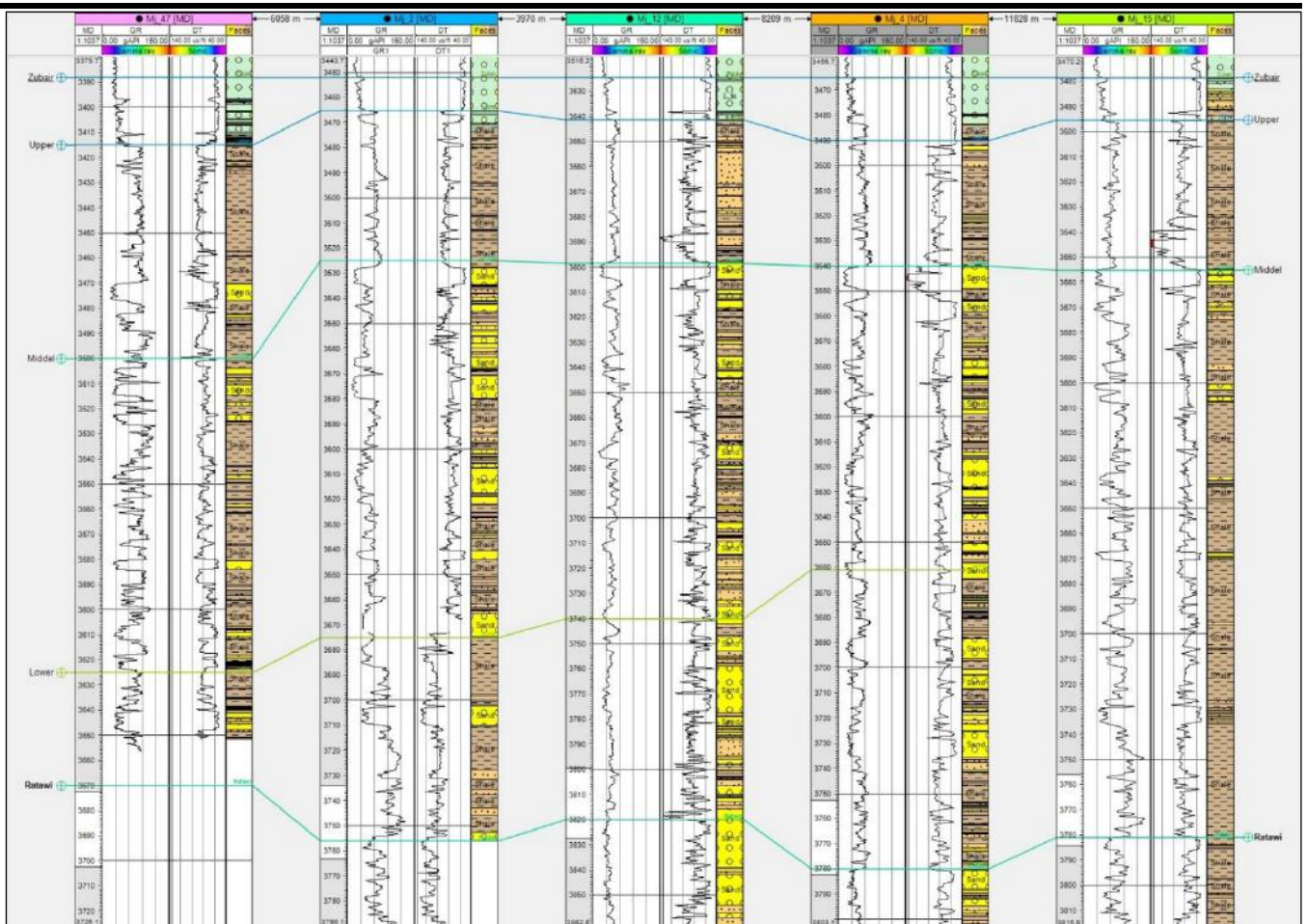


Fig. 4: The correlation of facies distribution of Zubair Formation in Majnoon Oil Field.

3.1 Lower member:

This zone is characterized by GR log values with many cycles as decreasing upward (bell shape) and grain size increasing. This unit also has (a funnel shape) in some positions. The thickness of this member is about (130m) in Majnoon oil field. "Fig. 5" shows the facies distribution through this member.

3.2 Middle member:

This zone is characterized by low gamma ray values with many cycles of fine to coarse sand (cylindrical shape of GR log) in the upper zone of this unit, and coarse upward (hour-glass shape) in some positions. Thickness of this zone is approximately (60m) Majnoon oil field. "Fig. 6" shows the facies distribution through this member.

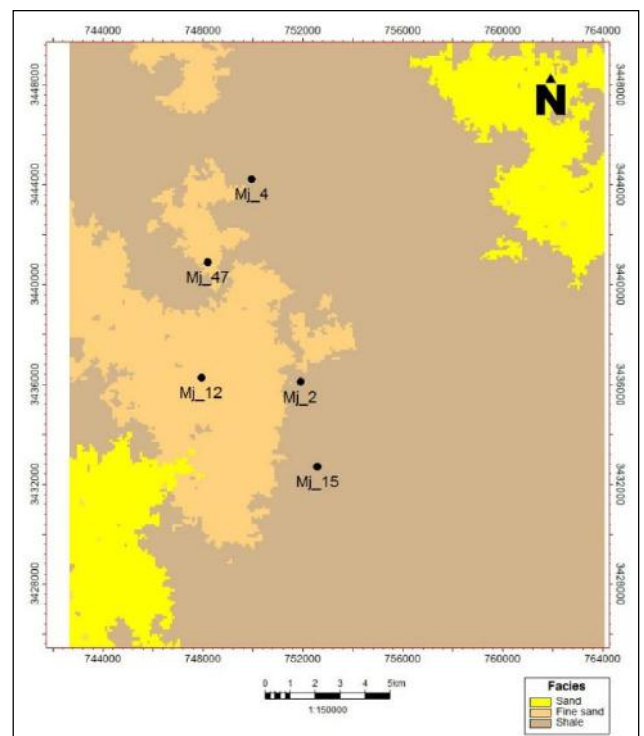


Fig. 5: Facies distribution map through the lower member of Zubair Formation in Majnoon oil field.

3.3 Upper member:

This unit is characterized by high shale volume and the general GR log is almost forming a serrated shape, which refers to relatively increasing upward in gamma ray values. Thickness of the upper unit is approximately (10m) in the Majnoon oil field. "Fig. 7" illustrates the facies distribution through this unit.

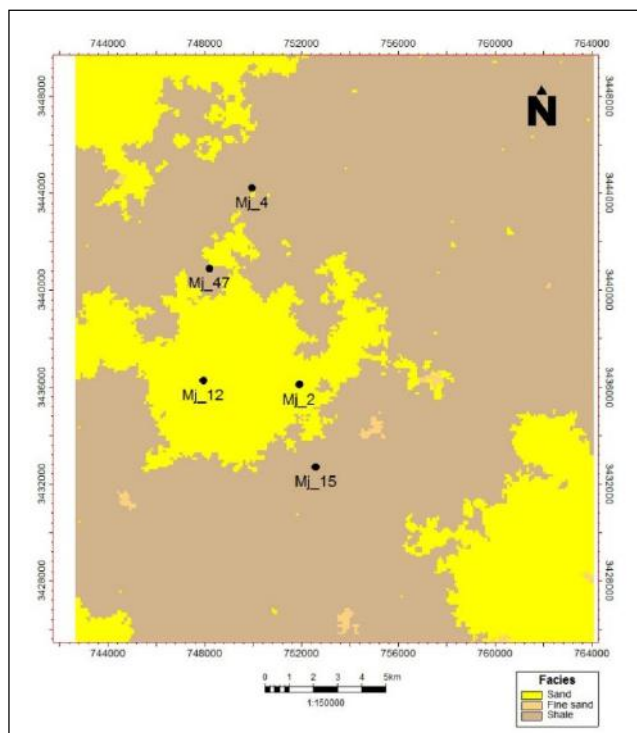


Fig. 6: Facies distribution map through the middle unit of Zubair Formation in Majnoon oil field.

These units are well shown in "Fig. 8" which draw the facies variations profile along W-E of the study area passing through Mj-2 and Mj-12 wells. While "Fig. 9" shows the lithofacies intersection along N-S in Majnoon Oil Field passing through Mj-4, Mj-2 and Mj-15 wells.

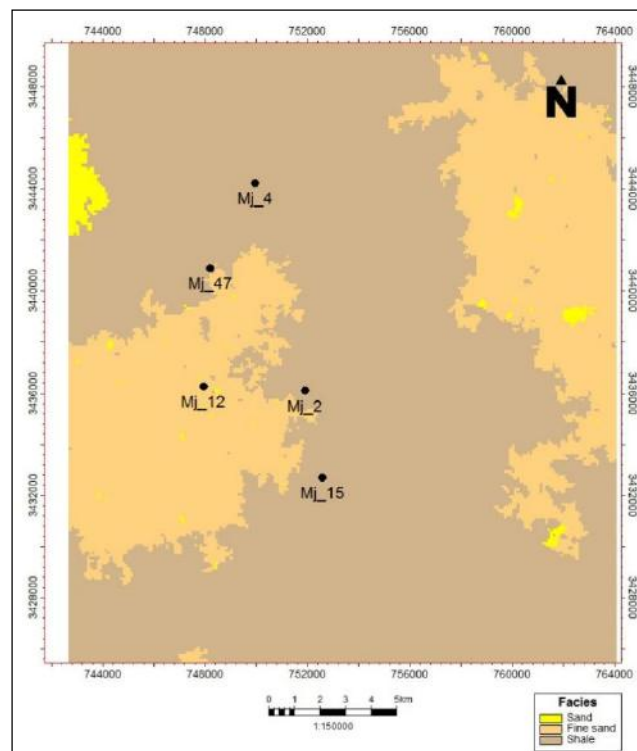
IV. Porosity distribution:

The porosity of a rock is a measure of the amount of internal space that is capable of holding fluids. it is important because it represents a potential storage volume for hydrocarbons (Asquith and Gibson, 1982).

4.1 primary porosity:

This type is formed by syndepositional processes which contains visual and non-visual pores between the grains,

so the spaces between the fragments of solid material deposited as sediment are the "primary" porosity. Porosity value can be obtained from the Sonic (Acoustic) log



(Asquith and Gibson, 1982).

Fig. 7: Facies distribution map through the upper unit of Zubair Formation in Majnoon oil field.

4.2 Secondary porosity:

This is formed after depositional processes. This type contains the pores which are created by dissolution processes and it be symmetrical formed by selective dissolution, which is called (moldic voids), or asymmetrical called (vuggy voids) or (channels) or (caverns). It may also be intercrystalline voids formed by dolomitization processes or fractures voids formed by different physical stresses (Asquith and Gibson, 1982).

4.3 Effective porosity:

The amount of internal space of void in a given volume of rock is a masseur of the amount of fluids a rock withholds and if this pore is interconnected and able to transmit fluids is called (Asquith and Gibson, 1982).

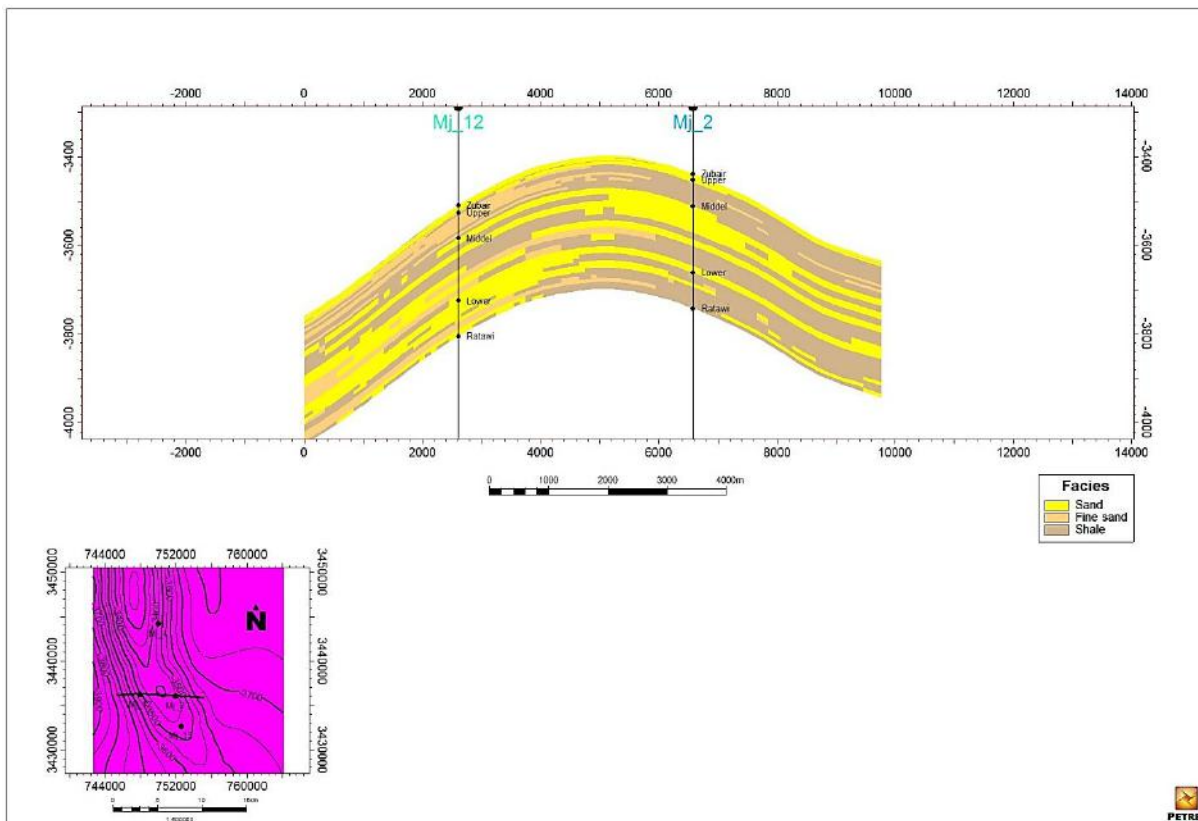


Fig. 8: Lithofacies intersection of Zubair formation along W-E trend in the study area.

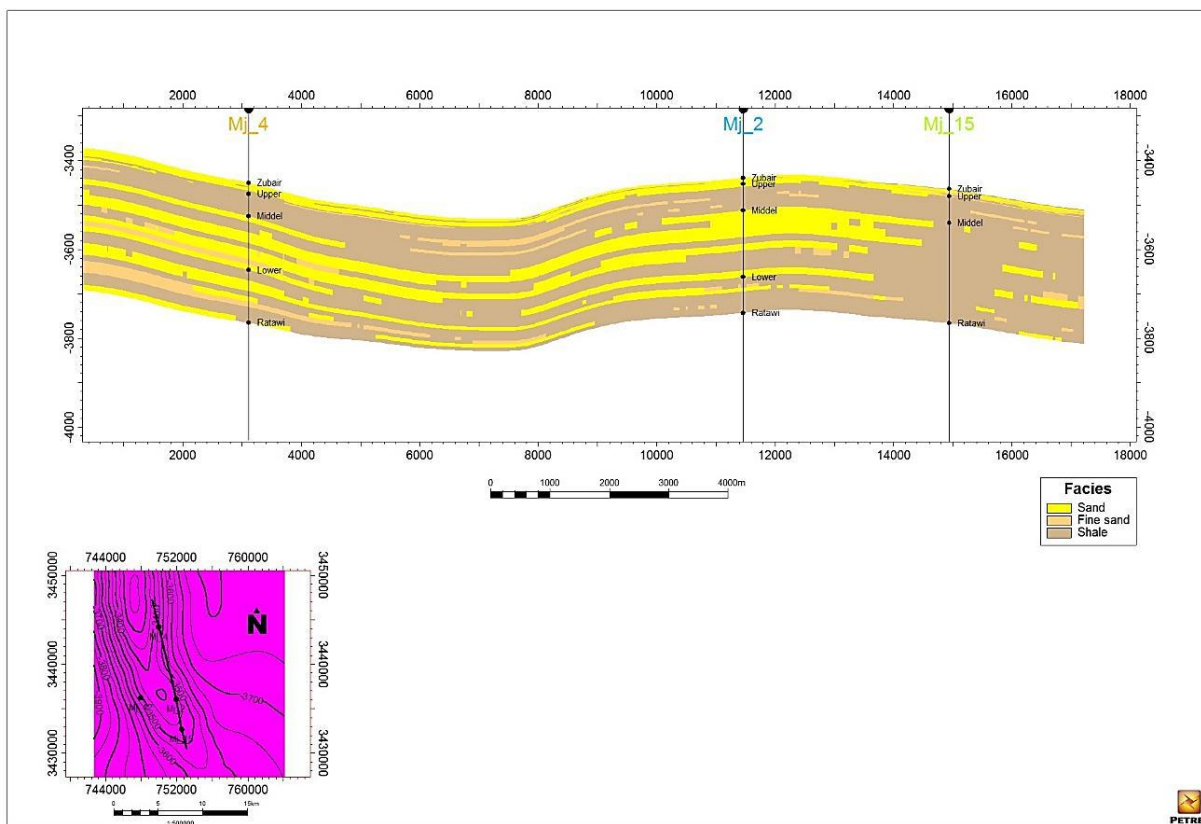


Fig. 9: Lithofacies intersection of Zubair formation along N-S trend in the study area.

The porosity of Zubair Formation sandstones declines towards the east of the Balambo-Garau Basin. Porosities of 30% in the Salman Zone decline to about 15% close to the border with Iran. Permeabilities in the formation range from 20 to 1800 mD with a mean of 700 mD (Jassim and Al- Gailani, 2006).

A better understanding of the relationships between porosity development, diagenesis, and sequence stratigraphy of the Zubair Formation is crucial to developing new play concepts. In all wells, the stacking pattern of rock-fabric units and diagenesis are systematic within systems tracts. Therefore, distribution of porosity and permeability is closely related to relative sea-level changes. For example, deltaic - shallow marine facies deposited during sea-level fall (low stand system tract) are porous and permeable. The same attributes can be observed in the upper part of the highstand systems tracts. In contrast, higher porosities largely occur within highstand systems tracts in shoal environments where the effects of relative sea-level fall. Thus, they are characterized by high primary porosity.

The various stages in the history of the depositional sequences of the Zubair Formation with late diagenetic processes modified the above logical interpretation of porosity development in the facies. The low stand systems tracts of the sequence have low sonic log values indicating high porosity due to the coarse grains of silt and sand. In the other sequence of the lower part of high system tract, the facies have lower porosity values because of the shale facies with low permeability.

V. Petrophysical model:

The above petrographic observations are in terms of rock-fabric units. These units can be most effectively converted into petrophysical parameters and into reservoir models.

The Zubair sequence can be divided by the gamma ray and shale value into three zones (upper, middle and lower); therefore, we have an interpretation of the logs porosity and porosity evaluation according to these

divisions. The porosity log (sonic log) in the studied boreholes showing an approximate matching with these zones. After the Petral application of sonic log drawing the porosity-depth relationship for each borehole rather than logs reading with depth. The sonic (porosity) log is studied to determination of the zones of void space that is interconnected and thus able to transmit fluids (effective porosity).

These zones are divided in to three types of rocks according to total porosity "Fig. 10":

1. High-moderate active porosity rocks (type I).
2. Moderate active porosity rocks (type II).
3. Low-non pores rocks (type III).

5.1 Lower member:

The lower zone is represented the shale – dominated member of Zubair Formation, with low to non-pores rocks (type III). This appeared in all studied wells "Fig. 11 & 12". There are many presences of the moderate porosity type (II) of rock within the sand bands lithofacies appears in these wells. This zone is containing two types of rocks according to total porosity, high-moderate ineffective porosity rocks (type II) and low-non-pores rocks (type III). The type (II) is appeared in the lower part of the upper unit at the Majnoon oil field. These features are matching with the sand rich rocks and low to moderate shale. The type (III) is represented the non-porous rocks which appeared in the lower part of this member. This type is distinguished the shale dominated rocks and poor sorted sandstone. This shows high resistivity-high gamma ray. There are many sub horizons as bands within the lower horizon as high resistivity-low gamma ray. There is a good reservoir horizon with high oil saturation (low water saturation) in this unit.

5.2 Middle member:

This zone is characterized by two subzones. The upper one characterized by high-moderate active porosity (type I) while the lower one characterized by moderate active porosity (type II) and low to non-pores rocks (type III) because of the high ratio of shale "Fig. 13 & 14".

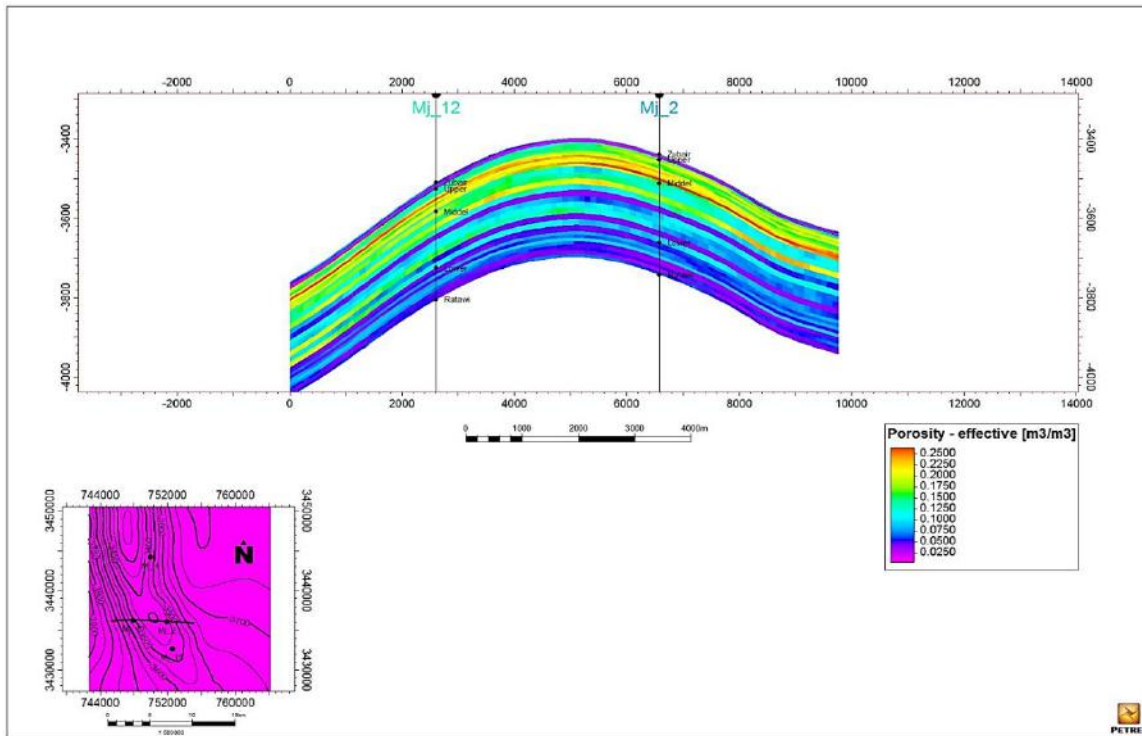


Fig. 10: East-West cross section porosity distribution of Zubair Formation.

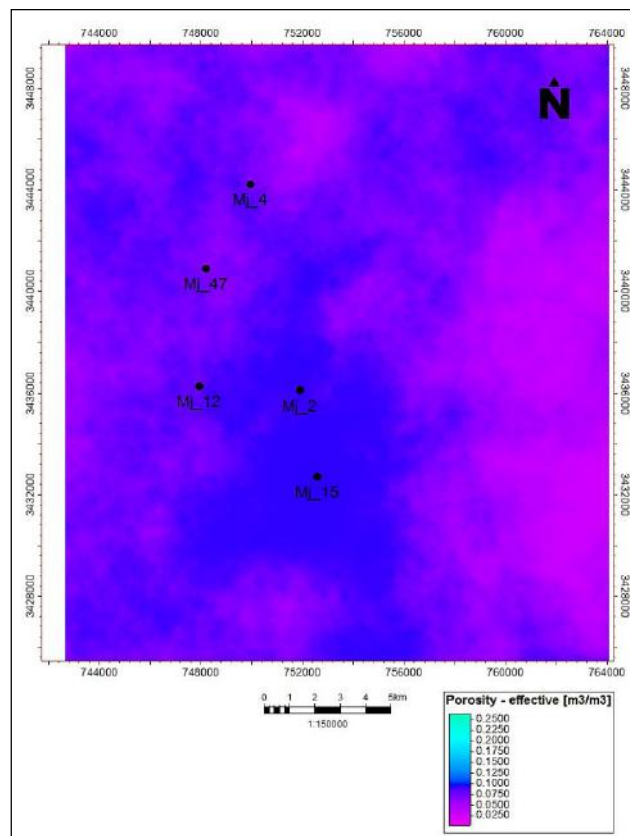


Fig. 11: Porosity distribution map through the lower member of Zubair Formation.

This zone is representing the middle part of Zubair Formation within the sand-dominated member.

This zone is characterized by two subzones in the southwestern part of Majnoon oil field. The upper part is characterized by high- moderate effective porosity (type I) while the lower part is characterized by moderate effective porosity (type II) because of presence a low volume of shale.

This zone is representing the middle part of Zubair Formation within the sand-dominated member. The middle unit is dominated by low resistivity-low gamma ray. The high percentage of water saturation in this unit caused the lack of clarity of the oil saturation, which appears in a narrow band.

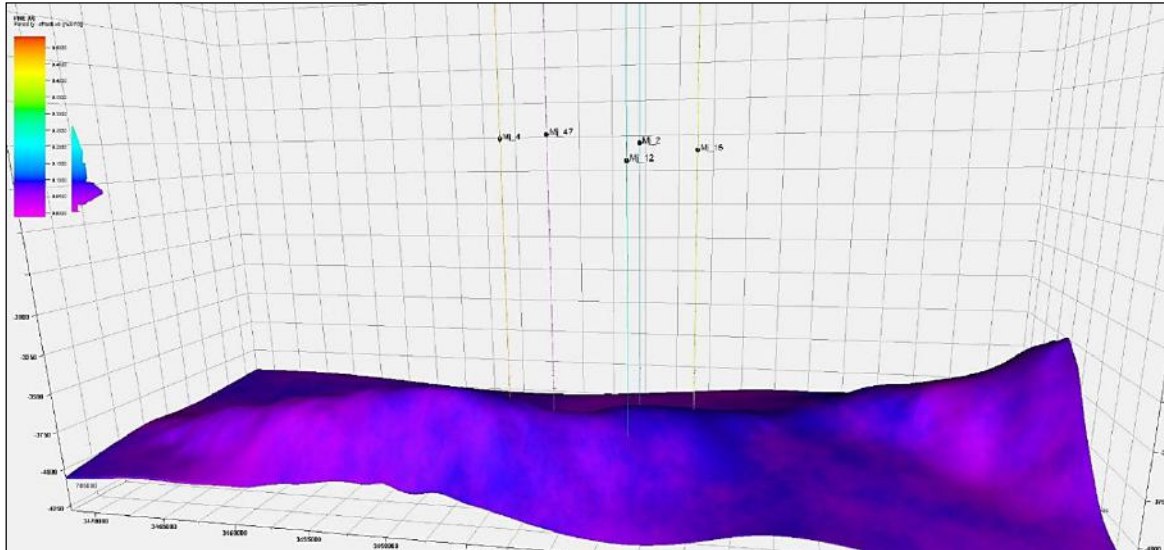


Fig. 12: 3D model of porosity distribution through the lower zone of Zubair Formation.

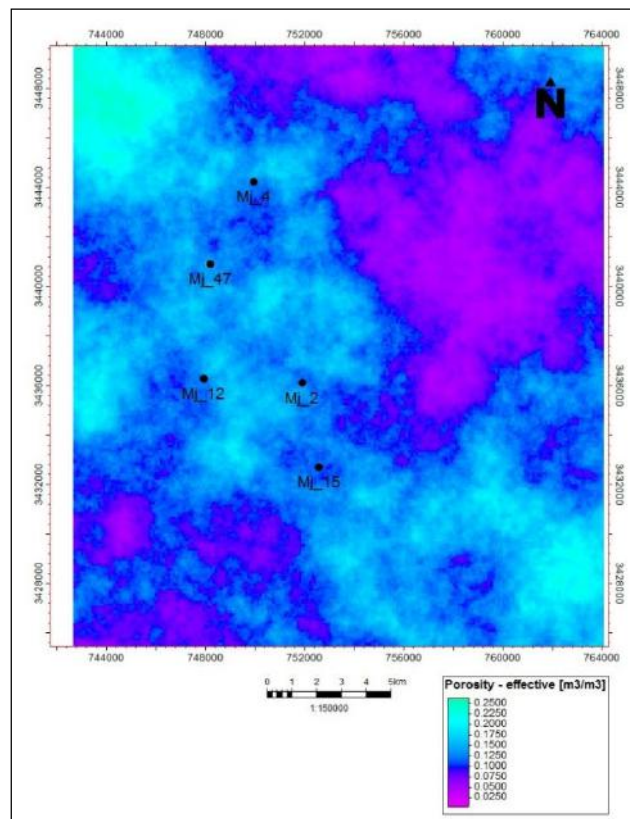


Fig. 13: Porosity distribution map through the lower zone of Zubair Formation.

5.3 Upper member:

This zone is containing high-moderate active porosity rocks (type I) because of well sorted coarse

grains. This type is appeared through the upper unit at Majnoon oil field "Fig. 15 & 16". These features are matching with the sand rich rocks and low to moderate

shale. There are limit presences for the high moderate effective porosity type (I) of rock within the sand bands lithofacies appears in these wells. The upper unit is characterized by alternative the high resistivity-low gamma ray horizon. There is good reservoir horizon with high oil saturation (low water saturation) in this unit.

VI. MODEL PROPERTIES (PROPERTY MODELING)

It is the process of filling the three-dimensional cells of the geological model with the characteristic

readings of the logs (Schlumberger, 2013). The facies model is constructed according to the facies variations (horizontally and vertically) that interpreted from the well logs.

6.1 Preparing data:

The first step in the Petrel software is the import of the available information to the software. The information included the coordinates of the wells of Majnoon oil field for Zubair Formation, the top lithofacies units of these wells and logs as well as the electrofacies in Petrel to build the model for Zubair formation.

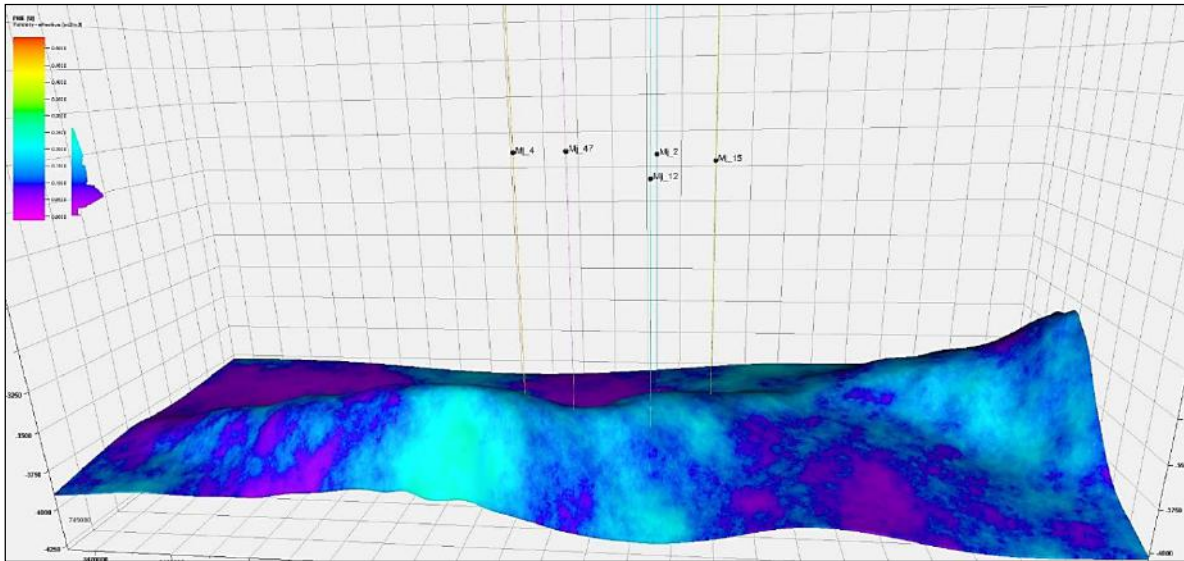


Fig. 14: 3D model of porosity distribution through the middle zone of Zubair Formation.

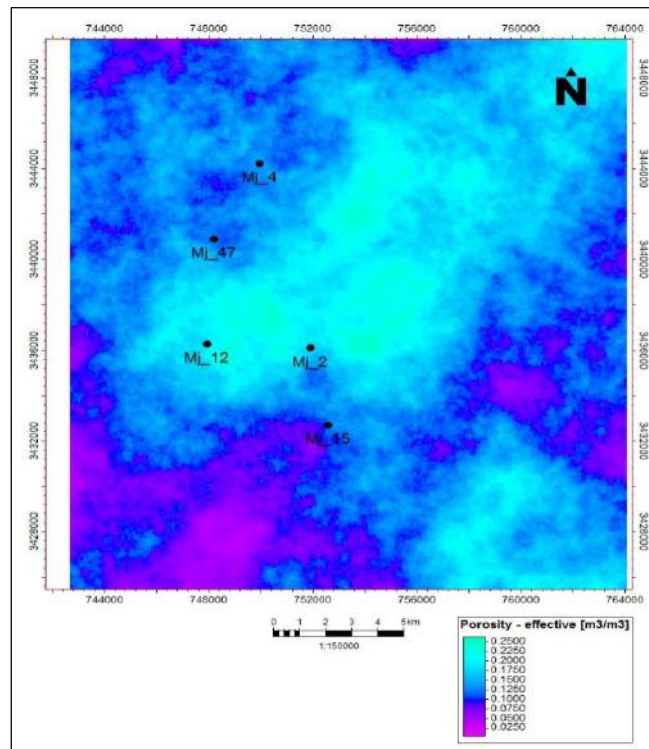


Fig.15: Porosity distribution map through the lower zone of Zubair Formation.

6.2 Construction of three-dimensional lithofacies model:

The construction of the clamp (Pillar Gridding) is the basic process to build the 3D model, it depends on the depth map on which the model is built. This map is taken from the study of interpretations as in the present study. If it is not available, it can be drawn from the top formations provided that there are a good number of wells as shown in "Fig. 17".

The other important process is the scale up which convert the reading of the logs to the shape of the three dimensional cell to fit with the reading of the logs to the gap of the clamp to know the horizontal and vertical thicknesses of the cell three-dimensional cells.

Finally, the three dimensional model can be constructed with the lithofacies variations through three zones in Zubair Formation as shown in "Fig. 18".

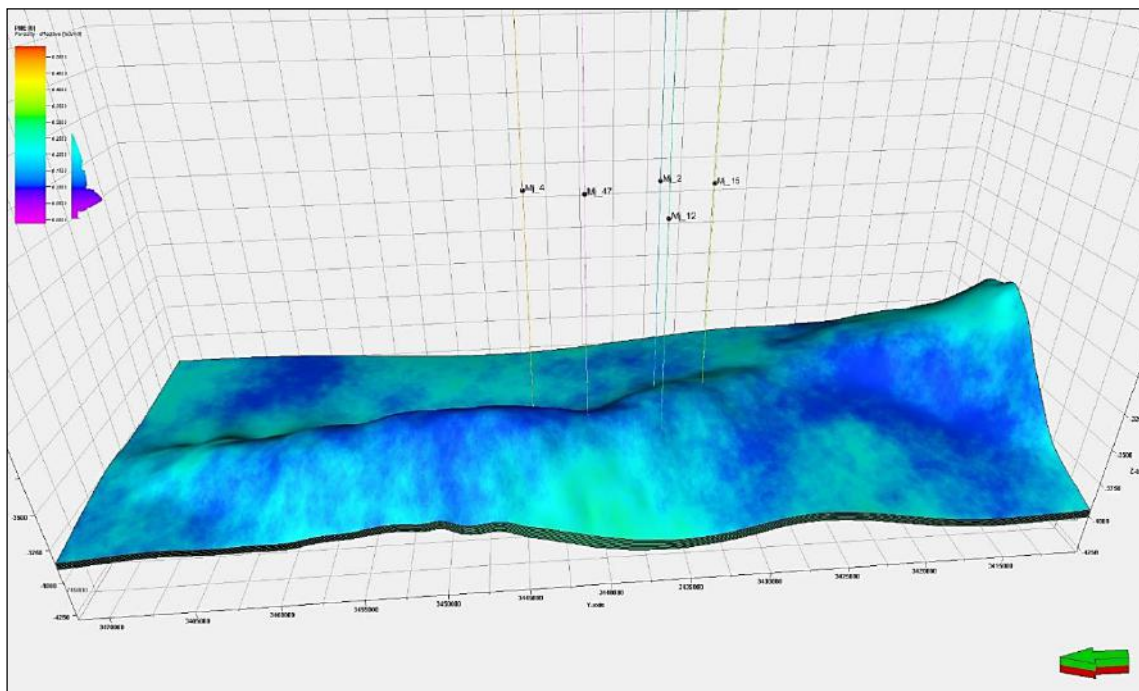


Fig. 16: 3D model of porosity distribution through the upper zone of Zubair Formation.

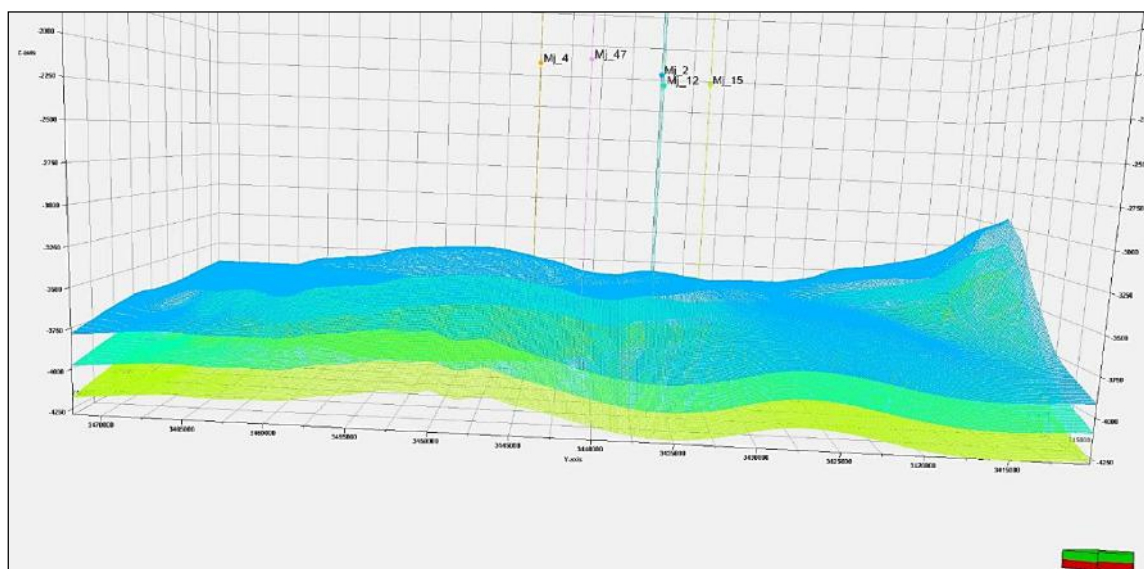


Fig. 17: 3D Pillar Gridding clamp of Zubair Formation in Majnoon Oil Field.

VII. CONCLUSIONS

The thickness of the Zubair Formation is about 200 m in the studied area. The sedimentary basin analysis is studied by understanding the mechanism of tectonics and

climate in the Barremian succession, and studying the sediment supply sources and the basin porosity distribution to give an enhanced basin modeling.

Zubair sequence can be divided by the gamma ray and shale value into three zones (upper, middle and lower); therefore, we have an interpretation of the logs porosity and porosity evaluation according to these divisions. The porosity log (sonic log) in the studied

boreholes showing an approximate matching with these zones. The structural and/or stratigraphic position have the greatest influence on the degree of diagenetic and developed of petrophysical properties.

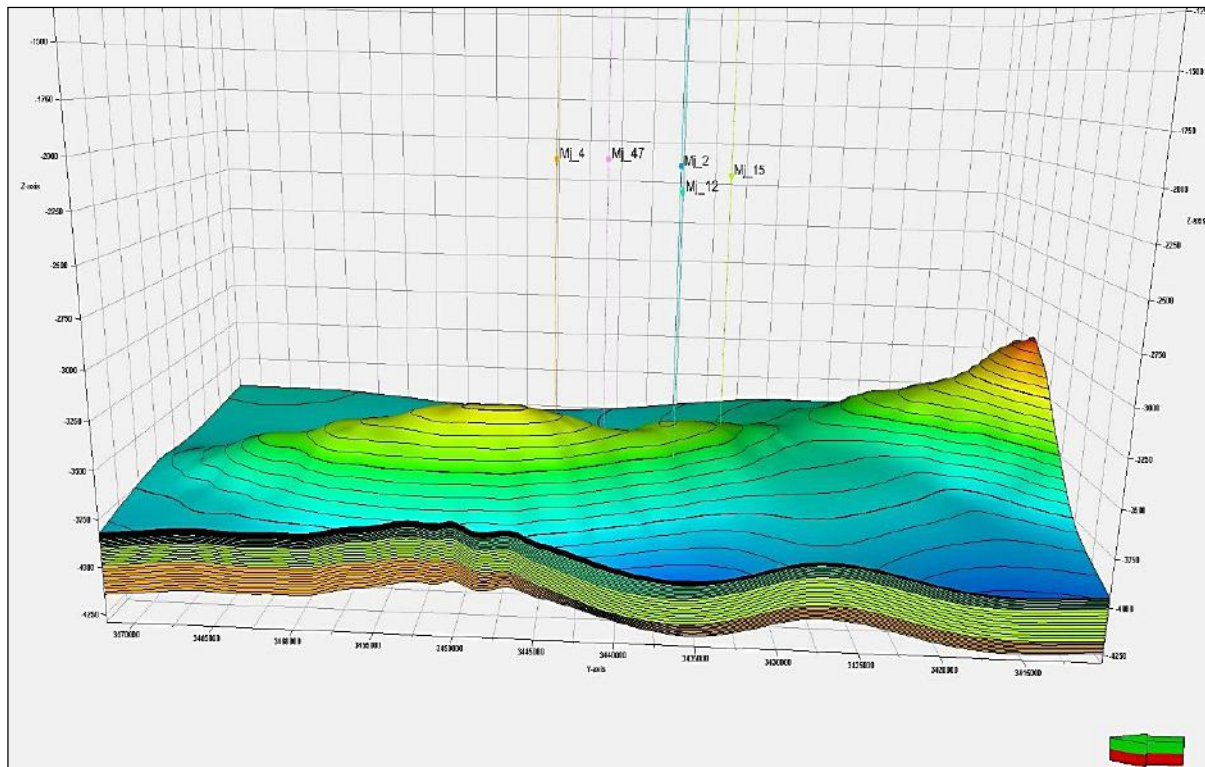


Fig. 18: Three dimensional model of Zubair Formation in Majnoon Oil Field.

The lower member of Zubair Formation is distinguished by shale dominated rocks and poor sorted sandstone. It has a high gamma ray with very low porosity. There are many sub horizons as bands within the lower horizon as high porosity-low gamma ray within the sand member. There is a good reservoir horizon with high effective porosity (low shale volume) in this unit. The middle member is dominated by high porosity-low gamma ray. The high volume of effective porosity in this unit caused the lack of clarity of the oil show, which appears in a narrow band. The upper unit is characterized by alternative the high porosity-low gamma ray horizon. There is good reservoir horizon with high oil show (low water saturation) in this unit.

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Computational Study of Fatigue Fracture in Rivet Housing of an Aeronautical Aluminum Alloy 7075-T6

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Abstract—This article describes computerized traction testing through the ANSYS software in aircraft materials, aluminum 7075-T6, which leads to variations of the strength limits with the stress concentration factor in the rivet cavity. However, was performed with a change in the radius of transition from the head to the body of the rivet in order to alleviate the stress concentrations within the rivet bore and improve the strength of the part by 5.25% with no relevant change in part displacement. The fatigue strength limit was higher in the samples without of the burr operation, observing that the geometric trunk of the section generated a decrease of 18.27% in the maximum plate stresses, with better uniformity in the tension distribution of the rivets, with a displacement of 3.125% and a minimum equivalent stress of 2.39% and a maximum of 24%, justifying the cause of the fracture in the riveting region.

Keywords— Aluminum Alloy 7075-T6, ANSYS Software, Fatigue Strength, Rivets.

I. INTRODUCTION

Technology in this industry is growing every year and one of the main focuses of research on aircraft is in relation to its weight, since fuel consumption is directly linked to the weight of the airplane. Therefore, a reduction of this aspect would entail a more competitive price of tickets since fuel expenses would be optimized.

The importance of reducing the weight of aircraft is noticeable, so they need to be the lightest and most durable, built of materials with high mechanical strength, so the use of aluminum in aeronautics has become essential because of its advantage in comparison to other materials when it comes to the relation weight as a function of the resistance [1].

These materials have as a positive point the resistance to corrosion and electrical and thermal conductivity, have good machinability and be a fragile material, yet all these characteristics do not deprive it of suffering fractures, particularly fatigue fractures when the efforts that the aircraft are submitted are so oscillating, whether due to loading, pressurizing or even the external environment

that is exposed.

In the study of Aluminum 7075 - T6 you can see a great range of benefits, compared to other materials, it admits thermal treatments, is of excellent toughness, weldable and recyclable in the general industrial environment.

Used in the manufacture of aircraft structure and other requirements of high strength, strong corrosion resistance of the high stress structure, such as aircraft, under the wing panel, stringer frame, etc.. After solution treatment, good plasticity, heat treatment strengthening effect is particularly good, in 150°C high strength and low temperature strength particularly good, poor welding performance, stress corrosion cracking, double aging can improve the resistance to SCC.

As mentioned above, its choice for the aeronautical industry is based mainly on its weight versus resistance ratio, where in Table 1 we can see some physical and mechanical properties of this material.

The plate used in the study is riveted with five rivets in a linear form with a center-to-center distance of 28.6 mm each, the rivets are of HI-LITE (HL) type made with a titanium alloy with 6% aluminum and 4% vanadium, produced by *HI-SHEAR Company* a subsidiary of *LISI S/A Aeronautical*, automotive and medical supplement development company, its activity is focused on fasteners of all kinds.

Table.1: Mechanical and Physical Properties of Aluminum Alloy 7075-T6

Mechanical and Physical Properties	Unit Metric	Unit English
Tensile strength	572 MPa	83000 Psi
Elasticity limit	503 Mpa	73000 Psi
Elongation until rupture	11%	11%
Modulus of elasticity	71.1 GPa	10400 Ksi
Resistance to fatigue	1595 MPa	23000 Psi

The plate used in the study is riveted with five rivets in a linear form with a center-to-center distance of 28.6 mm each, the rivets are of HI-LITE (HL) type made with a titanium alloy with 6% aluminum and 4% vanadium,

produced by *HI-SHEAR Company* a subsidiary of *LISI S/A* Aeronautical, automotive and medical supplement development company, its activity is focused on fasteners of all kinds.

The HI-LOK rivets, abbreviated to HL, are not ordinary rivets and yes created by the *HI-SHEAR Company* and have according to the company the combination of the

benefits of a rivet with those of a threaded screw.

The HL (HI LOK) has quick and easy installation mainly compared to a rivet or bolt, where its fastening necklace, as shown in Figure 1, has an excess of material that serves as a torque regulator so that the thread does not crush, and the HL can be fixed in the correct mode.

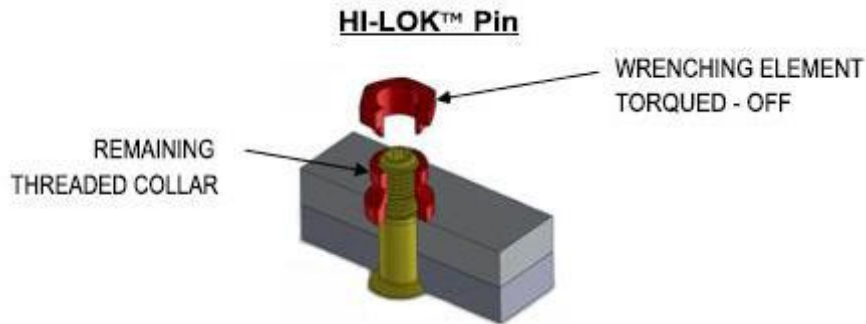


Fig.1: Rivet torqued control and pressing systems [2]

The HL compared to the other rivet models, and has a smaller working area section and therefore a shorter transition area enters the rod and the load bearing segment, with optimized transition from working area to the screw and considerably increasing the fatigue resistance.

HL type rivets account for 85% of aircraft structural joints according to *LISI S/A Company*, combining high strength materials and innovative design.

The research and development of technologies in this area are of extreme importance seeing that the current processes are becoming obsolete, and details become very important in the structural and behavioral analysis of the structures, which led this work to accurately analyze

fatigue fracture behavior of the 7075-T6 aluminum riveted with and without the scarification and burr process.

The installation of the fastening rivets involves milling and cold expansion of the main hole to the limit of fatigue crack growth is due to the compressive zone transmitted to the cold expansion orifice [3]

II. MATERIALS AND METHODS

The test specimen (CP) used in the experimental tests is in sheet form with a useful area of 4278.24 mm² and with 5 centered and aligned rivets whose CP dimensions are shown in Figure 2 and the rivet housing in Figure 3 .

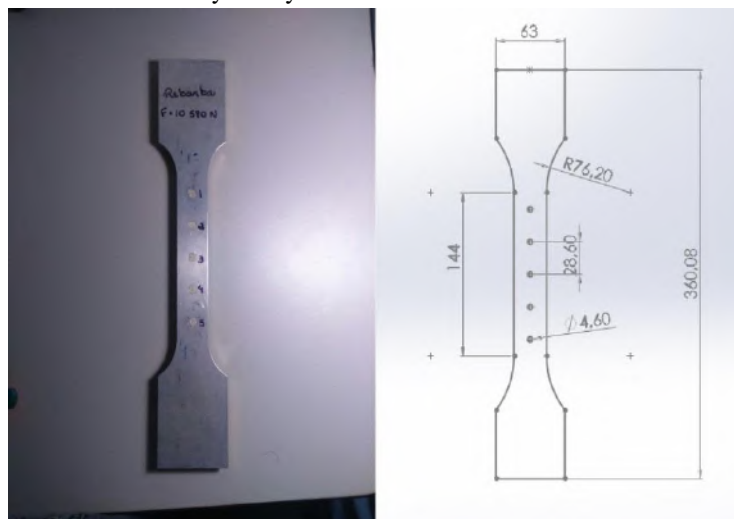


Fig.2: Type of specimens and dimensions according to norm NBR7549/2008

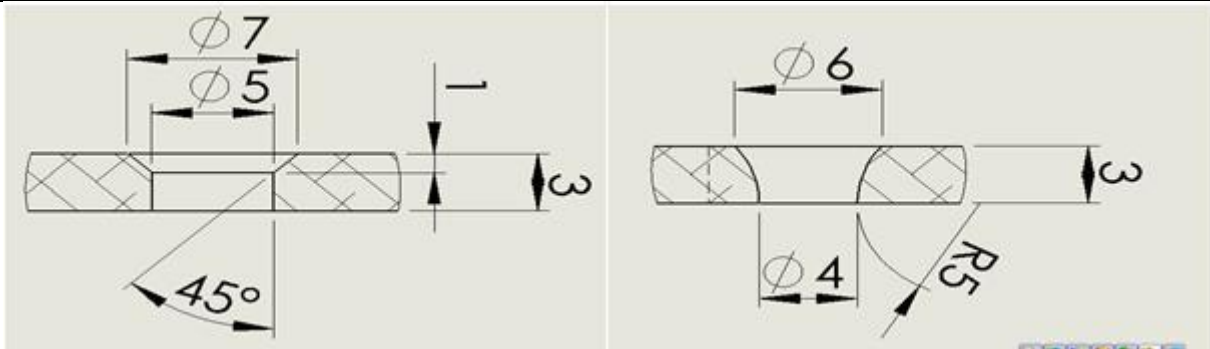


Fig.3: Specimens with the details of rivets housing reaming with dimensions in mm

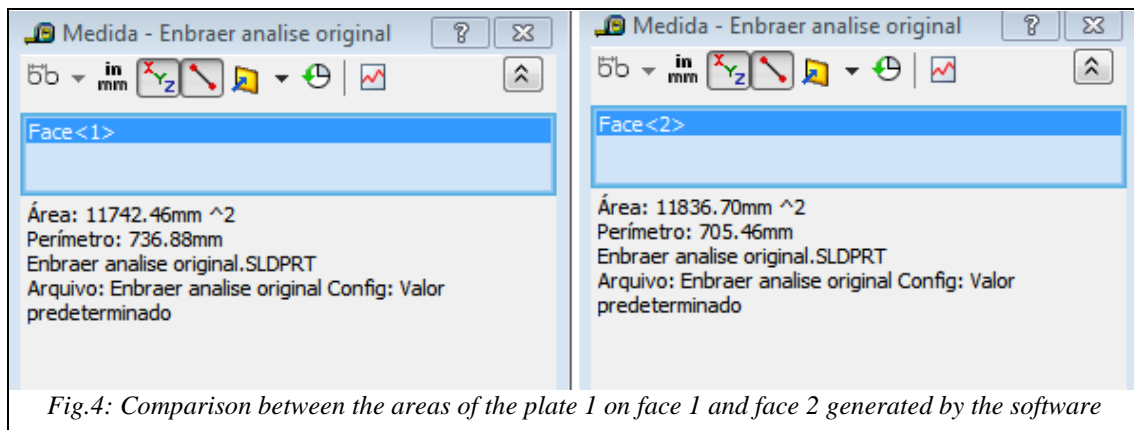


Fig.4: Comparison between the areas of the plate 1 on face 1 and face 2 generated by the software

On the right in Figure 4 we have the measurements on the plate currently used and to its left the measures to be proposed for better distribution of stresses in the plates. The HST11 6 rivet is from the Hi-Lite family as shown

previously, it is composed of 6% aluminum and 4% vanadium and 90% titanium, this material has the following mechanical properties located in Table 2 [4].

Table.2: Properties of Ti-6Al-4V Aluminum Alloy

Mechanical and Physical Properties	Unit Metric	Unit English
Tensile strength	950 MPa	138000 Psi
Elasticity limit	880 MPa	128000 Psi
Elongation until rupture	14%	14%
Modulus of elasticity	113.8 GPa	16500 Ksi
Resistance to fatigue	240 MPa	34800 Psi

Computational analysis of the plate

After previous behavior of the plates by laboratory traction test, a computational test was performed for a better understanding of the isolated components, where the specific plate 1 (in faces 1 and 2) was studied because of the presence of rupture characteristics and concentration of loads with higher incidence, certainly due to its geometry presenting area difference between its upper and lower areas, since the geometry of the housing bore section of the rivet showed change, according to

Figure 5.

The software computational test was done by applying a fixed geometry to one of the faces of the plate and applying a load of 1×10^6 N on the opposite face of the fixed geometry applied as shown in Figure 6. [5]

The computational analyzes were performed on the upper plate of the assembly referred to herein as plate 1 and the lower plate as plate 2 to facilitate discussion of the results obtained.

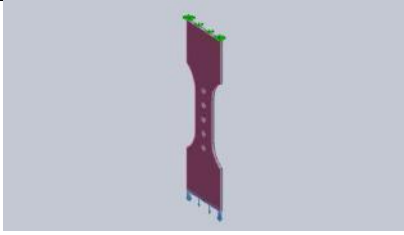
Loadname	Image Plate 1	Loadspecification	
Force-1		Local Type: Value:	1 face Normal force 100000 N

Fig.6: Demonstration of the force applied in the specimen

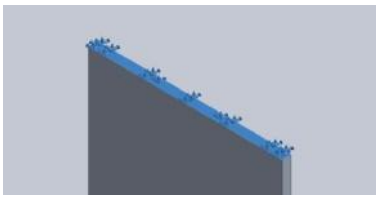
Fixing accessory	Fixture Attachment Image	Fixture accessory details		
Fixed-1		Local: Type:	1 face(s) Fixed Geometry	
Forças resultantes				
Components	X	Y	Z	Resultant
Reaction force(N)	-0.308655	99976.8	6.90748	99976.8

Fig.7: Demonstration of the type of fixation in the specimen

Mesh Information	
Type of mesh	Solidmesh
Used knit generator:	Mesh based on curvature
Jacobian Points	4 Points
Maximum element size	0 mm
Minimum element size	0 mm
Quality of the mesh	High
Total nodes	16424
Total elements	8462
Maximum proportion	6.1643

Nome do modelo: Enbraer_analise original
 Nome do estudo: Estudo 1
 Tipo de malha: Malha sólida




Fig.8: Mesh models generated by the software.

The study was based on a mesh of the solid mesh type, according to data and Figure 7, with mesh generator based on curvature, 4 Jacobian points, maximum and minimum size of elements = 0 mm, total nodes 16424, total elements 8462, maximum proportion 6,1643,% of elements with proportion <3 = 98 and completion time of the mesh = 00:00:02[6].

After the measurements of the test body and HL were taken, they were drawn in the SOLIDWORKS where the first computational tests of tensile strength were made to

generate real data of the transition part of the rivet head and the body, which was the region of greatest fragility [7].

III. RESULTS AND DISCUSSIONS

In Figure 9, the maximum and minimum stress points of the VON MISES are determined by the software and shown on the plate for better understanding, however in Figure 10 are shown the maximum and minimum points of the resulting displacement - URES.

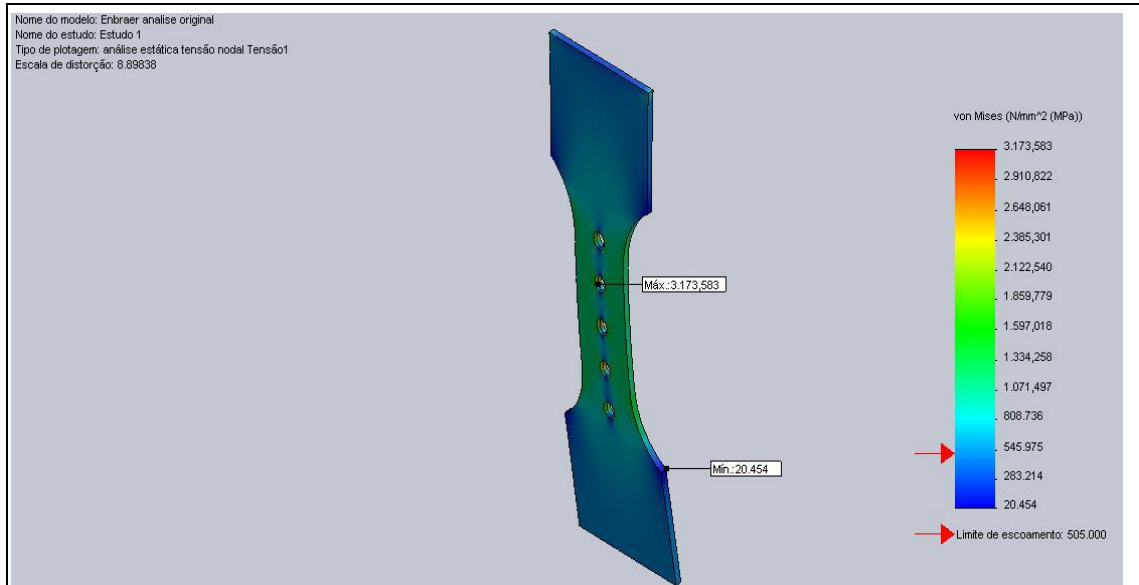


Fig.9: Points of concentration of maximum and minimum stresses of VON MISES in the computational study

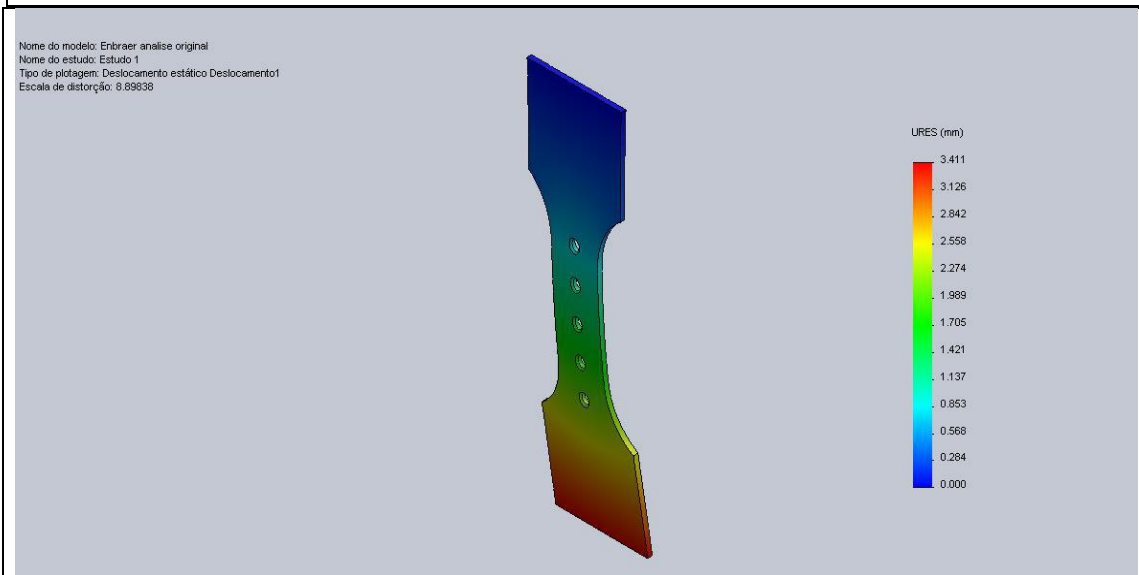


Fig.10: Displacement resulting in URES

In turn in the Figure 11 we have the points of maximum stress concentration also showing 6082.198 MPa, the yield strength that showed 505 MPa. In this image, it is noticed that the tension concentration was inside the hole where the fifth rivet is housed, in Figure 8 with the hole highlighted, we can see where the tension was

concentrated [8].

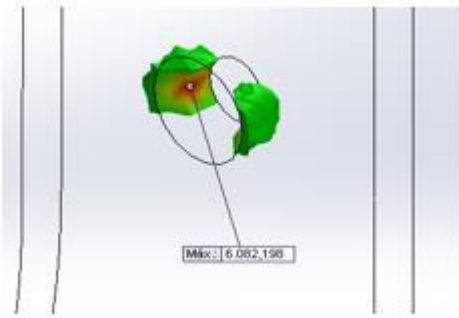


Fig.11: Point of greatest stress concentration

The point highlighted in this figure is a "living corner" produced by the shape of the rivet, it is in the transition from head to body, where there is a radius of 0.75mm, but it is not able to relieve concentration at this point

When we analyze the ray, we can see that it only exerts a smooth transition between the head of the rivet and the body and does not help in a better distribution of force and less concentration, so acting on this ray can represent much more expressive results. Thus, by analyzing different rays the following result is shown in Figure 9.

As the test demonstrates, with the change of radius to the value of 0.39, there was an increase of 319.503 MPa in the tensile strength somewhat around 5.25% increase, something much larger than the 1.76% of the transition radius. [9,10]

Complementary to the computational tests, fatigue tests were carried out on the test bodies at the Institute Technological Aeronautics (ITA- BRAZIL) at the request of EMBRAER, the company interested in the

study, which allowed us to verify that the fatigue strength limit of the material was maximum of 16.6 Ksi at 2×10^6 cycles with burr operation and maximum of 19.1 Ksi at 2×10^6 cycles without burr operation.

For comparative purposes, the maximum tensions and fatigue strength of the respective specimens [11] were highlighted in Table 3 and Table 4.

Table.3: Fatigue test of the CP with burr operation

Net Stress(Ksi)	Maximum Loading (N)	Cycles
37.017	20260	20919
16.564	9130	2000000

Table.4: Fatigue test of the CP without burr operation

Net Stress (Ksi)	Maximum Loading (N)	Cycles
36.6	20260	72081
19.1	10580	2000000

On the other hand, in Figure 12, the equivalent ESTRN equivalent maximum and minimum points are shown on the plate for a better understanding. Equivalent strain (ESTRN) is defined on the X, Y, Z axes as:

$$ESTRN = 2 [(\epsilon_1 + \epsilon_2)/3]^{(1/2)}$$

Where:

$$\epsilon_1 = 0.5 [(EPSX - \epsilon^*)^2 + (EPSY - \epsilon^*)^2 + (EPSZ - \epsilon^*)^2]$$

$$\epsilon_2 = [(GMXY)^2 + (GMXZ)^2 + (GMYZ)^2]/4$$

$$\epsilon^* = (EPSX + EPSY + EPSZ)/3$$

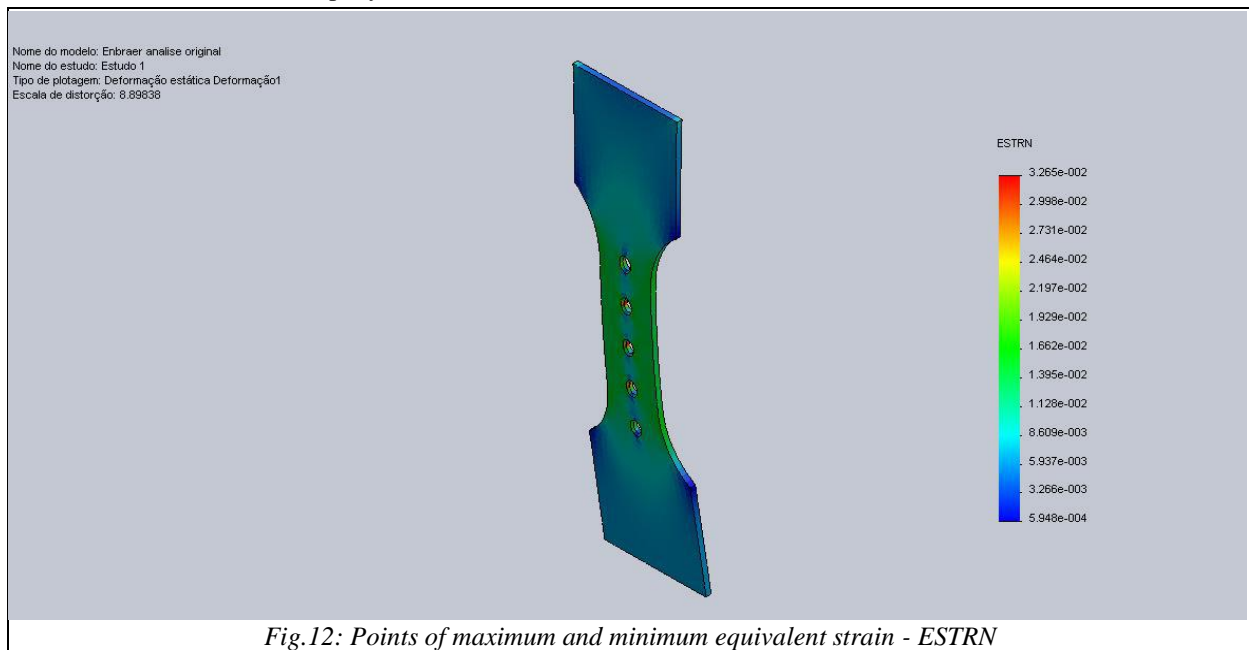


Fig.12: Points of maximum and minimum equivalent strain - ESTRN

Thus the results obtained from the values for this new geometry proposition are presented in table 5:

Table.5: Results of the analysis and its positions in the mesh (Proposed plate 1)

Type	Values	Situation
VON MISES Stress	20.4380 N/mm ² (MPa)	Node: 174
	2594.81 N/mm ² (MPa)	Node: 16435
URES: Resultingdisplacement	0,0 mm	Node: 94
	3.52 mm	Node: 193
ESTRN: Equivalentdeformation	0.000609347	Element: 5877
	0.0238112	Element: 4629

The test specimens of the fatigue test behaved as expected and predicted in the computational traction tests where the rupture occurred at that point by the charge concentration due to the geometry of the section of the hole of the upper plate as shown in Figure 13, thus there being thus a "tearing" of the plate.

Results of these tests extend information previously reported from tests on unnotched specimens and tests on specimens more severely notched and afford data on the variation of fatigue-strength reduction with notch severity.



Fig.13: Top and bottom view of the failure.

Under rotating bending fatigue tests the high stress zones are located at the fracture surface perimeter and decrease to the fracture surface center: the size of grooves decreases from fracture surface perimeter to the center [12]. Furthermore, for this type of specimen the center of fracture surface is characterized by fast crack growth zone

where the plastic deformation is small or zero.

This rupture occurred at that point by the charge concentration due to the geometry of the section of the bore of the upper plate as shown in Figure 14, thus there being a "tearing" of the plate as shown in Figure 13

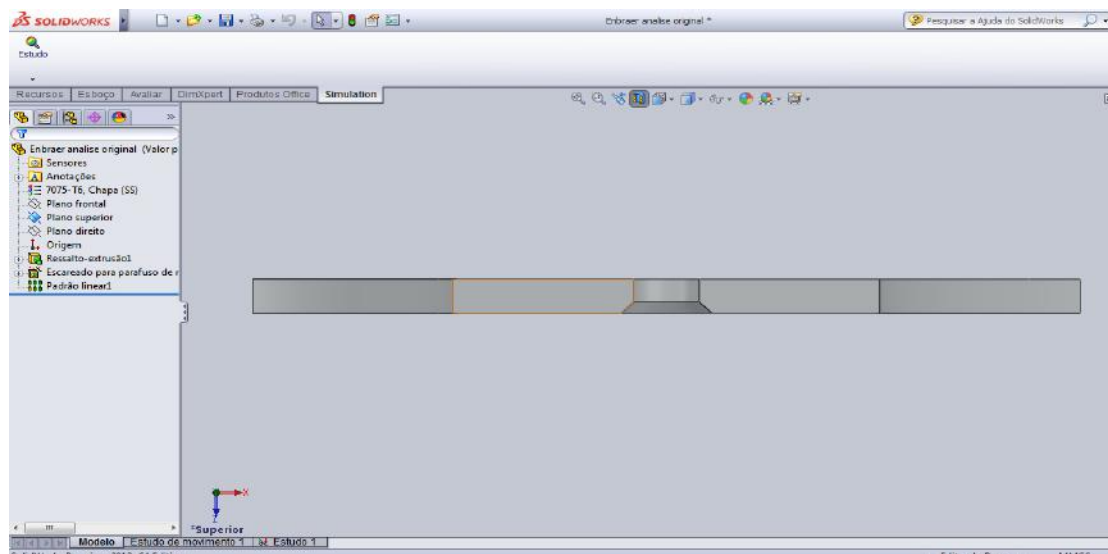
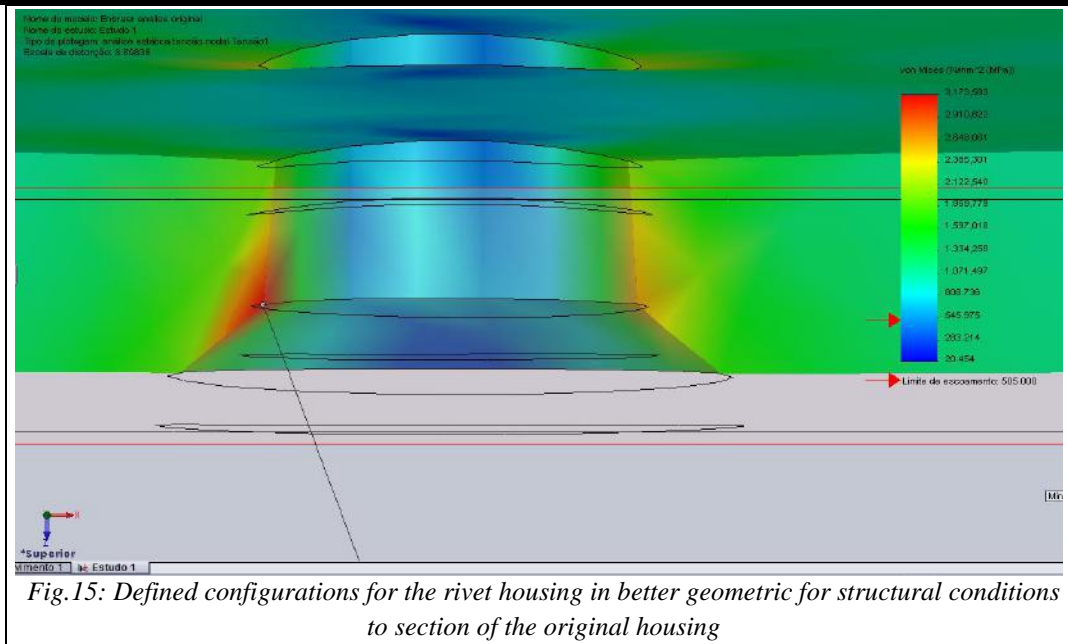


Fig.14: View of the geometry of the upper plate hole section

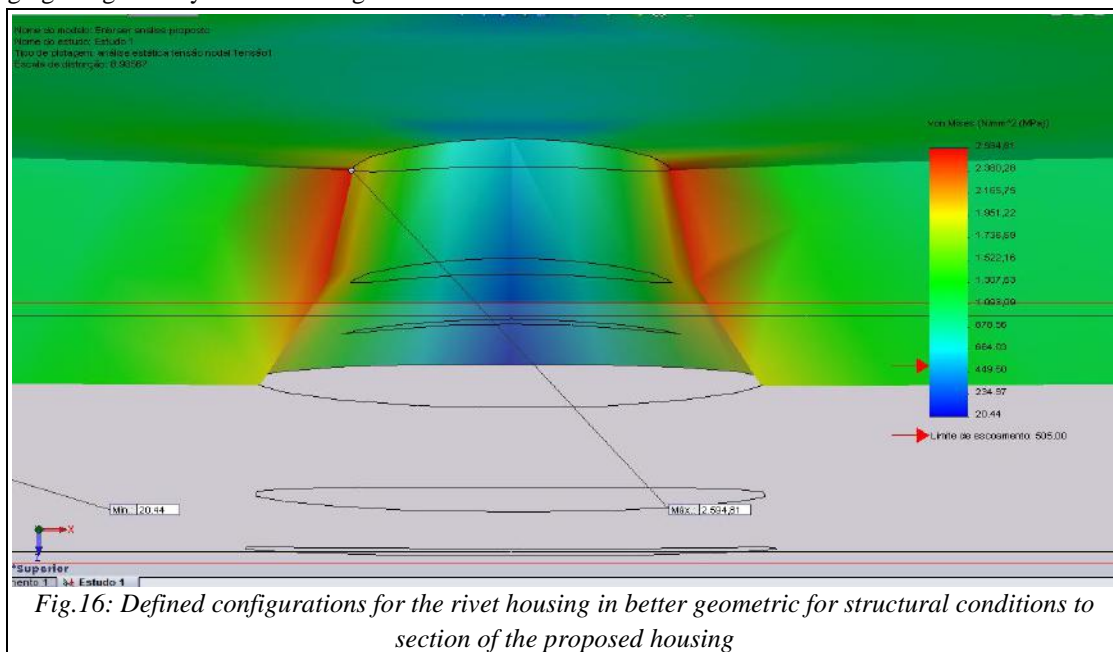


The fatigue cracking growth is associated with the growth of cracks in the riveted fracture mechanics. In turn, small cracks and grain size limitations in the microplastic regions, cause deceleration gradients and consequent slower cracking evolution [13,14].

The stress intensity is used to predict the stress state near the hole and crack tip caused by the applied loading; as the crack tip radius is effectively zero, the stresses at the crack tip would be infinite [15-16]

After changing the geometry of the housing section of the

rivet there was a reduction of approximately 18.27% in the maximum stresses in the plate plus a better uniformity in the stress distribution in the housings as shown in Figure 15 and 16, whereas the displacement only had an increase of 3.125% and the minimum equivalent strain of 2.39% and the maximum of 24%. The stress distribute drafts of the riveted plates obtained so that it is convenient to check the bending strength of the root of the hole and the fatigue contact strength of the union faces [16].



IV. CONCLUSIONS

Based on the results and computational techniques used in this work, the computerized tensile test with an intermediate level of certainty, it is determined that with a change in the radius of transition from the head to the body of the rivet, we can relieve the concentration of

tension within the rivet bore and improve the mechanical strength of the part by 5.25% without significant change in part displacement. However in the fatigue tests performed the work behaved as expected with fractures in the vicinity of the HL, but with the reaming operation there was a small inference on the fatigue strength.

However, the fatigue strength limit was higher in the test specimens without burr operation than the operation, noting that the geometric change of the section generated a decrease of 18.27% in the maximum stresses in the sheet, in addition to a better uniformity in the distribution of the tension in reaming of the rivets, with displacement increasing by 3.125% and the minimum equivalent strain of 2.39% and the maximum of 24%, often explaining the cause of the fracture.

ACKNOWLEDGMENT

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Water regimes and bean cultivar effects on the soil porous system characteristics

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Abstract— *Bean (Phaseolus vulgaris L.) is a crop of great economic and social impacts in Brazil. This crop is extremely appreciated by the Brazilian population and an important source of protein. Usually the small farmers are responsible by the largest production of the bean in Brazil. This work deals with the analysis of the effect of different water regimes (35, 28, 21 and 14%) on the porous system of a soil cropped with two distinct cultivars (Campos Gerais and Tuíuíú). Soil water retention curve (SWRC) and its derivative were utilized with the aim of investigating the changes in the porous system. Pore size distribution was also evaluated. The experiment was carried out at a greenhouse and the soil water content for the different water regimes was monitored by means of a TDR. Four undisturbed samples were collected from each wooden bed (eight) for the physic-hydrical characterization. Discrepancies in the SWRC were noticed for the region of small pressure heads. Differences were not observed between bean cultivars to SWRC. However, the water capacity function was sensitive to show differences in the soil porous system due to the treatments and cultivars. The lowest water regimes promoted the highest volume of fissures (big pores >250 µm) and, consequently, the highest ones had the largest volume of storage pores (<25 µm).*

Keywords— *Phaseolus vulgaris L.; water content; soil water retention curve; pore size distribution.*

I. INTRODUCTION

Bean (*Phaseolus vulgaris* L.) is a crop that occupies a remarkable economic relevance in Brazil (Carvalho et al. 2014). This crop can be cultivated practically in all regions of the country, even under water and temperature restriction conditions (Silva et al. 2017). Brazil has a production of over 3 million of tons with an average yield of 1013 kg ha⁻¹ (2014-2015) (Conab 2016).

The soil porous system is strongly influenced by its physical properties (Fernández-Ugalde et al. 2009;

Basso et al. 2011), which can be used as quality indicators. For instance, soil bulk density (BD) or total porosity (TP) evaluations allow for a better comprehension of the changes in the soil structure due to anthropogenic and natural activities (Spera et al. 2009; Silveira et al. 2011).

Another major physical property of the soil is the water content, which indicates the ideal conditions for the most appropriate soil management (Mantovani et al. 2009). Such a property is also very meaningful for studies dealing with water retention and movement at a given site (Bernardo et al. 2006).

Soil water regimes are directly related to the frequency of wetting and drying (W-D) cycles. A large number of irrigation occurrences are necessary to maintain the soil with an ideal amount of water; consequently, the porous system is submitted to a large number of W-D events. Sequences of W-D can affect the physical properties of the soil, mainly those dependent on the distribution of pores (Pires et al. 2005; Pires et al. 2008).

The pore size distribution (PSD) can be derived from the soil water retention curve (SWRC), which is an important physical attribute that relates the pressure head and water content between themselves (Reinert & Reichert 2006). SWRC is a robust indicator of soil physical quality, and its data (available water, field capacity, permanent wilting point) allow for a more rational and ecological management of the soil in order to maximize crop yield in production fields (Centurion & Andrioli 2000; Silva et al. 2010; Debnath et al. 2012; Pires et al. 2017).

PSD obtained indirectly from the SWRC is also a parameter that can be utilized for a better comprehension of the water storage and movement, which is relevant for the root system development (Kutílek & Nielsen 1994; Hillel 1998; Kastanek & Nielsen 2001; Lipiec et al. 2006). Through PSD, information about the volume of

storage and transmission pores might be assessed. These pores are linked to the transmission and retention of water process, which are pivotal for the water storage for the plants and plant yield.

The objective of the study reported herein was to evaluate the effect of four water regimes on the porous system of a soil cropped with two different bean cultivars in Southern Brazil. The soil porous system was characterized by measurements of the soil water retention curve and pore size distribution.

II. MATERIAL AND METHODS

This study was carried out at a greenhouse of the Agricultural Research Institute of Parana (IAPAR) at the city of Ponta Grossa, PR, Brazil (25°06'S, 50°10'W, 875 m above sea level), throughout the year of 2016 with eight wooden beds (2.50×1.25 m).

The soil is classified as Ferralsol, according to the world reference base for soil resources (FAO, 2006), as Rhodic Hapludox, according to the USDA Soil Taxonomy (Soil Survey Staff, 2013) and as Dystrophic Red Latosol, according to the Brazilian Soil Classification System (Santos et al. 2013). The soil presents a clay texture (158 g kg⁻¹ sand, 302 g kg⁻¹ silt, 540 g kg⁻¹ clay).

Disturbed soil samples were collected at the surface layer (0-20 cm) from an experimental field subjected to plowing and harrowing procedures. Soil sieved in an 8 mm-mesh was used to fill up the wooden beds. Each wooden bed had six spaced row at 40 cm with 12 plants per row. Each row had one single drip strip with eight emitters disposed at 15 cm each one with a maximum outflow per dripper of 1.4 L h⁻¹.

Two treated seeds per hole were manually sowed and after the emission of the first tree leaves roughing was done to allow only one plant per hole to remain in the wooden beds. Two different genotypes (Campos Gerais and Tuiuiú) of beans were utilized in this study. Soil fertilization was performed at sowing date with 19.5 g per row of the 4-14-8 NPK formulation. At 25 days after emergence (DAE) nitrogen fertilizer was applied in bands at a rate of 7 g of urea row.

The soil inside the wooden beds was submitted to four regimes of soil water content (35, 28, 21 and 14% at volumetric basis). The treatments (cultivars and water regimes) were allotted completely randomized in a 2×4 factorial experiment with 4 replications. Soil water contents within the stipulated irrigation water levels at this trial were monitored by means of a Time Domain Reflectometer (TDR) from Hydrosense (Table 1). All wooden beds received the same amount of water (66 mm) during the initial development stage of the crop.

After the final cycle of the crop, undisturbed soil samples (n=4) were obtained by using an Uhland sampler.

Samples were collected by using inox cylinders (5×4 cm height and internal diameter) up to a depth of 7.5 cm.

The undisturbed soil samples were saturated by the capillary rise method and submitted to the following pressure heads (h): -1, -2, -4, -6 and -10 kPa (suction table, Heijkamp®, model M-0801) and -30, -100, -400 and -700 kPa (in pressure chambers, Soil Moisture Equip. Corp.®, model 1500) (Klute, 1986). The water content at the permanent wilting point (-1500 kPa) was theoretically predicted by the mathematical adjustment of the SWRC.

After thermodynamic equilibrium reached for each pressure head, the moist soil mass was evaluated and the dry soil mass was obtained in a forced air circulation oven (105 °C / 48 h). The volumetric water content was determined by multiplying the gravimetric water content by the soil bulk density assessed for each treatment and depth studied (Lal and Shukla 2004).

The SWRC experimental data were fitted by using the mathematical model proposed by van Genuchten (1980) in the SWRC Fit computer program (Seki 2007). The Mualem restriction was employed (Mualem 1976):

$$\theta = \theta_r + \frac{(\theta_s - \theta_r)}{[1 + (-\alpha h)^n]^m} \quad (1)$$

where θ_s and θ_r are the saturation and residual soil water content, respectively; h is the matric potential; α , n and m ($=1 - \frac{1}{n}$) are empirical parameters that govern the shape of SWRC. The SWRC adjustments were obtained based on average values of θ (n=4).

After SWRC mathematical adjustments, the volumetric water capacity (C_θ) was obtained by means of the following equation (Radcliffe & Simunek 2010):

$$C_\theta = \frac{\alpha^n (\theta_s - \theta_r) m n (-h)^{n-1}}{[1 + (-\alpha h)^n]^{m+1}} \quad (2)$$

where θ_r and θ_s denote soil residual and saturated water contents, respectively. The equivalent cylindrical soil pore radii (r) were obtained in μm with h expressed in kPa ($= \frac{149}{h}$).

Relative differences (RD) were calculated by:

$$\text{RD}\% = \left(\frac{X_i - X_{i-1}}{X_i} \right) \cdot 100 \quad (3)$$

where X_i represents the soil attribute evaluated, e.g., θ or C_θ .

The influence of the treatments on the structure of the soil was also scrutinized taking into account soil pore classification systems based on functional characteristics. The system proposed by Greenland (1977) was used for this purpose, in which pores with equivalent cylindrical radii <0.25 μm are considered bonding + residual pores; ranging from 0.25 to 25 μm storage pores; varying from 25-250 μm transmission pores; and >250 μm comprise fissures.

With regard to the statistical analyses soil bulk density (BD), total porosity (TP), macroporosity (MA) and microporosity (MI) were subjected to Shapiro-Wilk test ($p < 0.05$) for assessment of normality of the data. Moreover, ANOVA with application of F test along with S-N-K test ($p < 0.05$) for two beans cultivars, and regression analyses for soil water regimes were performed herein.

III. RESULTS AND DISCUSSION

Soil physical attributes

The soil physical attributes BD, TP and macroporosity (MA) were influenced by the bean cultivars and water regimes, while the microporosity (MI) was affected only by the water regimes (Figures 1 and 2). The Campos Gerais cultivar provided higher BD and lower TP and MI than the Tuiuiú cultivar ones (Figure 1).

Under the studied soil water regimes it was verified linear effects on BD, TP, MA and MI. By this way, an increase in the water regimes means increases in BD and TP and decreases in TP and MI (Figure 2). These results give some idea about the importance of the W-D cycles caused by the water regimes (Table 1) in the process of soil structuration (Pires & Bacchi 2010).

By considering the initial condition of the unstructured soil, the effects of the largest soil water contents can be ascribed to the capillary forces acting in the formation of inter-aggregate bridges (Aluko & Koolen 2000; Viana et al. 2004; Ogunwole et al. 2015).

Soil water retention characteristics

Regardless of the bean cultivar, it was noticed tendencies among the SWRCs under the different soil water regimes (Figure 3). The highest soil water regimes (35 and 28%) showed water retention levels similar between them and such regimes were then characterized by the highest θ throughout the whole curve in comparison with the lowest soil water regimes (21 and 14%). The latter thresholds also brought about similarities in water retentions between them (Figures 3a and 3b).

For the Campos Gerais cultivar only slight differences were observed in the water retention for the highest pressure heads (Figure 3a). The water retention was practically the same between the treatments 21 and 14% ($RD < 3\%$). Within the range of smaller pressure heads the treatments 35 and 28% resulted in a larger θ . In this case, RD was larger than 10% for the water regimes 35 and 28% in comparison with 21 and 14% (Figure 3c). Such an outcome is coherent with the largest MI and BD observed under both treatments (Figure 2) as a result of the rearrangement of the microaggregates and soil particles due to the W-D cycles (Pires & Bacchi 2010; Ogunwole et al. 2015).

For the Tuiuiú cultivar similarities in water retention were evidenced under the highest pressure heads among treatments, except for the 35% water regime (Figures 3b and 3d). The driest SWRC region presented similar results as to Campos Gerais cultivar, that is, a higher θ under the highest soil water regimes. This response is related to the highest MI and BD found under the highest soil water regimes (Figure 2). Similarities in θ near saturation are mainly linked to slight differences in TP and in specific parameters of the SWRC mathematical adjustment (Table 2).

The samples subjected to the highest water regimes had greater values of MI (Figure 2), which is one of the causes of the highest amount of water retained in the driest SWRC region, as previously mentioned. The soil under the lowest water regimes revealed a larger MA (Figure 2), indicating an easy drainage capacity when compared to the soil under the highest water regimes (Hillel 1998; Lal & Shukla 2004).

It is pertinent to mention that the water retention process is directly influenced by the soil texture, structure and organic matter content (Dexter et al. 2004). According to Rawls et al. (1991), such a process under the highest pressure head occurs mainly by capillarity, being, therefore, extremely governed by the arrangement of the soil particles owing to the presence of structural pores (Kutílek 2004; Kutílek et al. 2006; Lipiec et al. 2007; Pires et al. 2017). However, under the lowest pressure head the soil texture and its mineralogy become quite important due to the water adsorption process (Gupta & Larson, 1979; Machado et al. 2008). As in this study, once the soil used to fill up the wooden beds was the same, there are no differences in its texture and mineralogy that could explain the discrepancies observed within the driest region of the SWRC.

Pore size distribution

By analyzing the interactions between cultivars and soil water regimes, it can be seen that the water regime 35% revealed some similarities in C_0 , with the most frequent pore size similar between cultivars and a frequency of pores slightly larger for Tuiuiú. Under the 28% soil water content, the Tuiuiú cultivar had a larger frequency of pores in comparison to Campos Gerais and a shift of the most frequent pore within the region of larger pores (Figures 4a and 4b).

Regarding C_0 for the Campos Gerais cultivar, it was observed a large frequency of pores within the lowest soil water regimes (Figure 4a). There is also a shift in the most frequent pore within the region of higher sizes under the lowest water regimes. These results are directly related to the values of BD, TP, MA and MI (Cássaro et al. 2008; Ogunwole et al. 2015). Under the highest water regimes (28 and 35%) there are small differences in C_0

(RD <10%) (Figure 4c), which is an indication that under such regimes, the soil porous system is quite similar between both treatments.

For the Tuiuí cultivar, the size of the most frequent pore is practically the same under water regimes of 28 and 14%, along with a slight shift for the largest pore sizes in comparison to 35 and 21% (Figures 4b and 4d). Similarities were noticed between both cultivars with the largest frequency of pores belonging to the lowest water regimes. Therefore, for the Tuiuí cultivar only small differences were observed in C_0 under water regimes of 28, 21 and 14% (Figure 4d), differently from what was observed for the Campos Gerais cultivar (Figure 4c).

The results obtained under water regimes of 21 and 14% can be explained by the small number of W-D cycles applied to the soil. The increase in the number of W-D cycles causes an increment in the rearrangement of the soil particles and microaggregates and, as a consequence, BD and MI increase and MA decrease (Nolla 1982). Therefore, C_0 suffers a decrease with the increase in the number of W-D cycles, which points out that the soil when subjected to distinct W-D cycles turns out to be a target of important changes in its structure (Pires et al. 2005; Pires et al. 2008).

Finally, an analysis of the soil pore size distribution based on the Greenland classification was also carried out herein (Greenland 1977). For the Campos Gerais cultivar, the water regimes of 35 and 28% demonstrated a decrease in the volume of big pores (fissures) as opposed to the 21 and 14% soil water content (Figure 5a), which in turn are responsible for the water infiltration process (Kutílek & Nielsen 1994; Libardi 2005). However, an increase in the volume of storage pores (<25 μm) was found under the 35 and 28% soil water treatments. Similarities in the volume of pores responsible for the redistribution of water (25-250 μm) within the soil profile were observed among soil water regimes (Figure 5a).

For the Tuiuí cultivar, there is only a slight difference in the proportion of transmission and fissures pores among the water regimes of 28, 21 and 14% (Figure 5b). The treatment 35% presented a decrease in the volume of big pores (fissures) in comparison to the other treatments and a slight increase in the volume of transmission pores. It was also observed that the water regimes of 35 and 28% had the largest volume of storage pores (Figure 5b).

The comparison between cultivars (Figures 5c to 5f) showed that the water regimes of 35 and 28% were characterized by the most significant differences in the pore size distributions between cultivars. For all soil water regime treatments volume of fissures was higher for the Tuiuí cultivar. In contrast, volume of storage pores

was to be higher for the Campos Gerais cultivar, mainly under soil water regimes of 35 and 28%.

IV. FINAL CONSIDERATIONS

The findings here indicate that for the driest region of the soil water retention curve under the highest soil water regimes (35 and 28%) presented the highest water retention for both Campos Gerais and Tuiuí cultivars. However, there are no great differences in water retention between cultivars. The most consistent differences were observed at the high values of pressure head mainly under the 35 and 28% soil water regimes.

The derivative of the SWRC was a parameter more sensitive to evidence differences in the soil porous system due to the treatments. For both cultivars, the frequency of pores was larger under the lowest water regime (14%). It was also noticed that the Tuiuí cultivar was featured by a large frequency of pores under all soil water regimes studied.

Concerning the pore size distribution based on the functional characteristics of the pores both cultivars have showed a large volume of big pores (fissures) under the lowest water regimes. Yet, the highest water regimes were yoked to a large volume of storage pores. Nevertheless no significant differences between cultivars were detected.

Thus, considering that in the beginning of the experiment the soil presented a predominance of big pores owing to sieving, we can infer that the lowest water regimes (mainly 14%) had a null contribution to the soil structuration process. These results give some insights about the adequate water availability for the re-structuration of the soil under the action of wetting and drying cycles.

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TABLES

Table.1: Number of irrigation events (wetting and drying cycles) and the total irrigation water levels for the different soil water regimes

Cultivar	Number of irrigations			
	35%	28%	21%	14%
Campos Gerais	22	15	7	4
Tuiuiú	19	21	10	10
Total irrigation water levels				
Campos Gerais	216	155	80	25
Tuiuiú	232	263	113	107

Table.2: Parameters of the mathematical adjustment of the soil water retention curve for each cultivar (Campos Gerais and Tuiuiú) and soil water regimes (35, 28, 21 and 14%)

Cultivar	Level	θ_s	θ_r	α	n	R ²
Campos Gerais	35	0.6339	0.2369	1.978	1.414	0.997
	28	0.6266	0.2225	1.805	1.408	0.998
	21	0.6473	0.2062	2.606	1.436	0.999
	14	0.6452	0.1977	3.347	1.377	0.999
Tuiuiú	35	0.6634	0.2096	2.279	1.374	0.999
	28	0.6590	0.2072	3.586	1.359	0.999
	21	0.6590	0.2092	3.076	1.444	0.999
	14	0.6632	0.2058	3.552	1.446	0.999

θ_s : saturated volumetric water content; θ_r : residual volumetric water content; α and n: adjustment parameters; R²: coefficient of determination

FIGURES

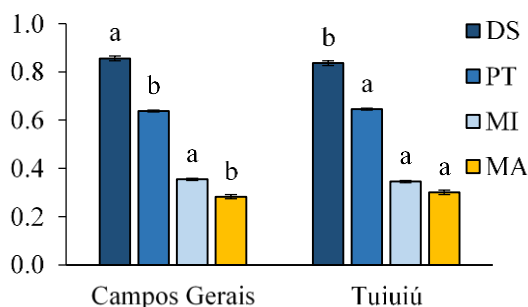


Fig.1: Soil bulk density (BD), total porosity (TP), macroporosity (MA) and microporosity (MI) of the soil under the influence of two bean cultivars (Campos Gerais and Tuiuiú) Different letters mean statistic differences by the S-N-K test (p<005)

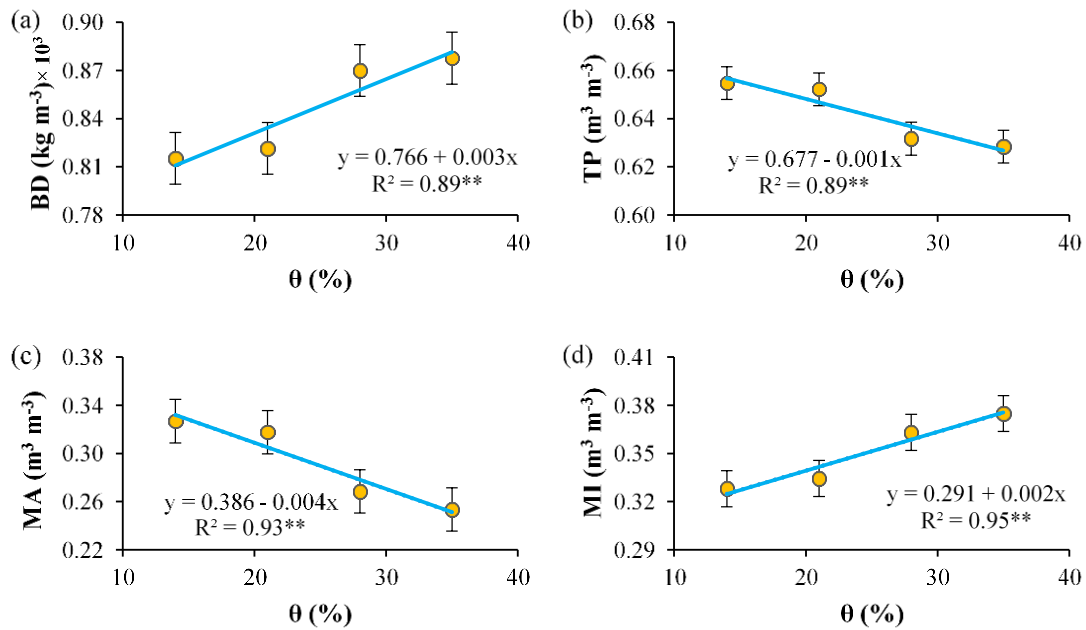


Fig.2: Soil bulk density (BD) (a), total porosity (TP) (b), macroporosity (MA) (c) and microporosity (MI) (d) as a function of different soil water regimes (θ) (35, 28, 21 and 14%) ****Significance at $p < 0,01$**

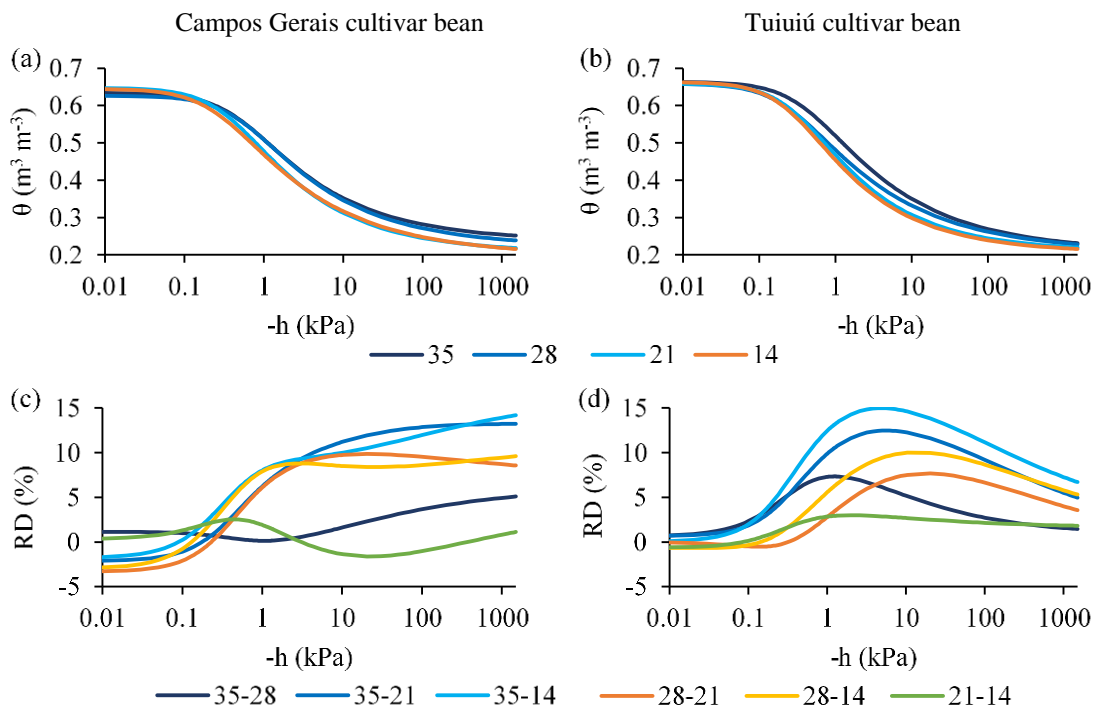


Fig.3: Soil water retention curves (SWRC) (a,b) for the bean cultivars Campos Gerais and Tuiuiú as a function of different soil water regimes (35, 28, 21 and 14%) along with relative differences (RD) among SWRCs for each cultivar (c,d) RD was calculated taking into account the highest soil water regime as a reference

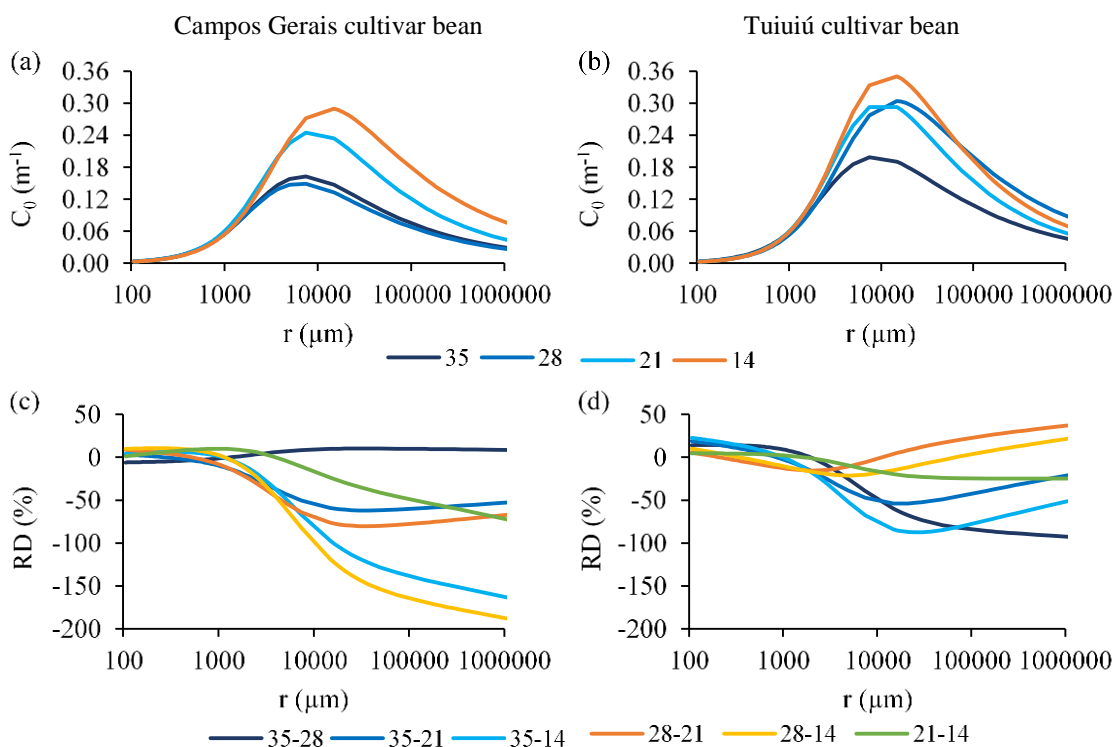


Fig.4: Volumetric water capacity (C_θ) curves (a,b) for the bean cultivars Campos Gerais and Tuiuiú as a function of different soil water regimes (35, 28, 21 and 14%) and relative differences (RD) among C_θ for each cultivar (c,d) RD was calculated taking into account the highest soil water regime as a reference

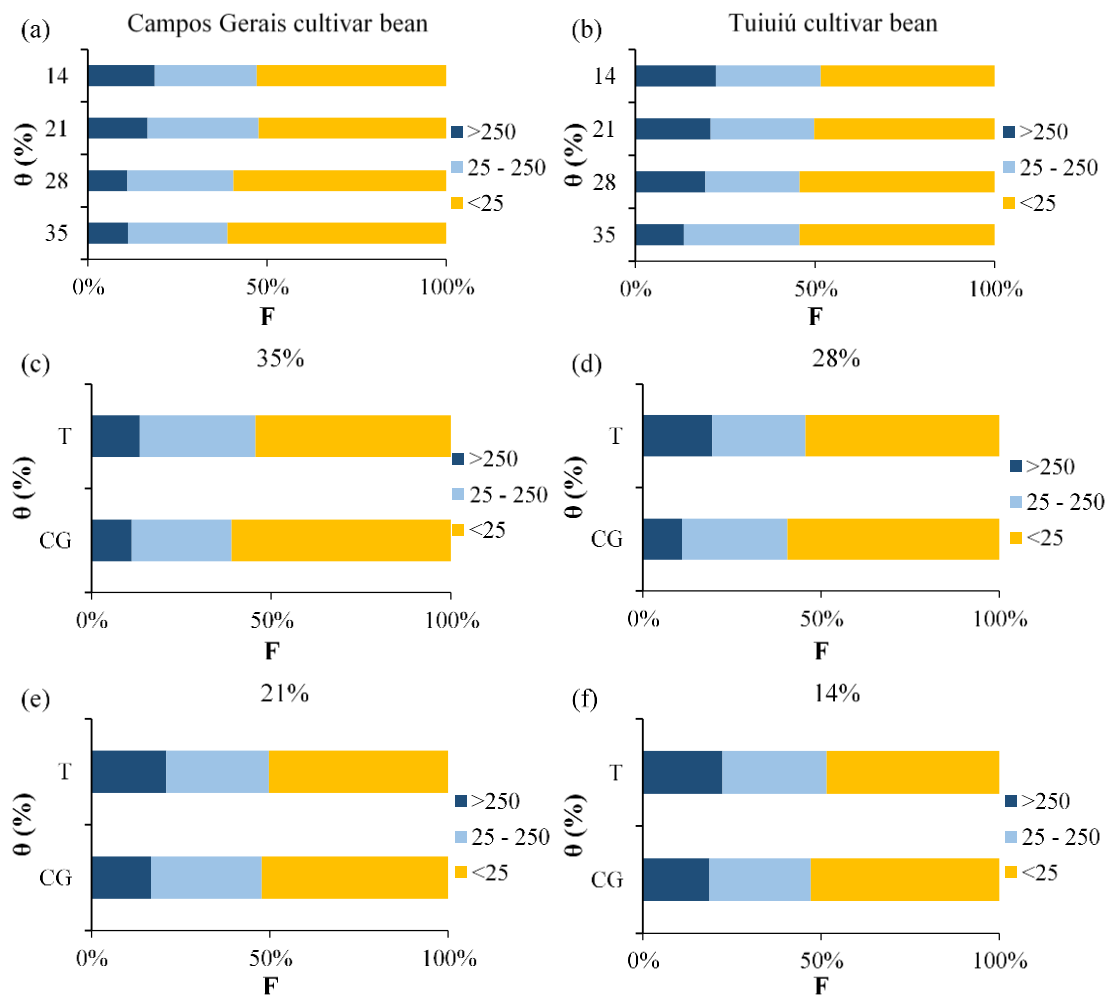


Fig.5: Frequency of pore sizes for the Campos Gerais (CG) (a) and Tuiuiu (T) cultivar beans (b) plus comparison between cultivars under different soil water regimes: 35% (c), 28% (d), 21% (e) and 14% (f) Three different pore size categories were evaluated according to the classification of Greenland (1979)

Cladding welding of CA6M with pulsed FCAW and results analysis through the L9 TAGUCHI and ANOVA

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Abstract— The cladding welding analysis with pulsed flux cored arc welding (FCAW) process, were carried over a AISI 1020 base metal (thickness 12,7 mm, width 63,5 and length 185mm) with an CA6NM steel wire with diameter of 1.2mm. Was performed only one weld cord in the flat position. For experimental design was used the method of Taguchi L9 to determinate the parameter to be analyzed through the application of the analysis of variance (ANOVA) method. The response signals in RMS (Root Mean Square) analyzed were the voltage, current and acceleration. The procedure is based on a non-parametric domain-selective ANOVA for functional data, which results in the selection of the intervals of the domain presenting the most statistically significant effects of each factor over the selected response signals. The statistical results presented by ANOVA show that not all the selected variables have influenced the results. The best results for the cladding welding were obtained from the current average of 230amperes, and statistically the average current was the variable that significantly affected the results, however, the welding speed only affected the yield of the process.

Keywords— FCAW Pulsed, Martensitic steel cladding, RMS current, ANOVA.

I. INTRODUCTION

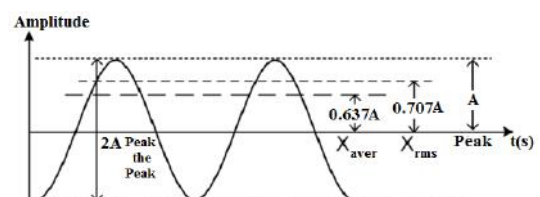
The cladding welding of carbon steel with stainless steel is defined by PALANI & MURUNGAN (2007) as the deposition of a layer of stainless steel on surfaces of carbon steel or low alloy steels with the purpose of obtaining coatings with good properties of corrosion resistance. Even though the stainless steel offers some huge advantages over the common carbon steel, the price of using stainless steel can be ten times greater. In that way, the cladding welding process main advantage is related to the fact that the produced layers are less

expensive but still benefits from some of the properties of the stainless steel if compared with the carbon steel.

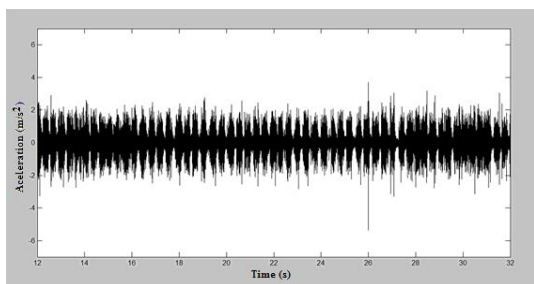
The arc welding with FCAW (Flux Cored Arc Welding) is a process that produces coalescence of metals by heating them with an arc established between a continuous consumable tubular electrode and the work piece (MARQUES et al., 2005 and RODRIGUES et al, 2008). The protection of the arc and the weld bead is provided by a welding flux contained within the electrode, which can be supplemented by a gas flow supplied from an external source. For stainless steels literature recommends using argon mixture with 2% oxygen which has a slightly oxidizing behavior.

The monitoring technique used in this work was based in sensors that could acquire simultaneously signals such as, current, voltage and acceleration. The vibration signal that provides interesting results in Predictive Maintenance Programs, and also in the analysis of welding stability, as the spectral analysis of vibration frequencies can show different defects characteristics during a welding process.

In the Figure 1a, it is possible to observe the correlation between the average, peak, peak-to-peak, RMS value and the amplitude of a sinusoidal signal. The Figure 1b shows a generic vibrational signal. In a signal of this nature, the choice of the numerical value to be used to determinate its characteristics can imply in great differences.



(a) Main characteristics of a vibration signal Average, RMS and peak.



(b) Example of a vibration signal in the time domain.
 Fig.1: Examples of vibration signals (RAO, 2009)

The method that involves vibration measurements are subdivided into: techniques based on the time domain, frequency domain and time/frequency domain. The graphics of the signal in the time domain registers the amplitude as a function of the time but when analyzed through the frequency domain, the amplitude is presented as a function of the frequency. As can be observed in the Figure 2, the identification of the frequency components of complex signals by using the time domain is very difficult, so the signal is transported to the frequency domain to make it simpler to find erratic behaviors that could represent some failure or another point of interest in the signal. The effective value or Root Mean Square (RMS) is the mean quadratic level of a sinusoidal signal, being an extremely important measure of the amplitude, as it shows the average energy contained in a vibratory movement.

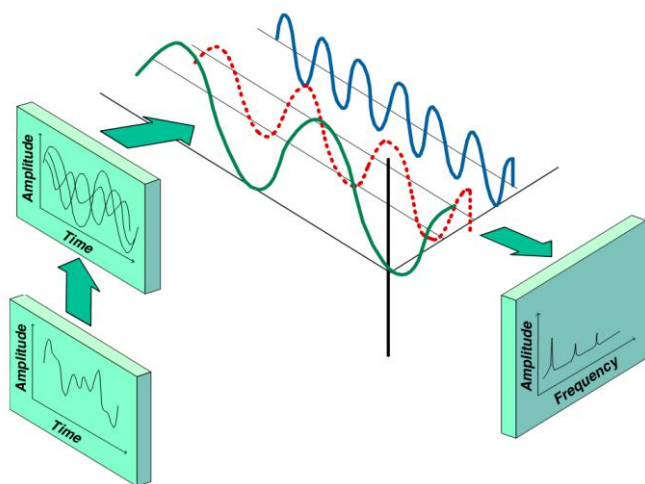


Fig.2: Comparison of the analysis of a signal through the time and frequency domains (RAO, 2009)

Based on the simultaneous acquisition of signals, a variety of studies has been developed, such as the research of (ARATA et al; 1981) that used an accelerometer and a microphone to identify possible defects in a GMAW welding process, where (GRAD et al; 2004) also conducted an extensive research of this process through the analysis of the current signals with a noise signal acquired with a microphone. In a more advanced research, JOHNSON et al (1991) coupled the current, voltage and noise signals together to produce a more reliable analysis system.

For the FCAW process, (WANG et al, 1995) wrote about the prediction of the metal transfer modes through the analysis of simultaneously acquired signals. As well as LIMA & FERRARESI (2006) that developed a research on the analysis of current and voltage signals in a way to determinate the metal transfer mode.

The statistical analysis in this work is based on the analysis of variance (ANOVA), that is primary used to verify which parameters are more intensively correlated to the results obtained during the tests (THAKUR & NANDEDKAR, 2010).

The main parameters analyzed through this method are the average current, pulse frequency, welding speed and contact tip to work distance, which were correlated to the geometrical parameters of the weld cord. ANOOP & KUMAR (2013), KUMAR (2014) at optimization in tungsten gas arc welding with aluminum and stainless steel, respectively using Taguchi and ANOVA. PINI et al (2015) studied the analysis of a laser welding process through the ANOVA software method (ANIL KUMAR et al, 2015) studied the parameters of welding with ANOVA.

II. MATERIALS AND METHODS

Materials:

The base metal used was an AISI 1020 steel plate with the following dimensions (185 × 63.5 × 12.7 mm) and for the cladding was used the EC410NiMo MC 1.2 mm in diameter electrode wire with the shield gas a mixture of argon with oxygen 2%. The chemical composition of the base metal and filler is show in Table 1.

Table.1: Chemical composition data for the base metal and the filler metal

Materials	C	Mn	P	S	Si	Ni	Cr	Mo
AISI 1020	0.18/0.23	0.30/0.60	0.03	0.035	0.10/0.30	0.15	0.15	...
EC410NiMo	0.027	0.590	0.024	0.006	0.44	4.86	12.50	0.43

Methods:

To perform the welding, a test bench consisting of a welding machine, a displacement system for the welding torch and a modular data acquisition system, compose by an ammeter, a voltmeter and an accelerometer. A diagram of this test setup can be seen in the Figure 3 at where the main features and components are described. The welding process is usually limited by the diameter of the wire used for deposition.

Being possible to use large diameter wires to weld in the flat surfaces in the horizontal position, the use of small diameters wires makes possible to weld in almost any position.

After the welding process, a layer of slag that covers the weld bead must be removed to be able to visualize clearly the bead and its defects. Figure 4 shows a schematic view of the flux-cored arc welding process.

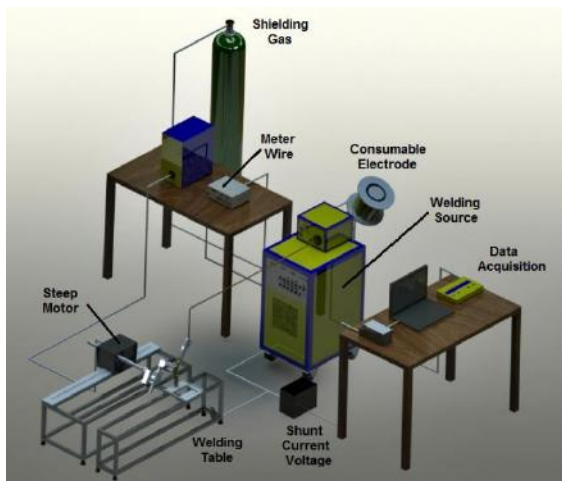


Fig.3: Diagram showing the layout of the test equipment

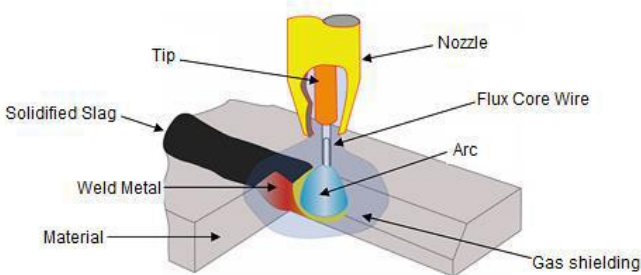


Fig.4: Schematic view of the flux cored arc welding process

The FCAW parameters of interest for this work are the welding speed, current, the distance between the wire and the work-piece or Arc Length, and the pulse frequency. The welding parameters were defined through an extensive bibliographical consultation and preliminary tests. Through the analysis of those acquired data and taking into

account the main goals of this study, the limits of each variable were prefixed. The Table 2 shows those parameters and their values that were used during the tests. Before the welding process, all the specimens surface were treated through an abrasive blasting process with steel grit G-25 S-280 with hardness D, this process were produced in accordance to the SAE J444 (1993) standard, to provide a surface free of contaminants. The equipment used were a CMV blaster, model GS-9075X.

After that, all samples were pre-heated to a temperature of 200°C in a muffle furnace NT-380 before they were brought to the test bench, then, an infrared gauge were used to monitor the work piece temperature, in the moment that it reached 150°C, the welding process were started.

Table.2: Optimal parameters obtained for the FCAW process and their respective values

Parameters	Values
Polarity of the Electrode	DCEP
Shielding Gas	O ₂ + 2% Ar
Gas Flow	18 L/min.
Torch Angle	90°
Welding Position	Flat
Inter-pass Temperature	150° C
Number of Cords	01
Peak Current (I _p)	350 A
Peak Time	10 ms

The signals provided by different sensors (ammeter, voltmeter and accelerometer) were acquired simultaneously as well as the welding vibration that was detected with a piezoelectric accelerometer model KSD-80D, with a sensibility of 100 mV/g and response frequency in the range of 0,13 ~ 22000 Hz.

The accelerometer was installed in the central part of the specimen below the welding table, in such a way that its operating temperature would not be exceeded, where the initials tests to verify the accelerometer responsiveness and was possible to verify that its location did not affected the results.

Figure 5 shows a schematic view of the accelerometer assembly used in the work piece, and is important to observe that the torch displacement systems was not mounted in the same structure as the welding table in a way to isolate the noises that could be picked during its motion.

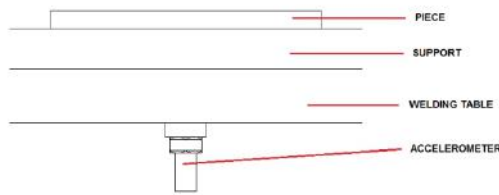


Fig.5: Schematic arrangement of the accelerometer

Development of L9 Taguchi

The method developed by Taguchi objective: Project products or processes that are robust with respect to the environmental, design and develop products that are robust to the variability of its components and minimize variability around a nominal value.

The methods Taguchi (MONTGOMERY & RUNGER, 2012) typically use three or more levels in the welding process parameters that aim at estimating potential non-linear interactions thereof.

To relate the combination of four variables and three levels of each was used the test by Minitab software and the relationships are presented in Table 3.

The Taguchi method has been optimized for many studies of welded joints by various processes where delineating experimental matrix with their levels.

Experiments based on the Taguchi technique was used to get the data by analysis of variance (ANOVA) were used to investigate the welding characteristics for deposition of EC410NiMo MC in AISI 1020 steel and optimize welding parameters (SAPAKAlet al 2012)

III. RESULTS AND DISCUSSIONS

For a better uniformity of the results, the signals were all analyzed between the times of 20 and 30 seconds. In that way, the results obtained were most probably found in a zone where the arc was fully developed. The results shown as RMS (Root Mean Square) values can be seen in the Table 4 for the 9 samples. It is possible to observe that the highest RMS current and voltage values were obtained for an Average Current of 230 A.

In the FCAW welding process as in the GMAW, the metal transfer through short circuit occurs at low currents and low voltages levels, then, possibly at voltages up to 20 V this was the predominant type of metal transfer. While at voltages above 20 volts there was probably occurred globular transfer with the presence of elongation, causing the drop to touch the workpiece without being transferred.

Table.3: Design of Experimental Matrix

Sample	Average Current (A)	Pulse Frequency (Hz)	Welding Speed (mm/min.)	Tip to Work-piece Distance (mm)
1	170	18.18	300	30
2	170	22.22	350	33
3	170	20.00	400	36
4	200	20.00	300	33
5	200	18.18	350	36
6	200	22.22	400	30
7	230	22.22	300	36
8	230	20.00	350	30
9	230	18.18	400	33

Table.4: Results for current, voltage and acceleration of the pulsed current in RMS

Sample	Welding Parameters				Results		
	Average Current (A)	Pulse Frequency (Hz)	Welding Speed (mm/min)	Contact Tip Work Distance (mm)	Current RMS (A)	Voltage RMS (V)	Acceleration RMS (m/s ²)
1	170	18.18	300	30	193.2465	15.2346	0.3779
2		22.22	350	33	185.4450	16.9629	0.3147
3		20.00	400	36	160.5643	17.7862	0.2945
4	200	20.00	300	33	191.3539	25.4825	0.2009
5		18.18	350	36	182.2212	26.3488	0.1854
6		22.22	400	30	178.3370	22.1801	0.2065
7	230	22.22	300	36	209.9335	27.8447	0.1810
8		20.00	350	30	215.3948	25.3854	0.1700
9		18.18	400	33	195.2679	25.3066	0.1665

The best welding current during all the tests was 230 A, this result could be probably related to the fact that it could be above the transitional current and that it could have a greater heat input that increases the wire tip temperature due to the Joule Effect, which facilitate the transfer process.

Using shadowgraph KIM & EAGAR (1993) mention what the fact that the transition between metal transference modes (globular with elongation and rotational transfer) are more likely to occur when the base material is steel and the shielding gas is argon.

It is also possible to observe in the Table 4 that the average RMS acceleration for the pulsed current was 0.3290 m/s² for 170 A, 0.1976 m/s² for 200 A and 0.1725 m/s² for a 230 A current, which shows that the acceleration decreases substantially with the increase of the average current, meaning that less vibration was captured, leading to a more stable arc during the welding process.

ANOVA is a statistically based, objective decision-making tool for detecting any differences in the average performance of groups of items tested. Tables 5, 6 and 7 present the RMS ANOVA of current, voltage and acceleration respectively. Table 8 shows these compiled results.

The software MINITAB in its version 16 was used to produce the statistical results for this work. Statistically when the significance level (α) of an output parameter, provided by ANOVA results for a given factor, were less

than 5%, we can say that this factor must directly affect the response of the result.

However if the significance level (α) values are greater than 5% there is a weak correlation between the factor analysis and the output signal (PATEL & PATEL, 2014).

It is also possible to observe in the same table, the factors that affect the output signals are the average current, which was directly correlated with all three results, but on the other hand, the welding speed was the only affecting RMS Current ($\alpha = 0.000344\%$).

On the other hand, the Contact Tip to Work Distance were more likely to have close correlation with the RMS Current and Voltage ($\alpha = 0.028926\%$ and 0.004418 , respectively), but with less intensity if compared to the other situations.

The Root Mean Square showed that the effects of the quadratic regression, was better than linear regression in a given range.

However, quadratic regression could not directly perceive the relationship between the welding parameters and weld geometry. Hence, this research considered the establishment of the exponential regression.

This exponential regression showed that with the increasing of welding average current, notice that the weld width and reinforcement increase and also if welding voltage increases, the weld width increases, reinforcement decreases a bit.

Table.5: ANOVA to RMS Current

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Regression	4	3315.20	3315.20	828.80	17.0582	0.000043
Average Current (A)	1	1894.73	1894.73	1894.73	38.9969	0.000030
Pulse Frequency (Hz)	1	6.00	6.00	6.00	0.1235	0.730870
Welding Speed (mm/min)	1	1121.58	1121.58	1121.58	23.0841	0.000344
Contact Tip to Work Distance (mm)	1	292.89	292.89	292.89	6.0283	0.028926
Error	13	631.63	631.63	48.59		
Total	17	3946.82				

P.S. Adjusted squared sum (Adj SS) is a measure of the variation for the different components of the model.

Adjusted mean squares (Adj MS) measure how much variation a term or model explains.

Sums sequential squares (Seq SS) are measures of the variation of different components of the model.

Degree of Freedom (DF)

Table.6: ANOVA to RMS Voltage

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Regression	4	297.701	297.701	74.425	24.7937	0.000006
Average Current (A)	1	257.553	257.553	257.553	85.8003	0.000000
Pulse Frequency (Hz)	1	0.037	0.037	0.037	0.0122	0.913739
Welding Speed (mm/min)	1	4.654	4.654	4.654	1.5504	0.235061
Contact Tip to Work Distance (mm)	1	35.457	35.457	35.457	11.8121	0.004418

Error	13	39.023	39.023	3.002		
Total	17	336.724				

Table.7: ANOVA to RMS Acceleration

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Regression	4	0.086599	0.0965991	0.0216498	15.5975	0.000070
AverageCurrent (A)	1	0.081593	0.0815925	0.0815925	58.7829	0.000004
Pulse Frequency (Hz)	1	0.000033	0.0000332	0.0000332	0.0239	0.879474
Welding Speed (mm/min)	1	0.000758	0.0007584	0.0007584	0.5464	0.472926
Contact Tip to Work Distance(mm)	1	0.004215	0.0420150	0.0420150	3.0367	0.104992
Error	13	0.018044	0.0180444	0.0013880		
Total	17	0.0104644				

Table.8: Level of Significance (P) obtained through the ANOVA method

Factor	RMS Current (A)	RMS Voltage (V)	RMS Acceleration (m/s ²)
1 – Average Current (A)	0.000030	0.000000	0.000004
2 – Pulse Frequency (Hz)	0.730870	0.913739	0.879474
3 – Welding Speed (mm/min)	0.000344	0.235061	0.472926
4 – CTWD (mm)	0.028926	0.004418	0.104992

Figures 6, 7 and 8 shows the effects and influence of the factors for each response variable and the higher the slope of the curves, the bigger the influence of the factors over the output variables. Those graphics can provide a quick and interesting perspective of the data provided in the Table 4.

As it is possible to observe on the Figure 6, the average current are much more likely to interfere with the RMS current, specifically at higher current levels, on the other way, the welding speed is more likely to interfere at lower speed, the same is also true for the contact tip to work distance (CTWD).

On the Figure 7, the same behavior can be observed for the RMS voltage, being the average current the most correlated factor, on the other hand, the effect of the contact tip to work distance (CTWD) is the complete opposite, being more correlated for bigger distances. With respect to the acceleration, the results are totally opposite to the ones shown above, as the average current influence appeared at low accelerations, this result, as already discussed, demonstrate the higher level of stability of the arc for higher average currents, probably this happens due to a change of the metal transfer mechanism (from short circuit to globular).

For all the situations, it is possible to visualize the low influence of the pulse frequency in the results, the same result is possible to observe in the Table 4, as for this factor, the Level of Significance were the highest above all other factors. The welding speed, as well, did not show a high interference in all situations.

From the Table 4 as for the Figures 6 and 7, it is possible to note that statistically the CTWD affect more the RMS voltage than the RMS current and makes almost no effect over the RMS Acceleration.

This could be related to the fact that the CTWD will influence directly the amount of heat generated due to the Joule effect that can change the melting of the wire and its internal heating, which facilitates the metal transference.

If the distance is too big, there will be a lot of spills and the formation of a convex bead, but, if the distance is too small there will be more arc instability.

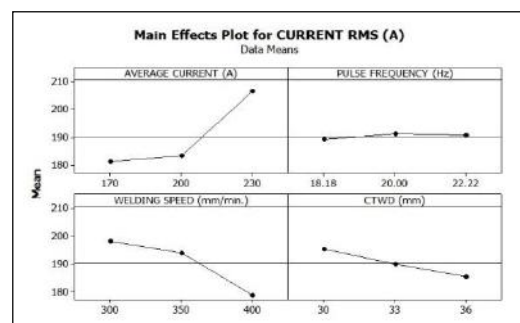


Fig.6: Effect of the main factors over the RMS Current

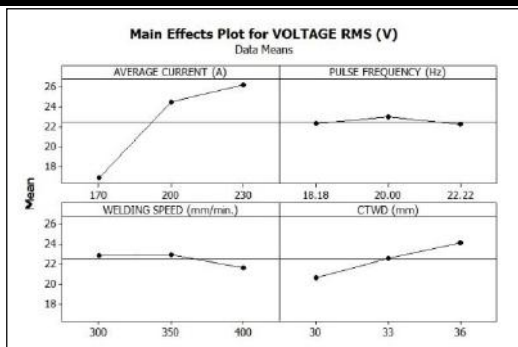


Fig.7: Effect of the main factors over the RMS Voltage

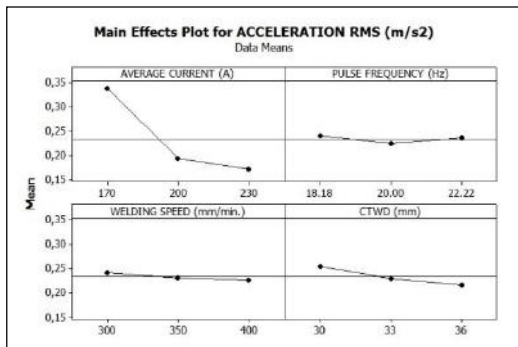
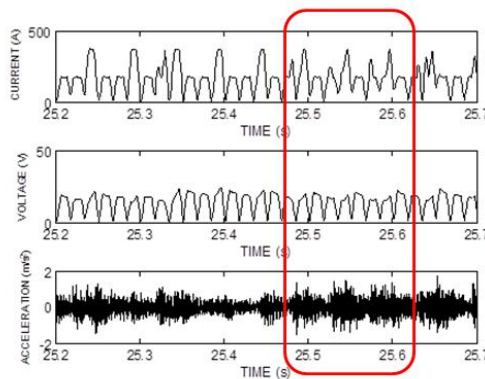
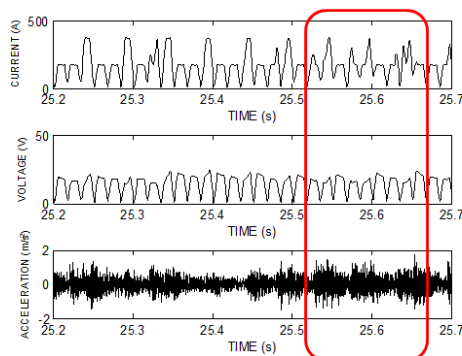


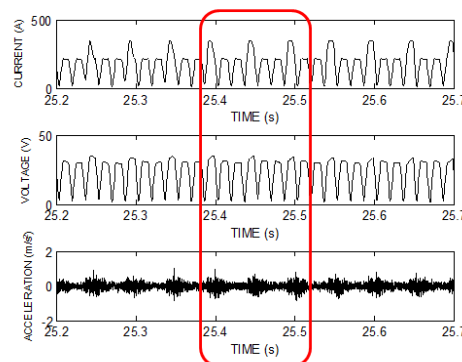
Fig.8: Effect of the main factors over the RMS Acceleration



(a) Current of 170 amperes.



(b) Current of 200 amperes.



(c) Current of 230 amperes.

Fig.9: Simultaneous signals acquired in a total range of 0.5s.

To provide a better view of the results obtained from the signals, the Figure 9 presents the simultaneous signals for the current, voltage and acceleration as a function of the average current in 0.5 seconds of interval.

For the average current welding at 170 A and 200 A, as shown in Figure 9a and 9b, respectively, there is an instability evidenced arc in the current graphics and acceleration, which showed abnormal behavior with series of current peaks with different amplitudes and lot of noise in the acceleration graphics.

Therefore, the results show that the metal transfer mechanism is not occurring as expected, with a behavior which characterizes the metal transfer short circuit.

Those characteristics were found as well by (LUZ et al; 2005), (LIMA & FERRARESI, 2006) (STARLING & MODENESI, 2005) that observed a behavior very similar with the one found here.

The better condition of droplet detachment was to current average of 230 A as in the Figure 9c, where you can observe a arc stability with current and acceleration and stable metal globular transfer (WANG, et al 1995, KIM & EAGAR 1993), which was observed in other studies in more detail by a high speed camera system (LOPERA et al 2011, DUTRA et al 2012).

IV. CONCLUSIONS

The analysis of the cladding welding through the FCAW pulsed process by applying the ANOVA method presented some very interesting results on respect to the weld quality and arc stability, mainly by high correlation between the average current and the arc stability.

The fact that the welding speed is not a big factor influences the arc stability and consequently to the quality

of the weld cord, shows that cladding process could be faster without to drop the quality.

Which respect to the pulse frequency, was found that it does not imposes great differences over the process, not interfering so much over the metal transfer process or arc stability.

As the acceleration showed very well the stability of the arc, it is possible to say that the use of an industrial accelerometer as a non-intrusive and easy to install method to verify the stability of the arc during the welding process, making it possible even to correct the parameters directly. Therefore we observed that statistically analyzed the best results for the cladding welding were obtained from the current average of 230 amperes, with the average current being that more likely to interfere with the RMS current, specifically at higher current levels.

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A Review on Storage of Pure Methane Gas in LPG Tank

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Abstract— This paper evaluates the use of renewable sources of energy i.e. biogas and suitability of a compact biogas system as a centralized decomposition of solid waste like kitchen waste and cow dung etc. and treatment option for the organic decomposition and fraction use of pure methane gas for the cooking, power generation purpose etc. This paper gives an idea and state of art innovations and research in the field of waste digestion and utilization of wasteful energy. In air-tight anaerobic digester bacteria were flourished and used for digestion of kitchen food waste and cow dung. Tremendous amount of Bio-gas was found to be produced which can be utilized for cooking or gas powered vehicles.

Keywords—Anaerobic Digester, Bacteria, Biodegradable Kitchen Waste and Cow Dung, Methane Gas.

I. INTRODUCTION

In today's fast moving world the resources are getting depleted due to their overuse though there rapid progress and development in all aspects as due to scarcity of petroleum and coal it difficult to supply fuel throughout the world also problem of their combustion lead to research in different corners to get access the new sources of energy, like renewable energy resources. Solar energy, wind energy, different thermal and hydro sources of energy, biogas are all renewable energy resources.

But biogas is distinct from other renewable energies because of its characteristics of using, controlling and collecting organic wastes and at the same time producing fertilizer and water for use in agricultural irrigation. Biogas is the product of the digestion of organic materials under anaerobic conditions. Biogas does not have any limitation and not require any technology to develop biogas, it is very simple to use and apply.

Biogas is product of biodegradable component and solid waste which substrate as manure, sewage sludge, municipal solid waste, biodegradable wastes or feedstock are transformed into methane and carbon dioxide. Purified methane gas can be used for the replacement to LPG gas.

Kitchen waste is organic material having the high calorific value and nutritive value to microbes, that's why efficiency of methane production can be increased by several orders of magnitude as said earlier. It means higher efficiency and size of reactor and cost of biogas production is reduced. Also in most of cities and places, kitchen waste is disposed in landfill or discarded which causes the public health hazards and diseases like malaria, cholera, typhoid. Inadequate management of wastes like uncontrolled dumping bears several adverse consequences: It not only leads to polluting surface and groundwater through leachate and further promotes the breeding of flies, rats and other disease bearing vectors. Also, methane which is a major greenhouse gas contributing to global warming.^[3]

Typical composition of biogas

- ❖ 50-75 % Methane, CH₄
- ❖ 25-50 % Carbon dioxide, CO₂
- ❖ 0-10* % Nitrogen, N₂
- ❖ 0-1 % Hydrogen, H₂
- ❖ 0-3 % Hydrogen sulphide, H₂S
- ❖ 0-2* % Oxygen, O₂

The process of anaerobic digestion is done by methane bacteria. Necessary conditions are:

- ❖ Anaerobic
- ❖ Temperatures between 15°C and 55°C
- ❖ PH-values between 6.5 and 8.0
- ❖ Avoiding retardants, such as heavy metal salts, antibiotics, disinfectants

II. EXPERIMENT SETUP

Principles of Production

Organic substances exist in wide variety from living beings to dead organisms. Organic matters are composed of Carbon (C), combined with elements such as Hydrogen (H), Oxygen (O), Nitrogen (N), Sulphur (S) to form variety of organic compounds such as carbohydrates, proteins & lipids. In nature MOs (microorganisms), through digestion process breaks the complex carbon into smaller substances.

The digestion process occurring in presence of Oxygen is called Aerobic digestion and produces mixtures of gases having carbon dioxide (CO₂), one of the main “green houses” responsible for global warming. The digestion process occurring without (absence) oxygen is called Anaerobic Digestion which generates mixtures of gases.^[2]

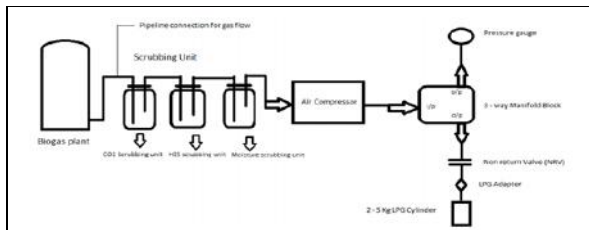


Fig.1:-Experimental setup of plant

III. CONSTRUCTION OF PLANT

1. Digester Tank

The amount of manure fed into a digester each day has an important effect on its operation. This is measured by volume added in relation to the volume of the digester, but the actual quantity fed to the digester also depends on the temperature at which the digester is maintained. In order to determine the unit size of a biogas unit, the following mathematical equation must be achieved:

$$\text{Digester size (m}^3\text{)} = \text{Daily feed-in (m}^3 \text{ day}^{-1}\text{)} \times \text{Retention time (day)}^{[7]}$$

2. Gas Holder

In which the produced biogas is stored, which is placed above the digester tank. Its construction look likes the digester tank. Output of digester tank is connected to the scrubbing unit.

3. Scrubbing Unit

The scrubbing unit is used for the separation of moisture from the biogas. There are three tanks. First tank separate the CO₂ gas and second tank separate SO₂ gas from the mixture of biogas. Then third tank is used for the removing the water particles from the biogas.

4. Compressor

The compressor is used to compress the pure methane coming from scrubbing unit. Compression is doing for storing of gas into the tank.

5. Storage of biogas

Biogas that has been upgraded to bio-methane by removing the H₂S, moisture, and CO₂ can be used as a vehicular fuel. Since production of such fuel typically exceeds immediate on-site demand, the bio-methane must be stored for future use, usually either as compressed bio-methane (CBM) or liquefied bio-methane (LBM) because most farms will produce more bio-methane than they can use on-site.^[4]

IV. METHODOLOGY

To conduct a detailed monitoring of the compact biogas plant, a fully operational unit will installing and operating in the campus of Bharati Vidyapeeth engineering college, Pune. However, this plant is operating on experimental basis and we are aiming to generate gas and store in the LPG tank for cooking purpose. We will allow flexibility in terms of changes in feedstock and on-site measurements of physical and chemical parameters of interest as well as gas production and composition. During the start-up period, the biogas plant will inoculated or fed with 50 kg of cow dung mixes with water. Thereafter, the plant has been left without further feeding for 45 days, in which only changes in gas production and composition were monitored. After 45 day the biogas plant was then fed with 1.5 kg/d used tea powder from canteen. The feeding rate of 1.5 kg per day has chosen because on one hand it represents a realistic quantity of organic waste produced by an average household and on the other hand it conforms to the reactor specifications.^[5]

1) Production Processes:

- 1) Manure collection
- 2) Feeding to digester
- 3) Anaerobic digester
- 4) Effluent storage
- 5) Gas Handling

V. CONCLUSION

The following conclusions are drawn from the study:

- 1) Effective mixing of extra bacterial seed improves digestion of waste and production of bio-gas.
- 2) It was found that the amount of biogas produced has increased by use of stirrer for homogeneous mixing of substrate with bacteria available in anaerobic digester.
- 3) It was found that the amount of biogas has increased with increasing proportion of cow dung in food slurry.

- 4) It is found that effect of mixing on an anaerobic digestion is advantageous on an effect of pH and effect of temperature.
- 5) Because in the effect of mixing with the help of stirrer, the contact between the substrates and the bacteria takes place in proper way due to that growth of bacteria as well as bacterial enzymes increases.
- 6) Separated methane gas is compressed by compressor and store in the LPG tank for further use.
- 7) Using the proposed method of Biogas compression system, the free natural fuel can be easily stored in cylinders.

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Analysis of the Behavior of Mottling in Coated Board using Neural Networks

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Abstract— *Quality monitoring of paperboard depends on the measurement of several properties. Part of these properties have online devices to do measurements while another part can only be measured in the laboratory, an activity that sometimes require more time than a production of one entire jumbo roll or generate waste until fix the production.*

The advantage to use mathematical modeling as the neural networks is the ability to 'predict' online the product final properties through the machine's information such as speed, flow of pulp, coating weight and the quality of fiber as degree of refining and whiteness.

One of the properties used for assessing the quality of paperboard is the mottling that describes a marbled appearance on the paperboard surface. Mottling is determined using the method STFI™ Mottling who is characterized by a coefficient of variation of reflectance or standard deviation - defined by the methodology of the equipment. This property when out of parameters affects the quality of the final printed package, giving unsightly appearance.

The focus of this study is to determine parameters by mathematical modeling that influence the mottling in order to provide conditions for machine's operators to perform the process, reducing the variation of this property and keep the values inside the specified limits. The model was developed from historical data of 6 months of paperboard machine operation.

The results indicated that mottling is mainly influenced by the temperature of the dryer after coating process.

Application—Statement: *A further understanding of the mechanisms that cause mottling would help to optimize the paperboard quality.*

Keywords— *Neural Networks, mottling.*

I. INTRODUCTION

Mottling is a property of paperboard characterized by blotches on the surface and nonuniform appearance of the printed product [1]. The print mottle is a phenomenon where paper unevenly absorbs the solvent of the printing ink [10] characterized by a non-uniform drainage of ink into the paper or non-uniform paper absorbency [20].

Among the important aspects characterizing the paperboard, mottling is shown as a property that should be monitored very carefully during production and can be defined as undesired variations in color density of board. [6] It could be influenced by base paper. Bad formation of the base paper can cause uneven binder distribution in a coating layer, which could mean uneven mottled print image [7]. Uneven formation and then variations in coat weight are usually behind this phenomenon. If different areas of coating consolidate at different parts of the drying section under different drying rates, it makes structure of coating heterogenic, which then makes the printed image mottled [10]. Mottling also depends on factors such as surface properties, pore size and size distribution of the pigment [8].

Fahlcrantz and Johansson [9] suggest that three aspects of monochrome print mottling should be considered when evaluating a measuring instrument of mottling: the amplitude of variation, dispersion and reflectance level of printing.

The formation and uniformity of absorption of the baseboard are main factors causing mottling. The coating, formulated mainly of mineral pigments and binders, sets up the printing ink and it is sensitive to mottling, since the size and shape of the pigment and the binder mobility are factors that affect the structure of the coating and consequently the sensitivity of printing ink mottling. Variations of the weight of the coating or surface of the baseboard are indicative of occurrence of mottling [10].

In practice, mottling is measured in the laboratory with samples taken at the end of the winding jumbo reel. This type of control assumes that results obtained represent the entire roll and changes are made with a delay from the end time of winding, up to publishing the results on quality reports.

A mathematical modeling tool for non-linear processes was used to estimate results of product quality and reduce the effects of late corrections due to laboratory analysis and avoid corrections made to jumbo roll data points.

In industries advanced control techniques like computation mathematical modeling are used to correlate the process parameters with the final product quality [2].

Paperboard Properties

Paperboard properties can be associated with fiber characteristics, quality of raw materials, and structure of paper machine and with machine operation, manipulated by operators [3]. Coating improves the printing properties of the paperboard [4]. The coat step is influenced by process application as drying, to consolidate the coating microstructure within the paperboard pores [5].

Effect of paper formation

The forming section consists of a head box and wire section. The head box dispenses pulp evenly onto the wire for the entire width of the machine. The most common wire section types are the fourdrinier, hybrid former and gap former. The wire section is where the water from the forming web is removed by drainage. The paperboard mentioned in this paper is produced in a fourdrinier wire section.

The term forming describes the dilution in the short circulation of the stock flow to a mix flow, the approach flow system, the cross machine direction distribution and jet generation of the mix by the headbox, as well as the creation of a wet web by dewatering of the mix in the wire section [4].

Mottling can be formed by an irregular formation of the base paperboard or uneven coating binder migration through the base paperboard during drying and coating consolidation. In **Figure 1**, arrows indicate the difference in coating thickness, resulting an uneven thickness of the base paper.

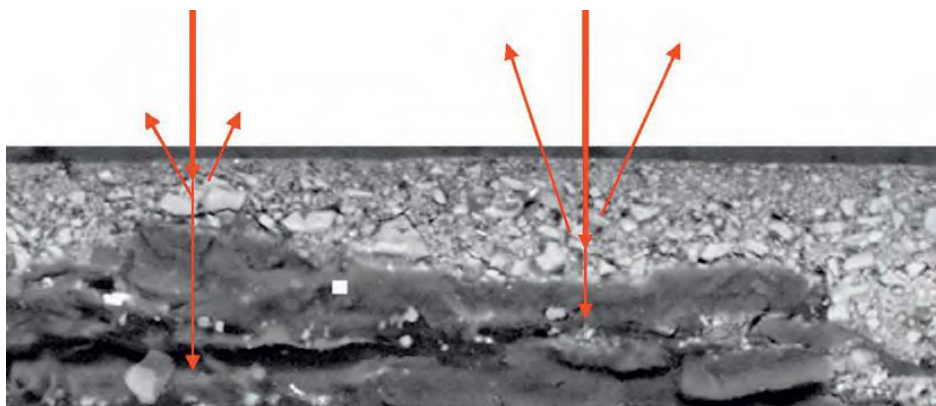


Fig.1: Cross Section of Paper

The arrows indicate the difference in film thickness due the irregularities in the thickness of the base paper.

SOURCE: "Mottling – Mottled impression." [21]

Besides wood fibers, paper consists of mineral and chemical additives. In the formation process these constituents are distributed stochastically. The formation of the paper is through distribution of these particles. Thus formation can be defined by the variability, in small scale, of the grammage of the paper.

The formation of the paper can be measured using different methods. These meters can give wrong results in the sense that the visual appearance is not equivalent to the structural uniformity of the paper because this property depends on the production process of the machine, coating and calender process. All these process can change drastically the optical behavior of the paper [11]. These changes occur, for example, due variations of fiber and coating distribution and thermal deforming on calender.

Effects of fines

Lu and Kuhn [12] evaluated the effects of fines and the formation of mechanical pulp papers in print mottling. The increase in drainage time deteriorates the formation of the paper and increases the weight of flocks. On other side, the increase in fines content improves surface properties, reducing roughness and porosity of the paper [12].

Effects of coating layers and dry process

Uniformity of coating layer is affected by the surface properties of base paper, such as roughness and porosity and also by penetration of coating in paper [13].

For the drying process of the coating there are three methods generally used: infrared, hot air drying and hot drying cylinders, which is also usually the order in which the coatings is dried. Right after the initial drying starts the consolidation phase that take place at the solids of the coating between 73% and 85%. Viscosity of the coating increases so much that pigment particles stop moving. The final pore structure of the coating is developed.

If coated areas are consolidated in dryer zones under different rates of evaporation it will generate heterogeneous coating structure and mottled appearance [10]. Delaying to start evaporation result in drawing more water into the base paper [15].

The pore structure of the coated paper has been considered the most important concept of ink setting. The non-uniformity in pore structure is not necessarily caused by non-uniform distribution of the coating, in some cases the drying conditions are the source of the issue [14].

Through a pilot coater under different drying conditions and printing with six colors, Kim *et al.* identified a good way to reduce mottling. The results show how sensitivity is the drying conditions near to the first critical concentration zone influences the mottling [15].

The mobility of the particles in the coating layer is determined by the concentration of particles in the coating. Through simulation, it is confirmed that the surface smoothness of the coating is maximized when the surface

roughness of the substrate is minimized and the solids content of the coating is maximized. The loss of particles from coating to substrate is undesirable and may cause reduction of softness and strength due to migration of the binders and low coverage [5].

Effects on paperboard and print quality

The occurrence of print mottling in coated paperboard is one of the most difficult problems to fix in the offset printing [16]. Mottling is often the main determinant of the quality of print [15].

Nowadays it is known that the setting of the ink on coated paper is made by the evaporation of the ink vehicle (solvent) and penetration of ink. However, the micro porosity and surface chemistry of the coating are factors to control it [14].

The uneven distribution of weight coating on the surface of paper is one of the main factors of instability between the transfers of ink to paper because the immobilization occurs mainly by ink oil absorption by micropores structure and by the permeability of the coating structure [17].

Description of the paperboard

The paperboard, **Figure 2**, consists in three fibrous layers when the top layer is bleached and coated by three coating layers. On the opposite side (base board) is applied a layer of surface starch.

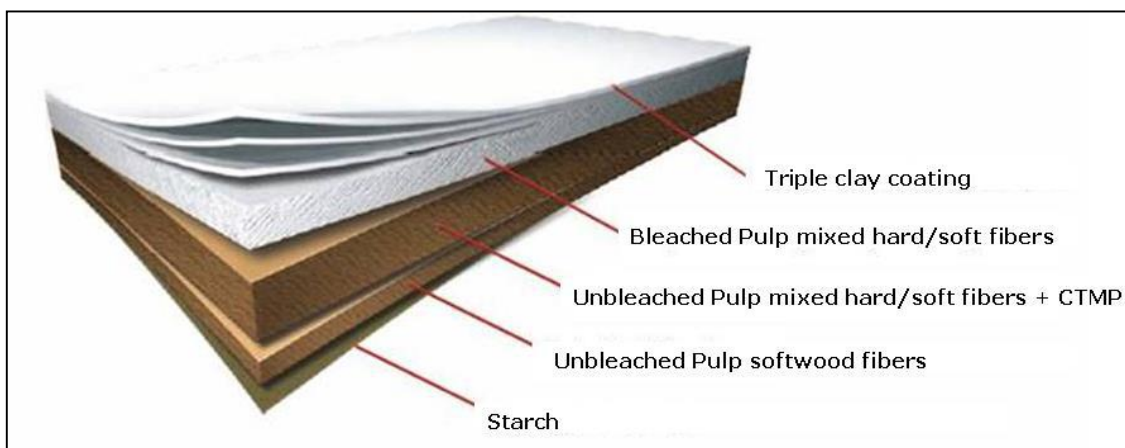


Fig.2: Paperboard Structure (SOURCE: COMPANY INFORMATION)

The lab analysis are made on samples taken from the end the winding machine. On Paperboard machine, this period occurs every 45 to 60 minutes, depending on the characteristics of the paperboard.

Mathematical modeling in a paper machine process

The control the paper machine quality parameters can be achieved basically in two ways: indirect control and model-based controls. The indirect controls are based on lab analysis of paper samples collected at the end of each

jumbo roll. These samples are small portions compared to the full roll and it is assumed that the analysis results represent the entire roll. When changes occur in regulatory control, the manipulated variables become tools to control the quality parameters. This is usually determined by the operator knowledge and hypothesis consideration. The model-based controls (mathematical models) use the basic principles and statistical modeling [18]. Due to the complexity of the mathematical models to characterized mottling on this study it was decided to use a model using

neural networks. The neural network is a parallel distributed processor made up of processing units, which are capable of storing experimental knowledge and make it available for use [19]. The neural network is a structure that fits the data. This adaptation process is called training. After training, the relationships are established between input variables and output [3].

II. METHOD

The mottling model was developed from historical data from approximately 6 months of paperboard machine operation. These data included lab analysis of paperboard samples and process variables such as pulp flows, head boxes pressures, refining pulp degree, coating weight, drying temperature and others.

Neural Networks used in this work were built with the tool Property Predictor of Pavilion Technologies, are the MLP (Multi Layer Perceptron) with three layers, and back propagation algorithm.

Collect of historical data

To collect the data is important that it represent the entire operating range of the paper machine. Due to the complexity of information on paperboard machine, 75 variables were initially selected for the mathematical model, collected minute by minute, as showed on software datasheet Pavilion, **Figure 3**. These data are instantaneous values of the variables, without any filtering or averages.

Tag Name:	DateTime	*ROLADEIRA	*kottling_M	*CT_FBC_MV	*CT_FBP_MV	50_09 1813	*entacao_C	*entacao_B	*WJT_B
Row	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8	Col 9
1	04/01/09 00:00:00	450,008	0,630	28,993	71,007	1,670	2,556	Cut	1,4
2	04/01/09 00:01:00	450,008	0,630	30,137	69,863	1,670	2,556	Cut	1,4
3	04/01/09 00:02:00	450,008	0,630	29,267	70,733	1,670	2,556	Cut	1,4
4	04/01/09 00:03:00	450,008	0,650	28,511	71,489	1,670	2,635	Cut	1,4
5	04/01/09 00:04:00	450,008	0,650	30,602	69,398	1,670	2,635	Cut	1,4
6	04/01/09 00:05:00	450,008	0,650	30,161	69,839	1,670	2,635	Cut	1,4
7	04/01/09 00:06:00	450,008	0,650	30,905	69,095	1,670	2,635	Cut	1,4
8	04/01/09 00:07:00	450,008	0,650	30,381	69,619	1,670	2,635	Cut	1,4
9	04/01/09 00:08:00	450,008	0,650	29,012	70,988	1,670	2,635	Cut	1,4
10	04/01/09 00:09:00	450,008	0,650	30,215	69,785	1,670	2,635	Cut	1,4
11	04/01/09 00:10:00	450,008	0,650	30,240	69,760	1,670	2,635	Cut	1,4
12	04/01/09 00:11:00	450,008	0,650	29,928	70,072	1,670	2,635	Cut	1,4
13	04/01/09 00:12:00	450,008	0,650	30,567	69,433	1,670	2,635	Cut	1,4
14	04/01/09 00:13:00	450,008	0,650	29,485	70,515	1,670	2,635	Cut	1,4
15	04/01/09 00:14:00	450,008	0,650	29,903	70,097	1,670	2,635	Cut	1,4
16	04/01/09 00:15:00	450,008	0,650	29,263	70,737	1,670	2,635	Cut	1,4
17	04/01/09 00:16:00	450,008	0,650	30,000	70,000	1,670	2,635	Cut	1,4
18	04/01/09 00:17:00	450,008	Err	30,488	69,512	1,670	2,635	Cut	1,4

Fig.3: Datasheet of input variables

Variables collected in the range of 1 in 1 minute.

Treatments were performed on input variables, based on operational range of these variables during stable production machine and removal of values considered erroneously by analyzing the data itself and range defined by the stable operation of the machine.

Structuring the model based on neural networks

It consists in portions of data separated for training and model test until the errors of training and testing are close. The training process of neural networks is performed when significant changes occur in the synapses of neurons. In this model were inserted 26065 patterns, distributed in training, testing and validation according **Table I**:

Table.I: Distribution of patterns behavior of model

Total	Training	Test	Validation
26065	22636	2473	956
100 %	87 %	9 %	4 %

Despite the low percentage of tests for validation, real data are in the process minute by minute.

Analysis of the model

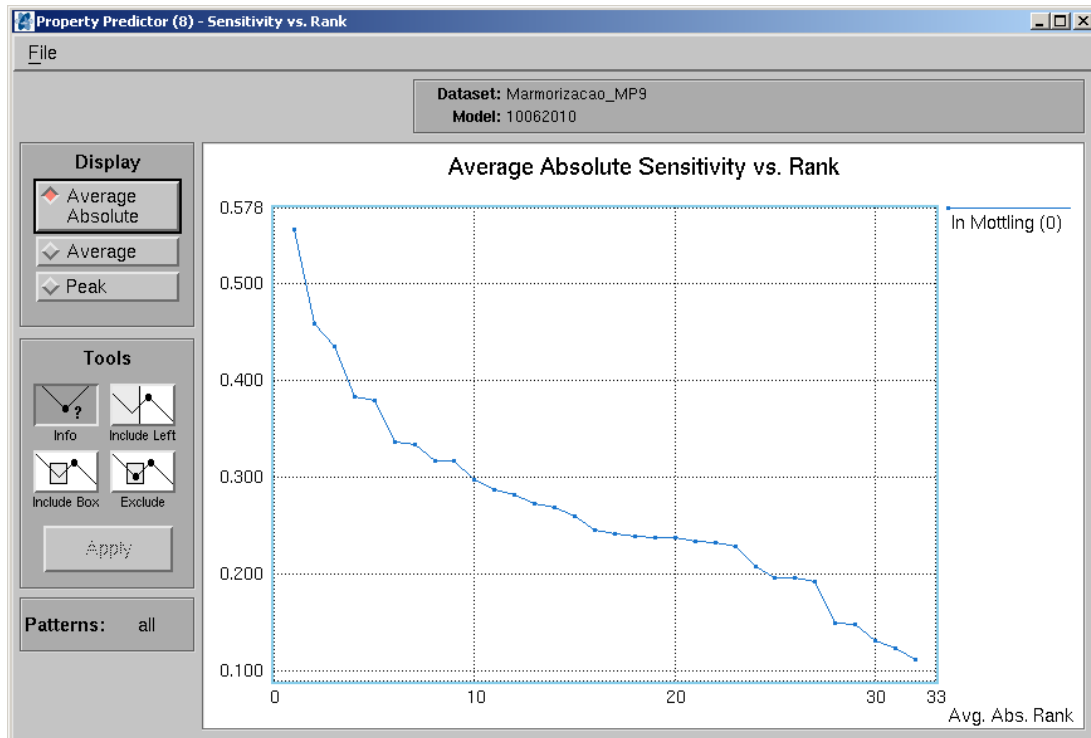
The model analysis must be done by examining the linear correlation coefficient (R^2) between the predicted value for the property and its true value, defined by equation 1.

$$R^2 = \frac{\sum_{i=1}^n (x_{pi} - \bar{x}_p) \cdot (x_{mi} - \bar{x}_m)}{(n-1) \cdot S_p \cdot S_m} \quad (1)$$

Where n is the number of values considered for the variable, x_p indicates the predicted value, x_m represents the measured value, \bar{x} represents the average and S_p and S_m represent the standard deviations of predicted and measured values respectively. For a perfect model R^2 is equal to one.

Validation of the model

To ensure the model comprised the essential aspects of process, it was validated through the performance by unknown data by the mathematical model. **Graph 1** illustrates the sensitivity curve of the variables with the effect of mottling. This tool lets sort, in order of importance, the input variables used as classification criterion the average gain of curves of the model response.



Graph.1: Sensitivity Curve of variables in the mottling model

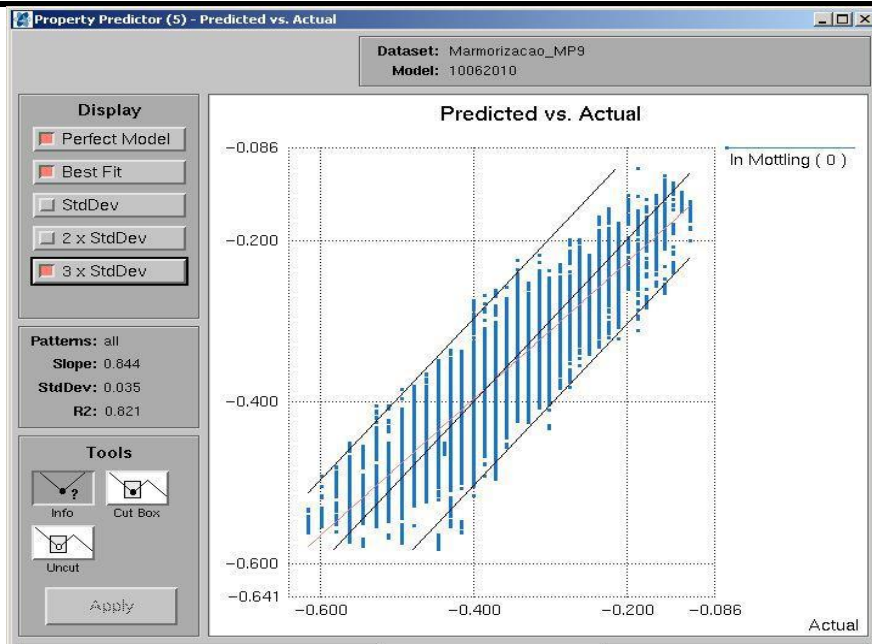
Defining of neural structure

The mathematical model for mottling on paperboard machine is a predictive network structure made up 32 input variables, 1 output variable and 14 neurons in the middle layer.

III. RESULTS

The linear correlation coefficient (R^2) determined by the equation presented above was 0.821 demonstrating good correlation between the real value and the predicted one.

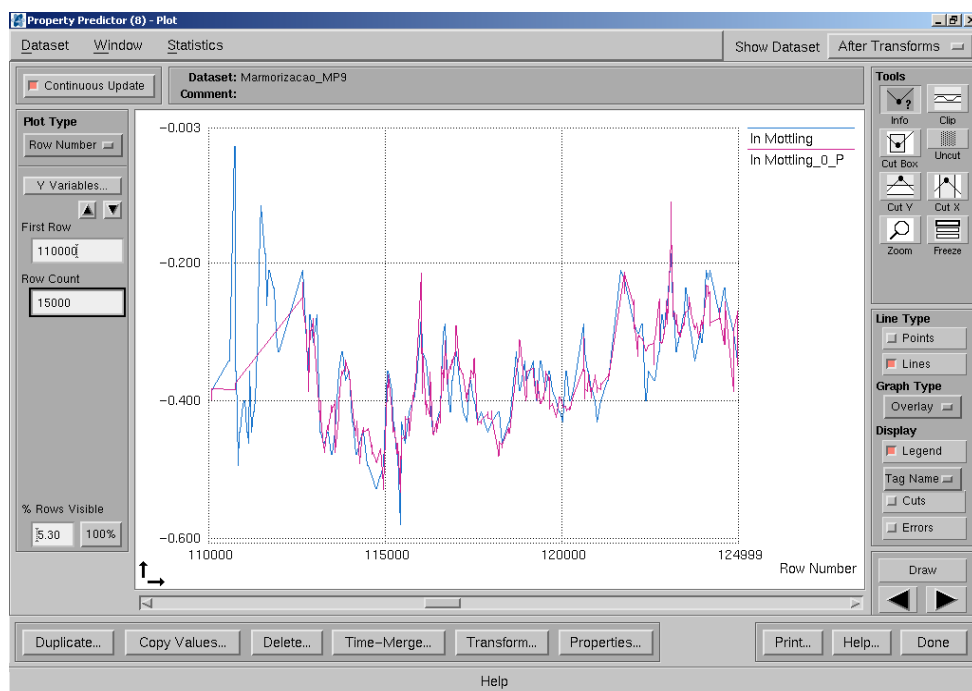
Graph 2 shows the curves with the results predicted and actual mottling.



Graph.2: Results of Predicted and actual mottling value.

With a variation of 3 standard deviation

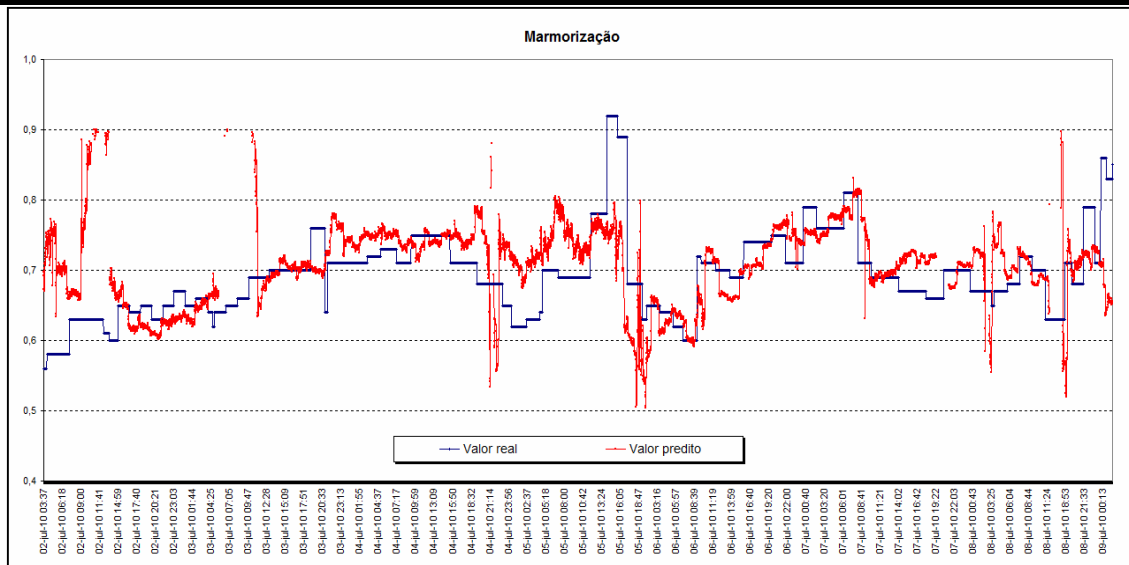
In **Graph 3** it is possible to see that the predicted values represent adequately the true values.



Graph.3: Comparison of predicted and true values

Predicted value represented by 'In Mottling_0_P' line and real value represented by 'In Mottling' line. The variation of the predicted value at the beginning of the graph indicates that one or more process variables instrument was out of action.

Graph 4 shows predicted results compared with laboratory results never seen by model in order to validate the model of mottling.



Graph.4: Comparison between mottling measured in the laboratory (Flat Line) and the mottling from the model (Rough Line)

Analyzing the results, it is possible to observe that the model could learn the behavior of mottling in the paperboard machine. Points out the trend are periods of instability on machine, start-up and calibration of measuring instruments.

APPLICATION STATEMENT

In terms of major input variables that influence the mottling property, it may be mentioned that these variables contribute as follows:

- Temperature of the coating dryers: The temperature control of hot air blown in the coating dryers affects the immobilization of coating. The right temperature provides a rapid consolidation of the coating avoiding the migration to the inside of the base board.
- The time using the same blades in coating applicators: The coating uniformly distributed over the board offers better uniformity of visual appearance, new blades helps to get it.
- Grammage: Increasing the grammage of fiber improves the outcome of mottling due its effect on the opacity of the board.
- Formation index board: Variations in formation on board highlight points of opacity and transparency of the board. Variations in formation in the middle and bottom layers provide transparent appearance of the board.
- Percentage of “ply bond” fiber in middle layer of the board: The ply bond fiber is characterized by a fiber with a high degree of refining. This fiber tends to be dark which does not favor mottling.
- Temperature of calender: The calendar works to uniform the base board before receive coating

applications. It was understood that higher temperatures help to uniform the surface of the board.

IV. CONCLUSIONS

On this study was possible verify that mottling is strongly influenced by temperature of coating dryers (improving the coating immobilization) and by the time using the same blades, where new blades provide uniform distribution in the coating profile.

There is more than one factor responsible for the occurrence of mottling. Among these, there is the binder migration towards inside the baseboard, the irregular distribution of the coating on the board surface and the application and dryer of the coating. The structure of the base board is a highly relevant factor in the final result of this property.

The mathematical model developed for this work is a tool for the virtual sensor for mottling property.

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<http://acervodigital.ufpr.br/bitstream/handle/1884/26907/d/issertacao%20Danielle%20Garcia.pdf?sequence=1>

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Connecting Regional Development to Environmental Education

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Abstract— *In this study we investigate how environmental education can be connected with the regional sustainable development. We perceive that the dialogues surrounding Environmental Education in formal education have been dividing opinions over the last two decades. This does not happen only in relation to the conceptual precepts, but mainly in relation to the field of activity. Our theoretical support comes from authors engaged with the Critical Environmental Education, signaling for the construction of what we call Reference Framework. Our research is developed from a qualitative perspective, having as a strategy the exploratory case study. For the analysis of the documents we make reference to the methodology of content analysis proposed by Bardin (2011) and reflective application of the Reference Framework. We argue that so far in Brazil, environmental education is divided into two major theoretical trends that reflect the practices of environmental educators. On the one hand, supporting a behaviorist / liberal / conservative tendency of Environmental Education (CARVALHO, 2001; GUIMARÃES, 2000; LOUREIRO, 2008), understand environmental practices from its immediate resolution dimension, focusing actions that situate environmental practices through changes in social behaviors, mostly promoted by environmental activism. On the other hand, we have the opposite, that is, the popular / critical / emancipatory tendency which situates its argumentative and practical content in the significant assumption of a new societal posture in relation to the economic*

models adopted. It establishes the connection between environmental education and local / regional development, delineating a perception of reality, forming a dimension of creating other ways of relating human and non-human, including the emergence of a rationality that impresses ethical socio-environmental values, other forms of understanding of the world and the concept of environmental rationality.

Keywords— *Environmental Education; Regional Development; Theoretical Trends.*

I. INTRODUCTION

The Italian philosopher Nuccio Ordine, in his book entitled *L'utilità dell'inutile. Manifesto (The Usefulness of the Useless: A Manifesto)*, when mentioning the importance of humanistic knowledge and scientific research, emphasizes that "all luxuries considered useless have a growing duty to nourish hope, to turn its uselessness into a most useful instrument of opposition to the barbarism of the present"¹ (2016, p. 26), an allusion to the present times in which the arts, philosophy, theater, music and all cultural manifestations are now considered to be useless.

In this context, an environmental issue is included, a knowledge considered useless, conceived from

¹ Our translation of "todos os luxos considerados inúteis, têm o dever cada vez maior de alimentar a esperança, de transformar a sua inutilidade num utilíssimo instrumento de oposição à barbárie do presente"

a conservationist perspective, whose importance is restricted to the planting of trees, environmental day celebrations and environmental preservation campaigns that are usually disconnected from the political struggles in which environmentalism flourishes (FRACALANZA, 2004).

In this perspective, the environmental issue in the school, over the past twenty years has been presenting signs of its epistemic fragility in the educational practices, as referenced in the research called *The different tints of Environmental Education in Brazil*², elaborated by the Ministry of the Environment. Such research presents the profile of the Brazilian Environmental Education from 1997 to 2007.

The evidence indicates that even with the existence of the law that establishes the National Policy for Environmental Education (Política Nacional de Educação Ambiental) – PNEA, there is still no public policy of environmental education in educational institutions. That results in the conceptual and epistemological multiplicity that schools present, marked by the educational practices and by the absence of specialized personnel in the area, as we can verify in the following excerpt:

[Certain difficulties cited in this dimension can be understood as effects of a practice under construction: lack of clarity regarding environmental epistemology, [and] of knowledge of disciplinary interfaces with environmental education. It was also mentioned the need to deepen reflection and praxis on the methodological aspect in order to reach the transversality of the environmental theme (2009, p.190).]

Certas dificuldades citadas nessa dimensão podem ser entendidas como efeitos de uma prática em construção: falta de clareza com relação à epistemologia ambiental, de conhecimento das interfaces disciplinares com a EA. Também se mencionou a necessidade de aprofundar a reflexão e a práxis na vertente metodológica para atingir a transversalidade da temática ambiental”

In this way, we also underline the MA thesis carried out by Luciana e Sá Alves, from 2006, entitled *A Educação Ambiental e a Pós-Graduação: um olhar sobre a produção discente* (Environmental Education and Post-Graduation: a look at the student production). In this research, she carries out a detailed survey on the academic

and scientific production on Environmental Education in Brazil from 1988 to 2006. It should be noted that of the 1064 papers supervised on Environmental Education at the time, collected through the database of CAPES – Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (Coordination for the Improvement of Higher Education Personnel), the term "epistemology" appears only twice, referring initially to the Tbilisi Conference when it mentions that:

[...] interdisciplinarity is defined as the interaction between two or more fields of study, ranging from the simple communication of ideas to the mutual integration of leading concepts, epistemology, terminology, procedures, data, and the organization of research and of teaching (2006, p.20).]

[...] a interdisciplinaridade é definida como a interação entre duas ou mais disciplinas, que pode ir da simples comunicação de ideias até a integração mútua de conceitos diretores, epistemologia, terminologia, procedimentos, dados e a organização da pesquisa e do ensino (2006, p.20).

In a second moment, the author herself uses the term to justify the content analysis carried out in her work, which can be described as follows:

[...] descriptive analysis of a group of 77 reports, which corresponds to the second research front of the Thesis, aimed to explain the content of the Theses and Dissertations regarding the problems investigated, the theoretical references of support and the methodological procedures adopted. In addition, based on the epistemology of FLECK (1986), more specifically in the analytical categories "style of thought", "collective of thought" (2006, p 49).]

[...] análise descritiva de um grupo de 77 relatórios, que corresponde à segunda frente de investigação da Tese, teve como objetivo explicitar o conteúdo das Teses e Dissertações quanto aos problemas investigados, aos referenciais teóricos de apoio e aos procedimentos metodológicos adotados. Além disso, ao fundamentar-se na epistemologia de FLECK (1986), mais especificamente nas categorias analíticas "estilo de pensamento", "coletivo de pensamento" (2006, p 49).

² “Os diferentes matizes da Educação Ambiental no Brasil” in its original, in Portuguese.

Also in the same direction, we highlight the work of Carvalho and Feitosa entitled *A produção brasileira de teses sobre educação ambiental na biblioteca digital brasileira de teses e dissertações – BDTD: uma análise temática* (The Brazilian production of theses on environmental education in the Brazilian digital library of theses and dissertations – BDTD: a thematic analysis), from 2011. Such work presents a research whose goal aimed at the recovery, cataloging and analysis of theses on Environmental Education available at BDTD. Once again, the thematic "epistemology" was not identified, nor was the term itself in the dissertations and theses recovered.

In these terms, it is possible to see that the epistemic issue in the environmental educational practices in the school presents incongruities that need to be discussed, since the criticism to the school projects that say they are based on environmental education establish a contradictory field of action, whose result reflects in practices devoid of the understanding of critical environmental thinking.

In view of this situation, the present thesis characterizes a careful effort to problematize the environmental issue in the school universe. It attempts to find ways that signal to an environmental education that transgresses the behaviorist postures, characterized by practices that only aim at the change of behaviors in relation to environmental problems, disregarding the economic models responsible for the production of misery (LIMA, 2009).

In order to do so, the environmental issue in the school was linked to regional development, establishing a necessary approximation, whose intended implications suggest the questioning of the development models that are associated with the degradation of nature and of human condition, thus raising the proposed reflection in this thesis.

Given this, we understand that the dialogue poses a burning challenge, both for the nature of the collective understanding in relation to environmental education, which suggests an epistemic variation regarding environmental educational practices, as for the social representation of an environment that provides resources that are redefined and valued from their transformation.

In this perspective, in times of barbarism of the human and environmental condition, we can infer the necessity, as Ordine points out, of problematizing the useless so that it can be transformed into an instrument of subversion of the crisis that presents itself. In other words, this work is an unfinished essay, whose proposal, in general terms, focuses on the elaboration of a Reference Framework that equips teachers and the school community in the elaboration and evaluation of environmental educational practices in schools.

In this direction, we underline that formal environmental education aggregates in its contours different epistemic faces, constituted by narratives, methodologies and structures that are particular, culminating in a plurality of conceptions that do not always establish congruence.

The reflection carried out in relation to Environmental Education and Regional Development subsidized the pedagogical perspective adopted in this scientific work, helping in the elaboration of what has been called the Reference Framework, whose function is the construction and/or evaluation of Formal Environmental Education projects and its repercussion in the constitution of Regional Development.

In the methodological way, the path in the research movement is based on the methodology adopted, situating it from a qualitative perspective, describing the course carried out by the researcher during the elaboration of the artifices that make possible the completion of the thesis.

We chose the exploratory case study as a research strategy, consisting of a collection of data that combined three different sources of information, such as: documents, interviews and reflective application of the Reference Framework. The analysis of the information was carried out through content analysis as the starting point.

Finally, the final considerations are pointed out, indicating the possible suggestions from a perspective of incompleteness, announced by the impossibility of exhausting the dialogue in relation to the proposed theme. However, as a final inference, the Reference Framework is revisited as a theoretical construct that can give conceptual subsidies to schools in the construction and/or evaluation of environmental education projects based on a critical perspective for regional development.

II. CONJECTURES ON REGIONAL DEVELOPMENT AND ENVIRONMENTAL EDUCATION

Environmentalism as movement that criticizes the relations established between man and nature began in the 1950s, becoming a reference for global manifestations of a new environmental order, which, over the past fifty years, has contributed significantly to the debate on environmental issues in civil society.

In this way, intellectuals and activists moved the world with criticism regarding the exploitation of natural resources, announcing the environmental crisis arising from a model of development that would not be able to sustain itself without the unreasonable use of the natural environment.

In the academic context, we highlight the work of the North American writer, scientist and environmentalist Rachel Carson, which denounces the contamination of

water and soil by pesticides. The influence of her work was decisive for the US government to prohibit the use of dichlorodiphenyltrichloroethane, known as DDT³, in the United States (DAMATO; TORRES; MALM, 2002).

The decades of the 1950s and 1960s, because of technological advances based on the premises of Western rationality, substantially increased production capacity and changes in the natural environment, especially in more developed countries, and the disastrous results of this indiscriminate manipulation of natural resources were clearly visible in later decades. Morin, on environmental disasters, mentions:

[The meta-national and planetary aspect of ecological danger came with the announcement of the death of the ocean by Ehrlich in 1969 and the Meadows report commissioned by the Club of Rome in 1972. After the worldwide apocalyptic prophecies of 1969-1972, there was a period of multiplication of local ecological degradation-fields, forests, lakes, rivers, polluted urban agglomerations (2002, p. 68).]

O aspecto meta-nacional e planetário do perigo ecológico surgiu com o anúncio da morte do oceano por Ehrlich em 1969 e o relatório Meadows encomendado pelo Clube de Roma em 1972. Após as profecias apocalípticas mundiais de 1969-1972, houve um período de multiplicação das degradações ecológicas locais-campos, bosques, lagos, rios, aglomerados urbanos poluídos (2002, p. 68).

The environmental situation of Brazil in this period was not different; reflecting devastating images, whose efforts to establish a confrontation against the hegemony of modernity resulted only from the actions of small organized groups and state environmental agencies. Dias, on the environmental crisis faced in Brazil in this period, asserts:

[The situation in Brazil was the same as in the vast majority of poor countries, that is to say, just where environmental education would be most needed, given the cruel socioeconomic realities established there, under the aegis of

imposed development models, of a notable capacity for degradation of the quality of life, environmental education did not develop enough to be able to produce the necessary transformations (1992, 23).]

A situação no Brasil foi a mesma da grande maioria dos países pobres, ou seja, justamente onde a EA seria mais necessária, dada as cruéis realidades socioeconômicas ali instauradas, sob a égide de modelos de desenvolvimento impostos, de notória capacidade de degradação da qualidade de vida, a EA não se desenvolveu o suficiente para ser capaz de produzir as transformações necessárias (1992, p. 23).

Meanwhile, although the Brazilian reality reflected the developmental project⁴ that arised in the end of the 1960s, groups of political exiles who experienced the European environmental movements and returned to Brazil in the late 1970s joined other advocates of the ecological movement, among them, José Lutzemberger. In the 1980s, especially in the state of Rio Grande do Sul, the consolidated strong conflicts against multinational companies. Gonçalves, on the consolidation of the environmental movement in Brazil, states:

[It is interesting to note that the environmental movement is socially more rooted in Rio Grande do Sul, where the AGAPAM ("Gaúcha" Association of Environmental Preservation) brought together ecologists from the struggle against Borregaarde, a multinational company that polluted the waters of the Guaíba River in the great port of Porto Alegre and where José Lutzemberger, former agronomist of a large multinational company of agrochemicals, breaks with the perspective of agrochemicals and takes on the ecological and social cause deeply. Most of the political exiles who embrace the ecological cause are concentrated in Rio de Janeiro, where some environmental struggles were already taking place, especially in the [region of] North Fluminense (Campos and Macaé,

³ Dichlorodiphenyltrichloroethane, better known as DDT, is a pesticide whose properties were discovered in 1939 by Paul Müller. With high lethality, DDT easily crosses the exoskeleton of insects affecting the central nervous system (DAMATO; TORRES; MALM, 2002).

⁴ The 1970s were marked by the works of the 'economic miracle period', prompted by the military government, whose predominant characteristics centered on occupation, territorial integration and pollution as inevitable consequences for the consolidation of progress in Brazil (SATO, 2003)

for example) and in Cabo Frio (struggle for the preservation of the dunes) (1990, p.16).]⁵

In this scenario, the environmental movement translated a relevant landmark for the propagation of environmental issues in various sectors of civil society, incorporating discussions in government agendas following the United Nations Conference on the Human Environment, held in Stockholm, Sweden, in 1972, when the development model began to be questioned by a probable scarcity of natural resources.

In this perspective, the discourses on the environmental issue highlight the antagonism between government policies and environmental movements, characterizing a unique challenge, whose struggle was centered on the denial, by environmentalists, of the current corporate model legitimized by the American way of life, whose nature is understood as an inexhaustible source of resources.

In view of this, the dialogue on environmental issues in Brazil, especially since the United Nations Conference on Environment and Development – Eco 92, held in Rio de Janeiro, Brazil, in 1992, and the elaboration of the National Curricular Parameters – PCNs, by the Ministry of Education, in the year 1996, begins to be part of the school context.

With the enactment of Law number 9,795 of April 27, 1999, which instituted the National Policy for Environmental Education, Environmental Education for formal education came to incorporate only educational systems linked to the Ministry of Education – MEC and non-formal non-formal, Environmental Education, whose target audience covers the portion of society that is not in school, is left under the responsibility of the Ministry of the Environment.

However, it is important to emphasize that the actions of the respective Ministries, of Education and of the Environment, seek to avoid an isolated work. For this, they bring their policies together through a Management Body, whose function is the coordination of the National

Policy for Environmental Education – PNEA, encouraging the guidelines for the implementation of Environmental Education at the national level.

In this perspective, the distinction between formal and non-formal education for Environmental Education has consolidated an important delimiting framework for the applicability of public policies, distinguishing the attributions between the Ministries of Education and of the Environment.

However, the distinction between formal and non-formal education for Environmental Education, sanctioned by the Law 9795/99, reflected directly in the educational practices promoted in schools, since the epistemic identity of environmental practices had its conceptual genesis in actions that were designated for a non-school audience.

In this scenario, schools began to imprint in their environmental education practices actions that were carried out with a non-school audience, substantially neglecting the historical precepts of Environmental Education itself, through multi-game competitions, competitive games, or, then, through awareness raising activities involving dances and festivities, called environmental education. Regarding the Environmental Education practices carried out by the teachers in the school, Sato emphasizes:

[...] specific actions of hugging trees or paper recycling workshops, without any critical posture to consumer models experienced by societies, or by the analysis of man's dominant mode of relationship to nature with high anthropocentric value. [...] The industries are campaigning in schools through competitive and non-solidarity games to collect aluminum "cans" while encouraging more consumption for the awarding of computers and other school materials [...] (2001, p.16).

[...] ações pontuais de abraçar árvores ou oficinas de reciclagem de papel, sem nenhuma postura crítica dos modelos de consumo vivenciados pelas sociedades, ou pela análise do modo de relação dominadora do ser humano sobre a natureza, com alto valor antropocêntrico. [...] As indústrias fazem campanhas nas escolas, através de jogos competitivos e não solidários, para coleta de "latinhas" de alumínio, enquanto incentivam mais consumo para premiação de computadores e de outros materiais escolares [...] (2001, p. 16).

⁵ In the original Portuguese: É interessante observarmos que o movimento ecologista é socialmente mais enraizado no Rio Grande do Sul, onde a AGAPAM (Associação Gaúcha de Preservação Ambiental) reuniu ecologistas a partir da luta contra a Borregaard, empresa multinacional que poluía as águas do Rio Guaíba, na grande Porto Alegre e onde José Lutzenberger, ex-agrônomo de uma grande empresa multinacional de agrotóxicos, rompe com a perspectiva da agroquímica e assume profundamente a causa ecológica e social. A maior parte dos exilados políticos que abraçam a causa ecológica se concentra no Rio de Janeiro, estado onde já se desenvolviam algumas lutas ambientalistas, sobretudo no norte-fluminense (Campos e Macaé, por exemplo) e em Cabo Frio (luta pela preservação das dunas) (1990, p. 16).

In view of this context, another conceptual aspect emerges for Formal Environmental Education, announcing in its propositions the need to promote environmental ethical relations, articulated through an educational project that aims to overcome behaviorist learning, to those that aim at the consolidation of "ecologically correct attitudes" within the school (LIMA, 2009).

In this direction, two different conceptual postures are inferred in relation to environmental educational practices in the school. On the one hand, practices that highlight the conservationist and naturalistic nature, commonly perceived in natural sciences projects, and, on the other hand, practices that intend, in their pedagogical movement, the consolidation of a society that holds political actions, aiming at an intervention in the world in a critical, reflective and dialogic form, based on the responsibility towards all beings (KAWASAKI and CARVALHO, 2009).

In this way, another conceptual possibility emerges for Environmental Education, unfinished in its epistemic dimension, but announcing other ways of doing science, provoking the overcoming of social inequalities, which does not imply a perspective of homogeneous concepts, but rather, the incitement of the unveiling of a world yet to be discovered. In relation to the unveiling of the world Velasco asserts:

[Reality must be "unveiled" because, in its naive, that is, a-critical and alienated apprehension, the social mechanisms of domination-repression-destruction that articulate its very heart are hidden. Hence the "immersed consciousness" in this view of appearances must "emerge" in the process of discovering the hidden mechanisms (1999, 32).]

A realidade precisa ser "desvelada" porque, na sua apreensão ingênua, quer dizer, a-crítica e alienada, ficam ocultos os mecanismos sociais de dominação-repressão-destruição que articulam seu coração mesmo. Daí que as "consciências imersas" nessa visão das aparências devam "emergir" no processo de descoberta dos mecanismos encobertos (1999, p. 32).

The practices of Environmental Education in schools constitute, for the most part, actions that ratify the competitive values of excluding societies, reinforcing the mechanisms of social inequality learned throughout western history itself. In this bias, it is emphasized that the Environmental Education trajectory, over the last years, denotes the complexity and the tension that the environmental issue in the school has been suffering, as

much by the theoretical obliviousness as by the methodological simplicity adopted (FRACALANZA, 2004).

In this context, referring to Fracalanza's thinking about simplicity in the practices of Environmental Education adopted in the school, Sato talks about the uncritical understanding of the political consciousness that some teachers have about environmentalism, as if "environmentalism was limited to commemorative dates and not set as a project of life, of social struggles"⁶ (2001, p.16).

That said, we can corroborate the understanding that Environmental Education should consolidate the possibility of a different perspective of understanding the world, aiming at the encounter between ethnic, cultural and social differences, being an exponential element for the subversion of the mechanisms of maintenance of power, of the division of classes and of the excessive authorization of dominating processes.

Environmental Education, understood as such, is an education that brings together values that foresees another society, with social actions of respect for others, transgressing the ecologically correct attitudes constantly promoted in advertisements sponsored by large international corporations that also include the large polluting companies.

Environmental Education, both in non-formal and formal education, claims the re-signification of the world, considering the environment as a space of perception of differences and, above all, acceptance of the human condition, that is, the legitimation of the decrease of social inequalities through the change of the established economic model.

In this way, it is understood that the school that intends to delineate its educational practices through a critical environmental project should be clear that the first objectives in its guidelines must move towards social emancipation, rethinking the curricular structure through the integration of activities and social actors.

We also emphasize that critical environmental educational practices in the school suggest the effective action of educators in the sense of occupying public spaces, since the understanding of education as a political-pedagogical doing emphasizes the political struggle that Environmental Education plays in civil society.

In this conception, the insertion of Environmental Education into civil society through the school can be a strategy of subversion of the current society, strengthening social relations that dignify the human

⁶ Our translation of "ambientalismo se resumisse a datas comemorativas e não configurasse como um projeto de vida, de lutas sociais".

condition to the detriment of the economic values commonly proclaimed.

It is important to note that although Formal Environmental Education does not establish a guarantee of abrupt social changes, through it there is the possibility to seize new learning, whose respect for the many forms of life safeguards the emergence of a new planetary culture, ecologically viable.

In this understanding, the school's need to comprehend its role in this process of constructing pedagogical intentions, that is, of learning to live in a democratic, tolerant and collaborative way, emerges. The dimension of the acceptance of the other must be taught or conquered through school relations.

Environmental Education, in this perspective, fosters the organization of joint decisions, establishing the social identity in the school, whose potentialities are evidenced from the collective participation, placing the objectives that should, as a priority, aim at the formation of democratic citizens.

Given this view, the role of the political-pedagogical project becomes singular, outlining the sequence of strategies, objectives, purposes and actions that schools should take towards the school that intends to support its guidelines in Environmental Education. The school, anchored in an environmental perspective, allows the overcoming of individualism, contributing to the design of a participatory, active and environmentally fair society in its ethical values.

In this way, it is up to the school to review the concept of curriculum that permeates its educational activity, re-signifying the conceptual matrices of the intended pedagogical movement, that is, the paths that must be traced in the construction of relationships that value the human condition in its first instance.

In this direction, the curriculum guided by the environmental perspective signals to the understanding that the school is a space for acquiring knowledge that converges towards a necessary transdisciplinarity, and Environmental Education is a reflective component of all areas of knowledge.

However, it is necessary to reorganize school curricula, not only in their objectives, but also in their philosophical premises, redefining their concepts and methodologies of action, since:

[...] by problematizing human formation, education, school education, school curriculum and teacher training, we can conclude that the insertion of the environmental education that we want and need goes through the reformulation of teacher training in the perspective of overcoming practical rationality, defining it as

the formation of the educated teacher (critical intellectual), investing in his/her role in the construction and realization of a school curriculum that guarantees the treatment of environmental themes as nuclear activities in schools, understood as an institutional social space whose role is to contribute to the full and omnilateral formation of the subjects by the critical appropriation of historically and socially elaborated culture to instrumentalize them in the realization of a critical and transformative social practice. This is the most elaborate form that we could develop in this study so that the insertion of environmental education in schools overcomes the weaknesses with which it has been incorporated, especially in its spontaneous form, often delegated to projects directed by social groups that are very distant from principles of environmental education with a view to social transformation (TOZONI-REIS, CAMPOS, 2014, p.159).]

In this sense, Environmental Education is not an isolated area of knowledge, but rather an interdependent one, aiming at the formation of intellectual agents that can overcome social and environmental dilemmas, engaged in the constitution of a just and fraternal society. In this way, critical Environmental Education enhances the formation of actors engaged in the process of changing the contemporary societal paradigm.

Another point deserving of highlight refers to the differentiating nucleus between Environmental Education and Ecology. Ecology is the perception and analysis of organisms or groups found in the environment (ODUM, 2006), while Environmental Education translates the complex relationship of the different areas of knowledge. Treating Environmental Education as the teaching of Ecology is to reduce the environmental dimension to the purely technical aspect, therefore, as a further challenge, it is to design an Environmental School Education from the creation of new teaching methodologies.:

In this way, it is evident that the pedagogical proposal of the school needs to be dialogued, articulated democratically within the school community, being the key piece for the constitution of an environmental praxis capable of creating reflective conditions for the combat of the imbalance in social relations.

In this perspective, Environmental Education translates a relevant space for the consolidation of ethical relations, subverting the current paradigm and taking on new looks in relation to the economic models that limit the meaning of the expression 'development'.

In this context, Environmental Education allows the creation of critical spaces, helping people to realize that the environmental problem does not dichotomize man and nature, but that the human condition is part of this nature, which directly implies the redoing of educational practice itself, that is, in the construction of the environmental identity.

In this perspective, Environmental Education is characterized as a delineation of epistemological character, provoking the creation of methodologies that enable the students to understand their role in the world, reflecting the origin of environmental problems. In this way, it is necessary to reinforce that the implementation of Environmental Education in schools must be integrated into the political-pedagogical project, thus materializing a collective proposal in which the school community can, collectively, give their opinion, propose, and define the actions that will be carried out.

In this way, learning becomes more meaningful, establishing a constant dialogue between teachers, students, technicians and parents within the school. Environmental Education becomes part of the daily school, contemplating the contents and the programs taught.

Another point that needs to be highlighted is the understanding that the projects that involve Environmental Education do not present immediate results, thus being a slow process that starts from the gradual assimilation of the community involved, since the objectives, methodologies and constant reflection need to be rethought daily. For this, some theorists suggest the perception of the school from a holistic vision, surpassing the exclusive dialogue of the environmental preservation. But it is undeniable that these actions are also necessary for school reflection.

In this perspective, the recognition of the environmental perception of the community involved becomes unique, since it materializes the relational forms that the school community establishes with nature, evidencing the conception of environment and nature of the actors involved. In this scenario, it can be said that the educational practices that permeate the environmental performance in the school should foster criticality, promoting actions to overcome environmental problems through a conceptual, historical and reflective analysis of environmental problems.

However, we highlight that the conceptual, historical and reflective analysis is not an exclusive condition of environmental education, but it should impress the pedagogical movement of any school, even those who do not want to highlight the environmental issue in its motto. This reflective attitude establishes an educational process that subverts the mere transmission of knowledge.

Furthermore, we understand the urgent need to combine the environmental issue with the perspective of local and, consequently, regional development, since formal environmental education is only relevant from the transformations of social relations that it offers in school, re-signifying the perspective of the universe in which the student community is inserted.

In this perspective, the imbrication between environmental education and local/regional development poses a unique challenge, since it refers to the process of assumption of the political-pedagogical dimension in which school must be situated, that is, of the assumption by the school institution of an emancipatory social policy, as Andrade points out:

[Environmental Education practices make of it an important local development mechanism because it highlights the relationships between the personal and interpersonal dimensions and stimulates the constitution of individual and collective identities (2013, p. 06).]

As práticas de Educação Ambiental fazem com que esta se torne um importante mecanismo de desenvolvimento local porque destaca as relações entre as dimensões pessoais e interpessoais e estimulam a constituição de identidades individuais e coletivas (2013, p. 06).

In this dimension, we emphasize that the concept of "location" is closely linked to the idea of territory, but it is not its result, nor its determination, since the location can be understood as a space "defined from the references, potentialities and needs that the community enunciates"⁷ (FERRARINI, 2012, p 235).

In this standpoint, the necessary connection between environmental education in the school and local/regional development is justified, emphasized by the understanding that environmental educational practices can offer other ways of understanding the concept of location, directing paths that point to the understanding of this space from its dimension of sociability and social cooperation, as described by Ferrarini:

[Localization is the set of initiatives that aim to create or maintain spaces of small-scale sociability, community-based, based on face-to-face relationships, oriented towards self-

⁷ Our translation of “definido a partir das referências, potencialidades e necessidades que a comunidade enuncia”

sustainability and governed by cooperative and participatory logics. (2012, p. 236).]

Localização é o conjunto de iniciativas que visam criar ou manter espaços de sociabilidade de pequena escala, comunitários, assentes em relações face a face, orientados para auto sustentabilidade e regidos por lógicas cooperativas e participativas (2012, p. 236).

Given this perspective, we infer that the connection between environmental school education and local/regional development delineates a new reality, forming a dimension of creation of other ways of relating human and non-human, including the emergence of a rationality that imprints ethical socio-environmental values. Leff, as a proposal to create other forms of understanding the world, discusses the concept of environmental rationality:

[In this way, environmental rationality is based on a new ethics that manifests itself in human behavior in harmony with nature; in principles of a democratic life and in cultural values that give meaning to human existence. These are translated into a set of social practices that transform the structures of power associated with the established economic order, mobilizing an environmental potential for the construction of an alternative social rationality (2001, p.85).]

Desse modo, a racionalidade ambiental se funda numa nova ética que se manifesta em comportamentos humanos em harmonia com a natureza; em princípios de uma vida democrática e em valores culturais que dão sentido à existência humana. Estes se traduzem num conjunto de práticas sociais que transformam as estruturas do poder associadas à ordem econômica estabelecida, mobilizando um potencial ambiental para a construção de uma racionalidade social alternativa (2001, p. 85).

It is also convenient to point out that the imbrication between environmental education and local/regional development suggests a dialogue in which the social actors consciously assume the process of autonomy, whose values of development come to be understood from a demystified perception of the place, subverting the idea that local development only reaches a region through higher spheres, either by the investment

made by private companies or by governmental bodies. Dowbor in relation to the understanding of society about local/regional development, elaborates:

[Local development has always been seen as a process that reaches a region or descends from higher spheres in the form of public investments or the setting up of private companies. Modernization, in the broad sense of generating employment and income, valuing small and medium enterprises, combating poverty, reducing inequalities and providing quality public policies, tends to be seen as dynamics that comes from outside and that the community expects in a passive way (2010, p.101).]

O desenvolvimento local sempre foi visto como processo que chega a uma região ou desce de esferas superiores, sob a forma de investimentos públicos ou instalação de empresas privadas. A modernização, no sentido amplo de geração de emprego e renda, valorização da pequena e média empresa, combate à pobreza, redução das desigualdades, provimento de políticas públicas de qualidade, tende a ser vista como dinâmica que vem de fora e que a comunidade espera de forma passiva (2010, p. 101).

Given this view, the function of environmental education is perceived as dynamics that instigates new understandings regarding the idea of development, signaling to environmental practices that transgress environmentalist practices, whose actions are summarized in activist practices of protection of the environment, distanced from a reflective posture about the constituent processes of Formal Environmental Education.

In this way, environmental education, understood as a factor congruent to local/regional development, suggests the design of educational practices based on critical and ethical relations, highlighted by social responsibility. Sauvé, on the role of environmental education in local communities with a view to regional development, expounds:

[Environmental education aims at inducing social dynamics, starting in the local community and later on into broader networks of solidarity, promoting a collaborative and critical approach to socio-environmental realities and an autonomous and creative understanding of the problems that are

presented and of the possible solutions for them (2005, p. 317).]

A educação ambiental visa a induzir dinâmicas sociais, de início na comunidade local e, posteriormente, em redes mais amplas de solidariedade, promovendo a abordagem colaborativa e crítica das realidades socioambientais e uma compreensão autônoma e criativa dos problemas que se apresentam e das soluções possíveis para eles (2005, p. 317).

In this sense, the approximation of local/regional development and environmental education in schools inspires an education, in function of its political perspective, which potentiates the overcoming of behaviorist learning, since the notion of social praxis, due to constant reflection about the educational action itself, causes the social actors to perceive themselves as constructors of their own history and, consequently, of their localities (SAUVÉ, 2005).

In this perspective, the concept of Formal Environmental Education adopted for this thesis signals to an understanding of educational practice that directly questions the development models, emphasizing the creation of new societal postures in relation to the economic models.

We elaborated a Reference Framework with thirteen epistemic dimensions /They are: critical environmental practices; environmental ethics; dialogue; overcoming behaviorist learning; political education; regional/local belonging; interdisciplinary predisposition; perspective of complexity; social transformation; curricular environmental insertion; rupture of the naturalistic limits; reflection on pedagogical practice and continuous qualitative evaluation.

In this context, the epistemic dimensions indicate an itinerary suggestive of Formal Environmental Education that allows the construction and/or evaluation of environmental educational projects that intend to articulate their actions from a critical perspective, enabling teachers to access a pedagogical instrument that can be used in different areas of knowledge in an interdisciplinary way.

In this way, the Reference Framework sets out a pedagogical proposition that has as its singular notion the deconstruction of the uncritical actions that limit the environmental perspective in the school to the campaigns of environmental preservation, commemorative dates and awareness-raising techniques, decontextualized of the political conflicts in which environmentalism arose.

In this understanding, critical Formal Education was instituted through the establishment of dialogue, a

unique condition for the democratic elaboration of actions that seek to problematize reality, as well as recognize the urgent need to overcome the social distancing imposed by religious, economic, political, and ethnic order, building the collective participation necessary to overcome the socio-environmental crisis.

In this bias, the Formal Environmental Education intended, by contradicting the behaviorist learning in education, points to the structuring of environmental projects that comprise the socio-environmental crisis from its historical assumptions.

In this context, we can infer the existence of a political status that governs school environmental actions, not being possible to consider the educational practices as neutral actions, since they congregate in their epistemic premises the claim of a new society, both in its pedagogical sense as through the political perception of their relations through a culture of environmental solidarity.

In view of the panorama presented, we can corroborate that environmental education, as it was announced earlier, is closely linked to local/regional development, which was denominated in the Reference Framework as an epistemic dimension of regional/local belonging. The imaginary construction of belonging propels a pedagogy of involvement, provoking social actors to rethink their problems from the proposition of ideas that come from their surroundings, whose practices of overcoming and proposition start from the community itself, the actors that know and perceive themselves in their own history.

In this sense, we understand that Formal Environmental Education needs to dialogue with different areas of knowledge, imbricating knowledge that challenged not only the interdisciplinary condition itself, but also the predisposition of the teachers involved who have to overcome scientific individualism and propose, collectively, actions that allow the resolution of the environmental problems defined in the school.

That is to say, in other words, that teachers who want to base their environmental educational practices in a critical posture should understand their practices from a perspective of complexity, due to the multidisciplinary nature that Formal Environmental Education demands.

Thus, we perceive that the Formal Environmental Education proposed points towards educational practices that establish meanings for the environmental issue, emphasizing social transformation as an unquestionable premise of educational actions, bringing the human condition closer to nature, being impossible not to perceive, for instance, poverty or intolerance of any kind as an environmental problem.

In this context, it is necessary to emphasize the need for a Formal Environmental Education that is

configured as a school proposal, and not as an isolated practice carried out by some teachers. The curricular dimension of environmental education triggers a burning need for understanding environmental issues as a proposal that should cover all areas of knowledge.

For this, a curricular environmental insertion that involves teachers, students, parents, community, extending the conceptual and practical limits of environmental education in the school, demystifying the exclusivity of the environmental debate to the natural sciences, is perceived as singular.

In this perspective, it is important to point out the necessary rupture of the naturalistic limits, that is, to dissociate from Formal Environmental Education the conception that environmental education practices circumscribe only the actions of the natural sciences, which substantially reduces the conception of critical environmentalism.

In this way, we should note that the rupture of the naturalistic limits implies the daily reflection of the pedagogical practice of the teacher who works with environmental education, suggesting the constant interpretation of her/his pedagogical practice, reviewing the adopted procedures, as well as evaluating the achievement of the goals which were proposed for the activity. In addition, we highlight as pressing in the conception of Formal Environmental Education, from a critical perspective, the continuous qualitative evaluation of the practices carried out in the school, which suggests the democratic dimension characteristic of the environmental education itself. This means that when environmental projects are constantly evaluated qualitatively there is the possibility to verify if the objectives are being achieved, and it is possible to establish, if necessary, changes that can improve the quality of the project.

It is also evident that the epistemic dimensions highlighted here as a proposal of the Reference Framework do not constitute a prescription, but deflagrates, on the conceptual premise of our thesis, the understanding of an unfinished synthesis that intends to be a critical reference in the construction and/or evaluation of environmental educational projects.

We can also understand that the Reference Framework, because it is an incomplete construct, allows its constant re-signification, being possible to configure it from the context in which the school is inserted. In this way, the epistemic dimensions can be altered, being suppressed or added according to the proposal of the environmental educational project.

However, it should be noted that the Reference Framework is an indicator that is based on a theoretical proposition whose assumption refers to Critical Environmental Education, that is, it inspires the execution

of practices that are congruent in their conceptual specificity, delineating categories, objectives, strategies and intended impacts that do not neglect the critical premise adopted.

In this sense, it is worth highlighting that the Reference Framework translates a pedagogical instrument that allows teachers an initial dialogue regarding environmental educational practices and, consequently, regarding the conception of environmental education in the school, signaling a challenging possibility that brings the school community closer for the elaboration of educational proposals that are pertinent to the confrontation of the identified environmental problems.

Still in this perception, we understand that the Reference Framework, based on the critical premise adopted, can help the school community in understanding the environmental problem itself, that is, schools are not always able to clearly visualize the environmental problems that are part of the daily life of the functioning school, for example, the conception of nature adopted by the school community.

And the Reflections on an epistemology for environmental education will initially establish the conceptual limits of our studies, indicating the emergence of environmental education as an interrupted course; the relation between knowledge and science; and the theoretical approximation between Formal Environmental Education and regional development.

We highlight the main currents of Brazilian environmental education, directing the dialogue to what was conventionally called in this Reference Framework a proposition to assist in the construction and/or evaluation of environmental educational projects.

III. FINAL CONSIDERATIONS

Therefore, it can be inferred that in Brazil, to this day, environmental education is divided into two major theoretical trends that reflect the practices of environmental educators. On the one hand, supporting a behaviorist/liberal/conservative tendency of Environmental Education (CARVALHO, 2001; GUIMARÃES, 2000; LOUREIRO, 2008), environmental practices are understood from their immediate resolution dimension, focusing on actions that situate environmental doing through changes in social behaviors, mostly promoted by environmental activism. On the other hand, in the dimension of opposition, the popular/critical/emancipatory tendency is emphasized, whose argumentative and practical content situates for the significant assumption of a new societal posture in relation to the economic models adopted.

Thus, we can infer that the environmental educational practices translate a kaleidoscope of actions that denote a historical conceptual fragility, reflected in the

projects that are outlined in the school, through uncritical and decontextualized positions of the expropriation mechanisms linked to the dominant economic systems.

From this perspective, emphasis is placed on the urgent need to create pedagogical instruments that serve as indicators for the environmental issue in schools, with a view to the critical reflection of the environmental educational practice, overcoming the limitations and the fads that Formal Environmental Education has been facing.

In this panorama, we highlight the dialogical amplitude that the environmental question suggests. However, we concentrate our discussion on Formal Environmental Education, in an attempt to create a pedagogical instrument that allows the elaboration of environmental educational projects, signaling for a critical conception. We also hope that the pedagogical instrument favors the adoption of conditions for the re-signification of the environmental problems in the school, as well as in the elaboration of didactic materials.

Finally, we might infer that the connection between environmental education and local/regional development delineates a new reality, configuring itself in a dimension of creation of other ways of relation between human and non-human, understanding the emergence of a rationality that imprints socio-environmental values. Moreover, it establishes the link between the proposals to create other forms of understanding the world, and about the concept of environmental rationality.

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Quality of Living Perceived of the Young People of the Vale do Sinos / RS/Brazil

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Abstract—The objective of this study was to identify the Quality of Life level of young people from Vale do Sinos / RS. The methodology was observational, descriptive and transversal. The sample had 391 young people. The data collection instruments were the WHOQOL-Bref and a socioeconomic questionnaire. Resulting in a total average score of 52.37 points, the highest for the Social Relations Domain and the lowest for the Environment. When compared to the variables "Sex", "Income" and "Age", the one with the highest statistically significant association among the domains was "Income", followed by "Sex" and "Age". It was concluded that the QoL of young people is smaller when compared with other studies, being relevant investments in public policies.

Keywords—Young people, Quality of Life, WHOQOL-Bref.

I. INTRODUCTION

Due to the reality of young people towards the society and the consequences that social problems cause them, then compromising their quality of life (QoL), it becomes relevant to search the current situation of the youth. Besides, to verify their satisfaction level in relation to the QoL, the factors that are most influencing its concerning results and how it is possible to improve them.

Even young people, representing a large part of the Brazilian population, are the least favored in terms of social programs, once the public policies focused in this public are few and precarious. Being this the most concerning issue after they are eighteen years old, since young people are comprised between the ages of 15 and 29 years old, and after majority, they represent to be the most

injured in social issues such as health, safety and, income, according to IBGE data.

From this information about the reality of the young, another issue that becomes very relevant and debated is regarding their quality of life, because they are not privileged in many sectors of society, both for reasons of historical events, which have classified them as a group of the population that generated and participated in many events of social conflicts, as well as for their current social reality, pointed out in the high IBGE indexes, mainly concerning to unemployment and violence issues, in which the young people are represented by the large part of this population (Silva and Silva, 2011).

The young people represent 26,4% of the Brazilian population, that is, they are 50.2 million of people in the age range between 15 and 29 years old. The authors abovementioned still bring alarming information about the unemployment indexes, affirming that almost half of the country's unemployed are represented by young people. Besides, those who are employed work irregularly. As well as, there are other concerning indexes regarding the education, health, and culture.

These data are confirmed in the website of the Brazilian government, in the field of National Youth Policy (NYP), in which they point out that even with the advances already accomplished by the young people throughout the history, many of them still are poorly served. From the main elements, mentioned in the website, wherein the young people are in less favored position, compared to the rest of the population, there are the rights to health, job, education, culture, among so many others that they are constantly claiming.

Another question, besides the problems abovementioned, according to Sposito and Carrano (2003), there are few public policies that cover the young public in general, especially if its considered their chronological age, because it is demonstrated in the NYP that the young people are divided into 3 groups being 15 to 17 years old, 18 to 24 years old and 25 to 29 years old, the first group is included in the Child and Adolescent Statute (CAS), which greatly benefits them because there are several government programs that favor them, as well as a specific Law that protects and guarantees their rights. However, the second and third groups are the least favored in this issue, because of their age being comprised by the majority they are excluded from the mentioned benefits ensured by the CAS. Even though on the Government website affirming that the public policies demanded to the youth population have gained strength since 2005, with the creation of the NYP, nowadays they are still considered few and those that exist do not always have a continuity.

Besides these problems that involve the young people and the indexes demonstrated by the IBGE related to unemployment, education, health, among other social issues, there is still the financial situation. According to Aquino (2008), some research data indicate that most of the young Brazilian people live with a family per capita income of approximately half a salary, this hampers and impair the opportunities in their insertion into society. Affirming that due to these data, the QoL of these young people is very compromised.

This quality of life, in which the author refers to, it is understood in its broader concept, that is, it should not be related only to health, in its biological sense, but to questions related to the general life satisfaction. These range from physical and psychological well-being to external factors that influence it, such as lifestyle and condition of life. Thus, considering that the QoL is something beneficial and very important for people's lives (Pereira, Teixeira and Santos, 2012).

The QoL, according to Pereira, Teixeira and Santos (2012), is also characterized as something subjective, being so, answered through the individual perception of each one as to their satisfaction with the issues addressed, as well as considering their feelings such as happiness, well-being, pleasure, etc. Besides, to answer them, it is necessary for the person to reflect the events and situations that occurred within a certain period established by the data collection instrument.

The collection instrument was developed initially by the WHO Quality and Life Group with the objective to evaluate the QoL in a broad and standardized way to be

utilized in many countries and by several areas, it was the WHOQOL-100. This is formed by 100 questions and was developed from the collaboration of professionals from several countries. However, there was an interest in having an abbreviated instrument, so it did not demand a long time to be filled, but with satisfactory results, that is when WHO created the WHOQOL-Bref. In it there are 26 questions that contain four domains being: 1) Physical; 2) Psychological; 3) Social Relation; and 4) Environment (Fleck et al., 2000).

Considering the wide concept of quality of life and all the factors that denominate and influence it, also relating it to the current reality of young Brazilians, it is possible to identify the QoL level of the youth. Therefore, this search justifies itself in reflecting the reality about the quality of life level of the young people, exclusively in the age range between 18 and 29 years old, in which are the least favored in the social sectors and the less benefited in public policies. In addition to pointing out ways to improve these indexes. Therefore, the aim of this study is to identify the level of Quality of Life (QoL) of the young people of fourteen cities located in the Sinos Valley/RS.

II. METHODS

The current research is characterized as observational, descriptive and transversal, with samples of young people between the ages of 18 and 29 years old, residents in the fourteen municipalities of Sinos Valley/ RS (Araricá, Campo Bom, Canoas, DoisIrmãos, EstânciaVelha, Esteio, Ivoti, Nova Hartz, Nova Santa Rita, Novo Hamburgo, Portão, São Leopoldo, Sapiranga and Sapucaia do Sul). The sample met the following study inclusion criteria: being between the ages of 18 and 29 years old; residing in one of the cities of Sinos Valley/RS, correctly fill out the research instruments; volunteer to participate in the study and sign the Free and Informed Consent Form (FICF). The exclusion criteria were: being under 18 years old or over 29 years old; do not reside in one of the cities of Sinos Valley/RS; has not properly filled out the research instruments; and not sign the Free and Informed Consent Form (FICF).

There was a sample calculation of a population of 336.396 young people with a margin of error of plus or minus 5%, which will give us a total of 391 subjects, according to table 1.

Table. 1: Sample Calculation of Young People from Sinos Valley

City	Men	based on the coefficient	Women	based on the coefficient	Total	Sample by city
Araricá	610	1	585	1	1195	4
Campo Bom	8057	9	7860	9	15917	20
Canoas	41014	47	41570	47	82584	94
Dois Irmãos	3874	4	3831	4	7705	8
Estância Velha	7520	9	5562	6	13082	15
Esteio	10375	12	10438	12	20813	24
Ivoti	2593	3	2538	3	5131	6
Nova Hartz	2463	3	2526	3	4989	8
Nova Santa Rita	2976	3	2849	3	5825	6
Novo Hamburgo	30658	35	30659	35	61317	70
Portão	4036	5	3927	4	7963	9
São Leopoldo	28184	32	27944	32	56128	64
Sapiranga	9926	11	9831	11	19757	24
Sapucaia do Sul	16936	19	17054	19	33990	39
Total	169222	193	167174	191	336396	391

Source: IBGE data 2015

The QoL level was measured using the WHOQOL-Bref, a questionnaire composed of 26 questions related to the last fifteen days prior to the evaluation. As well as, a socioeconomic questionnaire. The current research respected all the topics related to bioethical issues, as stated in the CNS Resolution 466/2012 and being approved by the Ethics Committee.

The data for this research were collected in formal and non-formal public environments, by a socioeconomic questionnaire and by the research WHOQOL-Bref instrument.

After the classification, tabulation and planning of the data collected through the two questionnaires, comparative and correlation studies were accomplished. Firstly, the data were submitted to a normality test, to later define the statistical techniques that were utilized for parametric and non-parametric data. The normality criteria ($p > 0.05$) for 4 domains was not met. Therefore, it was used a comparison test between the non-parametric mean scores denominated as Kruskal-Wallis test. The objective of the test is to compare if there is a statistical difference between the domains. For this statistical study, it was used the software "Statistical Package for the Social Sciences" – SPSS – for Windows, v. 22.0.

III. DATA PRESENTATION AND ANALYSIS

The socioeconomic questionnaire and the WHOQOL-Bref instrument were applied to a total of 392 participants.

Table. 2: Socioeconomic Questionnaire

Gender	Nº	F	%
	391		
Male		198	50,6
Female		193	49,4
Age	391		
18 a 20		197	50,4
21 a 23		86	22
24 a 26		55	14,1
27 a 29		53	13,6
Skin color	391		
Yellow		64	16,4
White		210	53,7
Black		46	11,8
Brown		71	18,2
Marital Status	391		
Single		327	83,6
Married		55	14,1
Sep/Divor		9	2,3
Student	391		
Yes		369	94,4
No		22	5,6
Employed	391		
Yes		271	69,3
No		120	30,7
Income	391		
(-) minimum wage		25	6,4
1 - 2 salaries		211	54

3 - 5 salaries		125	32
(+) 6 salaries		30	7,7
Exercise	391		
Yes		223	57
No		168	43
Times/week	391		
0		168	43
1		45	11,5
2		42	10,7
3		41	10,5
4		22	5,6
5		37	9,5
6		20	5,1
7		16	4,1
Health	391		
Excellent		78	19,9
Very Good		112	28,6
Good		142	36,3
Regular		55	14,1
Bad		4	1

Source: Elaborated by the authors

As observed in Table 2, from the 391 participants, 50.6% (198) are male and 49.4% (193) are female, with an age range of 18 and 29 years old. With reference to the age, 50.4% (197) were between the ages of 18 and 20 years old, denominated as young-young (18 to 24 years old) according to NYP.

The options chose by most of the participants are: 83.6% (327) single; 53.7% (210) white skin; 94.4% (369) students; 69.3% (271) working; 54% (211) have an income of 1 to 2 minimum wage; and in question of Physical Exercises, 57% (223) of the participants practice some type of physical exercise that varies between 1 and 7 times a week. The last question of the questionnaire is referring to the perception of their health, the alternative “Good”, found among the third of the five options, was chosen by a majority of 36.3% (142).

In the second questionnaire, the WHOQOL-Brief instrument, it was possible to obtain a comparative between their domains with the variables: sex, income, and age.

In the accomplishment of the comparative, the non-parametric Chi-Square test was used to verify if there was an association between the WHOQOL and these variables.

Table 3: WHOQOL-Bref Applied to the 391 Participants Residing in the Sinos Valley/RS

DOMAINS	MEAN SCORE	STANDARD DEVIATION
Domain 1- Physical	57.19	10.28
Domain 2 – Psychological	64.83	12.11

Psychological		
Domain 3 – Social Relations	74.23	16.95
Domain 4 – Environment	56.52	14.54
Total Domain – perc.	52.37	7.51

Source: Elaborated by the authors.

Among the domains, observed in Table 3, the one that presents the highest mean score was the Social Domain, with a mean score of 74.23 points and variability around the mean of 16.96 points (74.23±16.96 points). The lowest score was the Environment Domain with 52.37 points and variability around the mean of 14.54 points. The Total Domain had the mean score of 52.37 points and variability with an average of 7.51 points.

Table 4: WHOQOL-Bref in Relation to the Sex Variable

DOMAINS	VALUE	SIGNIFICANCE LEVEL
Domain 1- Physical	24,467 ^a	,058
Domain 2 – Psychological	32,299 ^a	,014
Domain 3 – Social Relations	8,514 ^a	,667
Domain 4 – Environment	43,099 ^a	,010

Source: Elaborated by the authors

In relation to the values obtained in results analysis, as observed in Table 5, there was a statistical significance association in the Domain 2- Psychological and in Domain 4 – Environment. Both domains demonstrated a higher level to male sex. The domains referred to Physical and Social Relations did not present any statistical significance association among the genders.

Table 5: WHOQOL-Bref in Relation to the Income Variable

DOMAINS	VALUE	SIGNIFICANCE LEVEL
Domain 1- Physical	63,557 ^a	,035
Domain 2 – Psychological	82,406 ^a	,004
Domain 3 – Social Relations	55,737 ^a	,008
Domain 4 – Environment	74,226 ^a	,406

Source: Elaborated by the authors

Concerning the Income variable, only in the Domain 4 – Environment, illustrated in Table 5, there was no statistical

significance association. However, the Physical, Psychological and Social Relations Domains demonstrated significance in group 2 (1 to 2 salaries) of the Income variable. The Domain 2 – Psychological presented the highest significance level, followed by domains 3 and 1, respectively.

Table 6: WHOQOL-Bref in Relation to the Age Variable

DOMAINS	VALUE	SIGNIFICANCE LEVEL
Domain 1- Physical	51,024 ^a	,249
Domain 2 – Psychological	41,820 ^a	,817
Domain 3 – Social Relations	52,926 ^a	,015
Domain 4 – Environment	69,944 ^a	,547

Source: Elaborated by the authors

Regarding the age variable, observed in Table 6, only in Domain 3 – Social Relations there was a statistical significance association, being the age group of 18 to 20 years old the one in feature. However, the other domains did not present significant associations.

IV. DISCUSSION

4.1 Quality of Life of Young People Regarding the four Domains from the WHOQOL-Bref Instrument

To discuss the results obtained in this research, scientific articles in which the authors applied the WHOQOL-Bref instrument to a public with the age group between 18 and 29 years old were searched. However, few studies with participants with this age group were found, being the majority articles verified the quality of life, especially in elderly people. Besides, the few articles found were addressed to the QoL of the young in relation to some pathology or that was found in some risk group.

As observed in Table 3, the mean score of the total domains of the WHOQOL-Bref was 52.37 points. Being the Domain 3 – Social Relations with the highest score of 74.23 points, followed by the Domain 2 – Psychological with 64.83, Domain 1 – Physical with 57.19, and the Domain 4 – Environment with the lowest score of 56.52 points. These results were similar in relation to the positioning of the domains from the highest to the lowest score, compared to the results of the research accomplished by Wilke *et al.* (2013), with patients from the Centro de Referência do RS, diagnosed with Gaucher Disease (GD) with the age group of 18 to 23 years old. The mentioned authors affirm that differently from what they expected in the results, the domain with the lowest

score was not the psychological, but the Domain 4 – Environment, which refers to safety, quality of health, social opportunities, transportation, among others. They also state that in other studies verified with young people in Brazil, this domain also had the lowest mean score, regardless of the risk group or pathological problems.

In a study also accomplished at the Centro de Referência do RS, according to Fleck *et al.* (2000), the samples were composed of 300 participants, 250 patients from this hospital and 50 volunteers (control). The result of the lowest score was the same as from the authors abovementioned, the Domain 4 – Environment was identified as the least satisfactory in the control group as well as in the patients group. With these results, it is possible to observe that the mentioned domain presents the lowest satisfaction level not only by patients with diseases but also by the control group of volunteers.

These same results, about the Domain 4 – Environment having the lowest score, is confirmed in the study conducted by Manzatto *et al.* (2011), with young students of Physical Education that aimed to relate the consumption of alcohol with the impact on the QoL level. The authors assume that this domain had the lowest score due to most of the survey participants need public transportation and are dissatisfied with this service, as well as in the public safety issue, once a few of them were assaulted and when seeking for assistance in the public safety demonstrated dissatisfaction in this sector.

Another study, carried out by Vieira *et al.* (2015), related the QoL of the youth in relation to smoking and had the same results of the abovementioned studies in relation to the Environment domain. As well as in the study by Mello-Silva *et al.* (2012), with the young people with the age range of 18 to 24 years old, surviving victims of gun violence.

When the justifications of all the studies abovementioned were verified, as well as the considerations made by all the authors that accomplished them, its concern about the low score result to the Environment domain was evident. Besides, in all these articles, the authors emphasized the importance of investment in public policies aimed at young people, so that they can obtain a better quality of life.

It as also noticed that regardless of the sample population having some disease or being part of some risk group, all the studies aforementioned demonstrated the Social Relations domain as the highest score. According to Manzatto *et al.* (2011), different environments frequented by young people, such as in the family, at school or at work, they exert more than a sense of obligations, these environments directly influence in the personality of the young people and they seek for social interaction in these spaces.

4.2 Quality of Life in Relation to Sex

According to Table 4, in relation to sex variable, the Domain 2 – Psychological and the Domain 4 – Environment presented significative associations, being in both domains the satisfaction levels better to male participants.

In a study carried out by Eurich and Kluthcovsky (2008), which verified the quality of life of young academics, there were also a relation among the variables highlighted in this study, in which there was significative associations only with the sex variable in relation to physical and psychological domains, with the highest score to male participants. The authors also reiterate that despite the difference in age and family income between the sample participants, there was only a statistically significance association in relation to sex.

In another study with 394 medicine students from the University of the State of Rio de Janeiro (UERJ), according to Chazan Campos and Portugal (2015) this university offers 45% of the vacancies to low-income students, the sample characteristics were 61% female students, and of these, 43% were quote holders, with a mean age of 23 years old. The result of this research in relation to the QoL presented that the female students, in general, were those who demonstrated the lowest scores in all domains, and the quote holders of social class C had the lowest score in Domain 4 – Environment. This study showed that the quality of life of the searched population when compared to the investigated variables, presented lower scores in all domains to the variables of female sex and social class C.

In accordance to Skopinski, Resende and Schneider (2015), in a study accomplished only with women, affirm that their quality of life is directly connected to the satisfaction with the body image and psychological factors. The authors presented associations between the depressive symptoms with the satisfaction of the body image and their QoL. According to the authors, this physical well-being factor regarding the body image is more characteristic of the female sex if compared to male sex, since their self-esteem when low negatively affects the QoL. The results of this study demonstrated that the participants who presented low satisfaction levels to their body image also presented lower index in the perception of QoL and low scores in Domains 1 – Physical, 2 – Psychological and 4 – Environment.

Another relevant result from Skopinski, Resende and Schneider (2015) study and that resembles the results of Chazan, Campos and Portugal (2015) study is in relation to the satisfaction level with the quality of life and the family income, in which presented that the participants who declared to have better financial conditions also have a

better perception of QoL and showed higher scores in Environment and Social Relations domains.

It is possible to observe that in all studies abovementioned, comparing to the domains with sex, women demonstrated the lowest scores in almost all WHOQOL-Bref domains if compared to male participants. These results were even worse regarding the dissatisfaction level of the quality of life in relation to the financial condition.

The results from this study and from those cited before in relation to the perception of QoL being less satisfactory to the female sex, according to Skopinski, Resende and Schneider (2015) can be related to the fact that women are more vulnerable than men in terms of self-esteem. Thus, it is understood that the women perception of body image directly influences in their QoL, presenting the lowest scores in most of the WHOQOL-Bref domains.

4.3 Quality of Life in Relation to Income

Relating the WHOQOL-Bref domains to income, it is possible to observe, in Table 5, that this was the variable that presented the most statistically significant associations among the domains, that is, three of the four domains had these associations and demonstrated the highest degree of significance for the “Psychological” domain, followed by “Social Relations” and “Physical” domains successively.

In the study of Ferreira et al (2009), in which the sample had 110 people with an age range of 18 and 40 years, when compared the QoL to the financial situation, there was a statistical significance in the Social Relations domain, to the participants classified as Class A. The general QoL of this study also presented better results to Class A compared to the participants from Class C.

The importance of the income in relation to the QoL is also noticed in the study of Martins, França and Kimura (1996) that presented in the results that most of the interviewed associates QoL with material well-being, more specifically to items acquired by financial means such as housing, food, clothing, among other products.

The financial situation, according to Lima-Costa *et al.* (2002), has a great influence on the perception of people’s quality of life, regardless of whether they are young, adult or elderly. In a study accomplished by these authors, composed by 178.229 people with an age range of 20 and 60 years old, confirm this influence, because the result demonstrated that the participants with lower income, independent of the age presented a greater dissatisfaction in relation to the perception of health.

Following with the results similar to those already cited and to those observed in this research, regarding the better perception of QoL in relation to a bigger income and to male sex, these are also confirmed in the studies of Santos, Campos and Portugal (2015); Gordia, Quadros and

Campos (2009). All these, despite presenting particularities in the characterization of their samples, such as university and high school students, as well as young people with some pathology or risk group, all of them obtained similar results regarding the QoL satisfaction related to their financial situation, making it clear the importance of the familiar income to a higher score in almost all domains of the WHOQOL-Bref instrument.

The financial situation of the country's young population is a concerning issue, according to Silva and Silva (2011), in Brazil, in the IBGE/PENAD (2007) data it was pointed out that young people are part of almost half of the unemployed population. The authors also affirm that from the unemployed young people 54% works irregularly according to the work laws and receives lower wages than employees with an adult age range.

According to Dimas, Pereira and Canavarro (2013) in their study the participants that declared themselves as unemployed, presented the lowest results in relation to social and family life, as well as negative impact in the family financial situation, and these factors are essential in the subject's QoL satisfaction. Another relevant result of this study was the fact that most of the unemployed participants were women, which possibly may be related to the lower values in the QoL level that women presented in the studies abovementioned.

Thus, even presenting the statically significant associations in different domains in relation to variables, in all these studies here cited, the results regarding the highest scores had relations to the participants that declared a higher per capita family income.

4.4 Quality of Life in Relation to Age

The participants of this study presented statistically significant associations in relation to age, according to Table 6, only in the Domain 3 – Social Relations, with the highest score for the first group, with an age range of 18 and 20 years old.

The study by Branco *et al.* (2010) presented similar results to those observed in this study regarding the higher score, when it demonstrated statistically significance associations in relation to age, the younger participants presented higher averages.

According to Pierone (2016), the results presented in her study, with 201 subjects attending a park, the Social Relations domain demonstrated the higher score to the younger participants group, in this case under the age of 19. This study also shows that the main motive to younger people attend this leisure space is the pleasure of being in this place, thus, considered by them as a place that allows social meetings. Differentiating from the adult and elderly group, which declared as the main motive the prevention of diseases.

In another study accomplished by Barrientos and Suazo (2007), in which the quality of life among the young and adult age was compared, the younger participants group presented a lower result regarding their QoL. In this case, the Physical Domain was the only one that presented a statistically significance association to the age variable, presenting the lowest score to the youngest participants. Possibly, according to the authors, these results for the younger group is related to the number of tasks. Usually, in this youth period, women already have children and are looking for stability in a loving relationship, professional and financial, resulting in a greater physical fatigue when comparing to older individuals, once they usually present better stability and tranquility in the factors in which the younger are still in the process of conquest.

In accordance to the latest two abovementioned studies, according to the study by Silva and Heleno (2012), they presented the same results in relation to Social Relations Domain being the best evaluated by young individuals and Physical Domain being the least evaluated. The latest one is probably associated with the low quality of sleep, the great number of tasks and transitory changes in age regarding new responsibilities in this period after majority.

V. CONCLUSION

Based on the data obtained, it is concluded that the quality of life of young participants of this sample was lower in the satisfaction level in comparison to other studies, presenting the domains mean score of 52.37 points.

The QoL, in relation to "Sex" variable, presented statistically significant associations to the "Psychological" and "Environment" domains with better results to male young people. This result, in relation to the QoL satisfaction being better for men, is similar to other studies, in which, even though presenting significant associations to different domains, they had better scores for the female sex.

In relation to "Age", this variable presented the least statistically significant association among the domains, being only the "Social Relations" domain to the younger group, 18 to 20 years old. Thus, this variable is not very determinant to the QoL levels between the young public, since difference among the biggest age range, that is, young and elderly, was observed in studies. However, in most cases, the youngest ones presented association to the same domain of this study, "Social Relations".

On the other hand, the "Income" variable demonstrated to have an influence on the QoL evaluation, once the ones who declared to have 1 to 2 minimum wages were those that presented satisfaction in most WHOQOL-Bref domains. Being this variable, confirmed by all studies

cited, determinant to the QoL level.

The results presented in this study are similar to other studies cited in this study, in concern of the QoL satisfaction level, even those with young population sample with different characteristics, risk groups or pathologies, it was noticed that this situation affects, in general, the young public. With this and in relation to the few and scarce social programs directed to this population, the importance of public policies focused on the needs and rights of the youth, in order to promote an improvement in their QoL, stands out.

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Characteristics and Functionality of Probiotic Bacteria's Supplemented in the Ration of Country Chickens

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Abstract— *The objective of this article is to present, in the form of a bibliographic review, the main characteristics and functionalities of probiotics, highlighting their importance in the dietary management of country chickens and the innumerable benefits that the inclusion of this additive in the diet can provide for animal health. The use of antimicrobial additives (antibiotics) contributed to the development of industrial and colonial poultry; however, the reflection of the indiscriminate use of these additives has raised concerns regarding the development of bacterial resistance in birds. Probiotics emerged as a viable and reliable alternative, to promote sanitation and poultry production, which favored its application in the feeding management of large or small batches of poultry.*

Keywords— *Additives. Country Chickens. Animal Health. Yield.*

I. INTRODUCTION

Poultry production is based on high productivity and production of quality chicken meat products, for which the industry uses food additives, whose primary function is to promote growth and maintain the health of poultry. The search for a safer additive, which allowed the establishment of a protective intestinal microbiota in the animal, made the use of probiotics an effective alternative and aggregator of beneficial actions for the bird (LODDI et al., 2000).

One of the main problems that directly interfere with the development of poultry is the stress to which they are subjected in a grange, a fact related to the requirements imposed by the increasing increase in poultry productivity. This stress causes a decrease in food consumption, which is reflected in energy deficiency and consequent mobilization of body reserves as a way to supply the lack of nutrients, leaving the animal susceptible to infections and changes in the digestive tract. Faced with these disorders, growth promoters act prophylactically (ALLIX, 2010).

Country chicken is an alternative source of income for producers who want to start in poultry production, either because of low maintenance costs (facilities and inputs) or guarantee of financial returns, often immediately. The "organic" creation of broiler chickens established a new model of industrial production, aimed at the use of management practices based on observation and understanding of the functioning of the organic systems of the bird, adding value to the final product. The scope of these differentiated food management practices becomes possible and accessible with the use of alternative growth biological promoters (BALOG NETO et al., 2007).

The use of probiotics as an alternative to the additives traditionally used in the nutrition of cutting birds has led to the development of new researches, whose data on zootechnical performance provide a better decision on the application of the additive.

The objective of this article is to present, in the form of a bibliographic review, the main characteristics and functionalities of probiotics, highlighting their importance in the dietary management of country chickens and the innumerable benefits that the inclusion of this additive in the diet can provide for animal health. The results obtained with the use of probiotics in experimental research were also presented.

II. POULTRY FARMING IN BRAZIL

Poultry farming is one of the most profitable economic holdings when compared to other types of agricultural production in Brazil. Due to its own characteristics, this activity presents a high degree of biological control, being able to develop in any type of climate or soil. Another differential of poultry, especially in the cutting, is the high conversion of grains to meat, which guarantees the establishment of high rates of productivity and economic return in the short term (EMBRAPA, 2003).

In Brazil, poultry farming began to develop in the late 1950s, more specifically in the state of São Paulo, where a small-scale production system was used to sell live or slaughtered chicken at the regional market. Subsequently, the national poultry began to industrialize with the appearance of the first large slaughterhouses, which allowed the expansion of the activity to other regions. In 1970, the reorganization of meat production in Brazil shifted poultry production to the South. During the same period, the integration system was created (VIOLÀ e TRICHES, 2013).

Currently the production chain of the cutting poultry is formed by main and auxiliary links, which act as a cycle. The main links are composed by the shed of chickens grandparents, core of matrizes, hatchery, aviary, refrigerator and retailer. The chain begins with the chickens grandparents, whose function is to produce the matrices (second link) that will provide the commercial chicks for slaughter. The third link in the chain is represented by the hatcheries, which are units commonly belonging to the slaughterhouses and responsible for hatching the eggs and sending the chicks to the aviaries after a few hours of their birth. In the aviary (fourth link),

the birds will undergo growth and fattening processes and will be sent for slaughter in a refrigerator (fifth link). After slaughtering, in the industry, the whole frozen or chilled chicken or pieces, goes to the retail market (sixth link). The auxiliary links, composed of the inputs, research, equipment, medicines and packaging, guarantee the operation of the entire production chain (ARAÚJO et al., 2008).

According to the United States Department of Agriculture (USDA), Brazil's poultry industry is the number one export position, second in production and fourth in poultry consumption among the influential market countries poultry, as can be seen in Tables 1, 2 and 3. Expected a 4% increase in Brazilian exports is expected for 2018 (USDA, 2017).

Between the years of 2013 and 2017, Brazil presented a progressive increase in exports, which gave it a prominence in the sector and the retention of leadership, unlike the United States and China, which had oscillations in their results in this same time cut; the European Union and Thailand also developed, but far from the reach reached by Brazil (Table 1).

Table.1: Main countries exporting of chicken meat

Export of Chicken Meat (1.000 Tonnes)						
Países	2013	2014	2015	2016	2017	2018
Brazil	3,482	3,558	3,841	3,889	4,000	4,150
United States	3,332	3,310	2,867	3,014	3,091	3,189
European Union	1,083	1,133	1,179	1,276	1,250	1,280
Thailand	504	546	622	690	770	800
China	420	430	401	386	400	385
Total	8,821	8,977	8,910	9,225	9,511	9,804

Source: USDA (2017)

Regarding the production of chicken meat, for the period from 2013 to 2017, it is observed that Brazil became the second largest producer in the year 2016, due to the retraction of Chinese production. The European Union has

progressively increased and is expected to surpass China in 2018. The United States remains the largest producer of chicken meat in view of the progressive growth of its productivity over the last 5 years

Table.2: Main countries producers of chicken meat

Production of Chicken Meat (1.000 Tonnes)						
Countries	2013	2014	2015	2016	2017	2018
United States	16,976	17,306	17,971	18,261	18,596	18,970
Brazil	12,308	12,692	13,146	12,910	13,250	13,550
European Union	10,050	10,450	10,890	11,533	11,700	11,880
China	13,350	13,000	13,400	12,300	11,600	11,000
India	3,450	3,725	3,900	4,200	4,400	4,600
Total	56,134	57,173	59,307	59,204	59,546	60,000

Source: USDA (2017)

In the last five years, the United States has maintained a steady growth in domestic consumption of chicken meat, a fact not observed in Brazil, which suffered a deceleration in consumption between 2015 and 2016,

remaining in the fourth position. The forecast for 2018 is that China consumes less than the European Union, falling to the fifth position (Table 3).

Table.3: Main countries consumers of chicken meat

Consumption of Chicken Meat (1.000 Tonnes)						
Countries	2013	2014	2015	2016	2017	2018
United States	13,691	14,043	15,094	15,331	15,576	15,838
European Union	9,638	10,029	10,441	11,018	11,170	11,320
China	13,174	13,267	12,344	11,650	11,650	11,095
Brazil	8,829	9,137	9,309	9,024	9,252	9,402
India	3,445	3,716	3,892	4,196	4,397	4,597
Total	48,777	49,652	51,080	51,219	52,045	52,252

Source: USDA (2017)

Brazilian poultry farming generates 3.6 million direct and indirect jobs, besides having skilled labor, favorable climatic conditions, guaranteed inputs and natural resources needed by industry. The poultry segment moves 36 billion reais and has a 1.5% share of GDP. The southern states are responsible for most exports. The high level of this sector is attributed to the country's production characteristics, based on the integration system (UBABEF, 2012).

According to Oliveira (2016), the integration system consists of a partnership between producers / poultry producers (integrated) and poultry companies (integrators), where the poultry farmer is responsible for facilities, labor, management and access to the aviary. It is the responsibility of the companies to provide the matrices, the medicines, supplies, the technical assistance and to take charge of the slaughter. At the end of the creation, the integrator pays to the integrated its participation in the production of the batches delivered for slaughter. This system is widely used by companies of the sector.

Garcia (2004) states that the expansion of poultry production — first established in the South and Southeast Regions — to the Central West region, between 1990 and 2001, was influenced by the adoption of the production system in "agricultural partnership". States such as Goiás, Mato Grosso, Mato Grosso do Sul and Bahia were able to benefit from the implementation of poultry projects that promoted the installation of chicken slaughterhouses, facilitating the growth of live chicken production and consequently the partnerships between producers and industry.

III. USE OF GROWTH PROMOTERS IN POULTRY FARMING

Antimicrobial growth promoters, such as antibiotics and chemotherapeutics, began to be employed on a large scale in the 1990s in commercial broiler breeding where the indiscriminate inclusion of antibiotics became associated with induction of bacterial resistance, of hypersensitivity and to cases of cancer. The deleterious effects caused by these promoters have forced the European Union to ban most of the antimicrobial growth promoters in animal feed (MENTEM, 2002; FARIA et al., 2009).

Other types of growth promoters, applied to food management, offer good results for poultry farming, among which we can mention organic acids, enzymatic complexes, symbiotic, prebiotic and vegetable extracts. The study of these new alternatives was driven by the desire to find additives that had the capacity to balance the microbiota and ensure the biosecurity of the meat (ALMEIDA, 2012).

Various types of additives, such as prebiotics and organic acids, also contribute to the balance of the microbiota, favoring the development of desirable bacteria or eliminating the undesirable ones. Prebiotics consist of substances that can not be hydrolyzed or absorbed in the upper gastrointestinal tract and should serve as a substrate for beneficial bacteria that will bring improvements at the intestinal and systemic levels. The function of short chain organic acids (SCOA) is linked to the reduction of the bacterial load in the digestive tract, since it interferes in the physicochemical characteristics of the medium, in order to establish a greater heterogeneity of the microbiota (DIONÍSIO et al., 2002; DIBNER and BUTTIN, 2002; RICKE, 2003).

Campestrini et al. (2005) argue that birds, because they are omnivorous animals, have difficulty digesting non-amidic carbohydrates, found in soluble or insoluble fiber, impairing the utilization of nutrients present in ingredients of plant origin, commonly applied in the diet of birds. The use of supplemental (exogenous) enzymes in food improves the digestibility of food in order to increase animal performance. A good example is the enzyme phytase, which when added to the diet releases the phosphorus that is associated with the phytic acid of the vegetables, making it available to non-ruminants. Cellulase, xylanase and glucanase are other examples of exogenous enzymes important for animal nutrition.

Prebiotics are additives (food compounds) that have the ability to select bacterial species beneficial to the animal's organism without being degraded by digestive enzymes or absorbed by the intestinal mucosa. The action of prebiotics is to stimulate growth and activate the metabolism of bacteria important for sanity and intestinal balance (eg, bifidobacteria and lactobacilli). For this, these substances must arrive intact in the intestine and undergo the fermentation process, carried out by the microbiota desirable (BRITO et al., 2013).

According to Silva et al. (2000), the use of probiotics in feeding has the function to improve the balance of the microbiota, inhibiting the development of pathogenic microorganisms, through the production of organic acids, antibiotic substances or pH reduction. Among the alternative additives available on the market, probiotics have characteristics and functionalities that allow their use as growth promoters in poultry.

IV. PROBIOTICS AS GROWTH PROMOTERS

The effects of probiotics have been known for quite some time. The term was established by Lilly and Stillwell (1965), when they found that certain microorganisms acted as growth promoters. The action of these additives is twofold, since at first they contribute to the increase of the weight of the animal, the improvement of the zoeconomic indexes and feed conversion. In a second moment, they promote intestinal protection, provided by their bactericidal action (SILVA and ANDREATTI FILHO, 2000).

Probiotic microorganisms can be classified as colonizers (example of *Lactobacillus spp.* and *Enterococcus*) or non-colonizers (free-flowing), such as bacteria of the genus *Bacillus spp.* and yeast *Sacharomyces cerevisiae*. The ideal probiotic should have rapid proliferation and resistance to the effects of acidity, bile salts and digestive enzymes present in the gastrointestinal tract (HUYGHEBAERT et al., 2011). These additives are used in animal production as

performance/productivity enhancers, which differs from that employed in humans (KURITZA et al., 2014).

Pelicano et al. (2002) reports that probiotics are classified by the Food and Drug Administration (FDA) as Generally Regarding As Safe (GSRA) substances, which makes them safe for use in animal feed, since these are beneficial microorganisms that establish equilibrium of the intestinal microbiota. The authors also indicates that probiotics must have essential characteristics such as: being a normal inhabitant of the gastrointestinal tract, developing and setting in the intestinal epithelium, resisting adverse situations (eg effects of bile) and acting as an antagonist of pathogenic microorganisms.

A mechanism linked to the competitive exclusion characteristic of probiotics is that found in yeast *Sacharomyces cerevisiae*, where the microorganism presents molecules of mannanoligosaccharides (MOS) on its surface, whose main function is to impair the ability of pathogenic bacteria to install on the wall intestinal, by the adhesion of these microorganisms to the wall of the yeast. The formed yeast-bacteria complex facilitates the action of the bird's defense mechanisms (GRAÑA, 2006).

Several experiments indicate that the presence of probiotic bacteria in the gastrointestinal tract of birds induces the expression of CD4 and CD8 cells. The very structure of the bacterial cell wall is already capable of producing this effect. There is also a greater proliferation of mucus-producing cells, which will ensure an important natural barrier against viral and bacterial pathogens that try to attack the wall of the intestinal mucosa (GABRIEL et al., 2006; CHICHOLOWSKI et al., 2007).

In birds the development of general and nonspecific immunity is in charge of the gastrointestinal tract, since these animals do not present lymph nodes like the other species. The lymphoid organs are represented by Peyer's plaques, cecal tonsils and the Fabricius pouch. The tissues of these organs recognize the antigen delivered by the digestive tract, stimulating the release of B and T cells. Humoral immunity, on the other hand, when it is stimulated, releases IgA-like antibodies via the mucosa, whose function is to block the receptors and reduce the number of pathogenic bacteria in the intestine (JIN et al., 1998).

The higher height of intestinal villi present in some birds led Petrolli et al. (2012) to relate this factor to good performance results. This characteristic confers to the animal considerable area of absorption and digestion capacity, as there is a wide surface of contact and the increase of the enzymatic activity in the mucosa and intestinal lumen.

Fernandes (2012) states that although prebiotics, probiotics and symbiotics are viable and interesting alternatives to poultry farming, the results are still very

contradictory. Differences in the results are due to the innumerable factors that can interfere in the action of these products, since there are several compositions of microorganisms and strains, concentrations, inclusion levels and preparation methods that end up changing their functionality. More research will be needed for a better understanding of the mechanisms of action.

V. RESULTS OBTAINED IN EXPERIMENTAL RESEARCH

Flemming and Freitas (2005) verified in their experiments that, at 28 days of age, chickens from treatment with probiotics inserted in the diet had greater weight gain than chickens that received other types of growth promoters (example: avilamycin) food. According to the authors, in the initial stages of breeding, probiotics establish a good balance in the intestinal microbiota and promote good zootechnical indexes.

Corrêa et al. (2003), when using the probiotic Estibion, observed an increase in feed conversion in early stage birds (1 to 20 days), after comparing with the same parameter obtained with the use of antibiotics, a fact not found by Rigobelo et al. (2011), who, in a similar work, analyzed the feed conversion in the initial phase and did not obtain satisfactory results with the use of the alternative additive.

Petrolli et al. (2014), in a research carried out in the poultry industry facilities of the University of the West of Santa Catarina, sought to evaluate the benefits of inclusion of probiotics on the performance and intestinal integrity of the birds. In order to perform the experiment, 600 animals of the Cobb lineage were obtained, distributed from the first day of breeding in five treatments, in which only three probiotics were included in the feeding. The probiotic, composed of strains of *Lactobacillus plantarum* and *Pediococcus acidilactici* and added to the diet, did not have a significant effect on the feed intake variable, which caused the authors to relate this result to the absence of a microbiological challenge in the environment where the birds were inserted.

Ramos et al. (2014), using a reused bed, verified that, up to 42 days of age, the birds of the treatment without additives (control) did not obtain a good average in the food conversion and weight gain variables, besides having low feed intake, when compared to those who received the probiotic.

Alva (2014), after including the probiotic *Paennibacillus sp.* in the ration of three treatments, in a progressive way, it obtained good results in the variables of feed consumption and feed conversion, when compared with the values acquired without the use of the additive, at 42 days of creation.

Meuer et al. (2010), when establishing five treatments for 1.200 birds, aiming to analyze the use of the probiotic *Bacillus Subtilis* on zootechnical performance, verified that the use of the diet with additive promoted a better productive efficiency, when compared to the control diet (without additives), during 42 days of creation.

Silva (2008), to included the probiotic Gallipro® (*Bacillus subtilis*) in broiler feed, did not observe differences in the productive efficiency index between the treatment with the additive and the that did not received the additive (control treatment) on the 41 days period.

Dalólio et al. (2015) established six treatments with the objective of analyzing the effect of the alternative additives as a substitute for antimicrobial developmental promoters in the feeding of 480 chickens of the Cobb 500 strain. At the end of the experiment, at 42 days, the authors did not find any difference between the treatments that received probiotic, enzymatic complex, antibiotic, garlic extract and the basal diet, with regard to carcass yield and noble cuts.

Another experiment, carried out by Caliman and Couto (2010), aimed to establish comparisons between the results from the use of probiotic BACSOL-VT as an additive in the ration of 2 treatments and the ad libitum supply of feed without additives in only one treatment. The lots were distributed according to a completely randomized design (DIC). The statistical analyzes of weight gain, comparing the different concentrations of the additive in the diet, showed no differences in the results. The authors attribute this absence of differences to the creation in good hygienic sanitary conditions, capable of alleviating the occurrence of microorganisms that cause diseases. On farms with precarious sanitary conditions, the product would probably have positive effects as it would help restore the balance of the animal's intestinal microbiota.

In another study, Santos et al. (2008), in an experiment involving 750 broilers of Ag Ross 308 strain, sought to observe the effects of the probiotic Colostrum avis® — composed of bacteria of the genus *Enterococcus*, producers of lactic acid, mannanoligosaccharides and lactose — on the development of birds. Zinc Bacitracin, a dehydrated product precipitated from the fermentation of *Bacillus Licheniformis Tracy*, was also used to support growth. Additives added directly to water and feed did not provide greater weight gain, increase in feed conversion or feed intake, in the analyzed phases (initial/growth/final). Significant results were due to the reduction in mortality and intestinal bacterial microbiota.

Traldi et al. (2009), in three experiments, sought to evaluate the influence of probiotic on zootechnical performance and carcass yield of broilers housed in a new

or reused bed. The 42 days after slaughter were submitted to a change of carcass yield.

Gonzales et al. (1998), when providing probiotic consisting of *Enterococcus faecium* and the antibiotic Avorpacin to broiler groups, obtained superior results in the parameters related to feed intake, weight gain and feed conversion in groups of birds that did not receive the probiotic additive. This result was also observed by Henrique et al. (1998) after the use of probiotic formed by a mixture of *Enterococcus faecium*, *Lactobacillus acidophilus* and *Saccharomyces cerevisiae*.

Rocha et al. (2010) added probiotics, prebiotics and organic acids in the diet of broiler chickens, aged 8 to 21 and 22 to 43 days, in order to analyze the yield and performance of the cuts. During the experiment, the authors verified that the feed additives had effect only on the feed conversion and breast yield of the growing animals. In the other phases, supplementation did not influence performance. The results below the expected were determined by the low microbial challenge to which the birds were submitted, since the facilities that received them were clean and unoccupied.

For DemattêFilho (2004), probiotics ensure that chicks, raised in alternative (colonial) systems, acquire resistance against harmful microorganisms in the first seven days of life. These pathogens produce metabolites, which in contact with the mucosa, generate irritative effects, decreasing the absorption of nutrients. The action of probiotics is precisely to mitigate or prevent these problems that affect the bird from the first days of life, because there is the stimulation in the production of B vitamins, important in inducing the immune response to aggressions.

VI. FINAL CONSIDERATIONS

Probiotics, elaborated from beneficial microorganisms, contribute to the establishment of a protective microbiota in the intestine. Can be used in the feeding of birds raised in unhealthy (exposed to the challenge, ie, to harmful bacterias) or salubrious environments, including country chickens, in order to promote growth. The disadvantage of the probiotics use in broiler breeding lies only in the cost and difficulty of acquisition (depending on the region). It is suggested the development of new research in which the microbiological challenge to birds be imposed.

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Evaluation of Water Quality for Water Bathing Conditions on Querer Beach in the Municipality of Santa Rosa, Tocantins

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Abstract— The water is an indispensable natural resource for life, economic development, and the conservation and maintenance of ecosystem services. It is known that the quantity and quality of water available for consumption is decreasing considerably and the increasing scarcity of this resource may be associated with factors such as the irregular distribution of water, waste and irrational use of it, socioeconomic and environmental problems, pollution of resources inadequate disposal of sewage, lack of basic sanitation and treatment of sewage, among others. In this way, the environmental problems have gained relevant space in the current discussions due to their importance, making the debates of these questions in the society necessary. Because of the anthropic activities that have been developed in a disorderly way and without planning, it reflects drastically in the environmental degradation, especially in this case, in the quality of the waters, which compromises this natural resource, whatever the purpose of its use. Thus, the objective of this work is to evaluate the water quality of Querer Beach in Santa Rosa-TO, promoting a water bathing condition study. Therefore, to investigate the effects of anthropogenic interferences on water quality, the water quality was evaluated by means of monitoring. The analyzes of the bathing conditions, show the percentages obtained for the situations in which the beach is classified as suitable for bathing, the investigations followed the criteria established by the CONAMA resolution nº 274/00. The water quality at a specific point of the beach was evaluated and monitored for a determined period of six weeks, and the microbiological indicator of water quality according to the

Collilert technique according to the methodology described by Standard Methods was used as a parameter. In this way, it was possible to verify the tolerances of the Brazilian parameters for the water bathing conditions indicators of Querer Beach.

Keywords— *Water Bathing Conditions Quality. Water quality. Natural resources.*

I. INTRODUCTION

Nowadays, discussions about environmental problems in society are increasingly gaining space. This happens due to the importance of the issue and its consequences. Thus, addressing water quality issues continually encompasses interaction with other environmental compartments. The variation in the quality of the water linked to the pollution processes implies the need for greater monitoring, in view of the quality standards peculiar to its use.

It is well known that water is a natural resource indispensable to life, economic development and conservation and for the maintenance of ecosystem services, being essential for the origin and preservation of life. In a historical way, water has always presented multiple uses such as: maintaining the vital functions of the organism, food production, cooking, energy generation, urban development, means of transportation of goods and people, agricultural activities and people's leisure alternatives.

In this sense, it is pertinent to say that Brazil is considered privileged in terms of its natural resources, with a vast and rich biodiversity. The fresh water available in the country is in great quantity and a considerable part of the coasts are

bathed by warm waters. In summary, Brazil is surrounded by beautiful scenery, which ends up inviting seaside and watering activities and attracts tourists from all over the world.

For Sperling (2005), the total volume of water on the planet is 1,386 million km³, of which 3% refers to freshwater and 97% is distributed to the oceans and seas. Of these data, 0.8% refer to groundwater and surface waters, and glaciers and shells form 2.2%. However, of all this volume only 3% represents greater accessibility to humans.

Brazil has 12% of the total volume of fresh water of the planet, which is a privileged situation; however, all this abundance does not represent the unequal distribution of the territory in the country, supported by aspects such as the significant increase in degradation of quality thus reflecting serious problems of scarcity in certain areas (HIRATA, 2001).

In this sense, according to Becker (2001), in Brazil, there is a great quantity of freshwater, even with poor distribution and with a rich biodiversity, besides about 3 thousand km of coast bathed mainly by predominantly warm waters, beautiful and quite inviting to water bathing conditions, attracting domestic and foreign tourists. Thus, it is important to create measures that subsidize the rational use of water resources and their conservation, as with this the volume of available water of the planet will be enough to supply the population demand.

However, the conservation of this natural resource (water) implies adequate and specific sanitary conditions, because during the water bathing conditions there is direct contact of people with water, making involuntary ingestion common. It occurs that water quality is not always adequate for this purpose. Generally, the problem of poor water quality is due to the disposal of sewage into it, with this happening directly and indirectly in the river basins. The degradation of water resources, contaminated mainly by sanitary sewage, increases the risk of transmitting diseases by the primary contact of the population when using these places for bathing and leisure activities.

In this context, the study regarding this theme is very relevant, since discussing water bathing conditions is not much evidenced and seen in the media when compared to other subjects involving public health. This reflects in increasing the attention and deepening the studies on the subject, putting it in evidence and being better publicized and worked.

Water bathing conditions is understood as the quality of water whose purpose is primary contact leisure, ie direct and long contact with water, such as water skiing, swimming, diving, among others, and with these activities the probability of considerable and appreciable water ingestion is high. In this way, the understanding of water bathing conditions is implied if the water is proper for

recreational bathing purposes, which is the definition of water bathing conditions. (CETESB, 2011).

In this sense, Quintela (2004) emphasizes the expression water bathing spas, relating to places with the same purpose, such as thermal and hydromineral spas. However, according to the place, whether in the country or historical moment, places suitable for bathing (leisure) have different designations.

The World Health Organization (WHO) characterizes in its safe water recreation guide places intended for water recreation, with fresh or salt water, such as freshwater, estuarine or coastal waters, where any form of recreational use of the same is performed by a significant number of people, also shows that even if its use is varied, the greatest concern is the contact through the ingestion of this water, which is a relevant risk (WHO, 2003).

The water bathing conditions index analysis the microbiological quality of the water bodies designated to recreation activities with long and direct contact with water (bathing and sport activities). The parameter qualifying water bathing conditions is the quantity of fecal coliforms present in the water. The analysis of water bathing conditions is regulated by the CONAMA Resolution n° 274/2000 which establishes the legal parameters and all the criteria related to water quality. With this scenario, the evaluation and the monitoring of water quality for water bathing purposes is an important tool in the reduction of impacts in the local economy, in the evaluation of environmental quality of the rivers and in the increase of sanitary security of the population.

With this perspective, this study intends to address issues pertinent to the environment, through the theme of water use as leisure and recreation, the sustainable use of this resource, as well as being a public health aspect. Thus, the present study evaluated the water quality for bathing purposes in Querer Beach in the municipality of Santa Rosa, state of Tocantins, which is a socioenvironmental concern.

Tourism, among other anthropogenic activities, accelerates the process of degradation of natural resources, such as water pollution, which can cause several health problems to the population, making it necessary to evaluate the conditions of water use. Thus, we analyzed in this study the conditions of the water sanitation level for bathing at Querer Beach in Santa Rosa -TO, and the alternatives that are necessary for the preservation/environmental maintenance of this natural resource of the region.

The development of anthropic activities, without proper planning, has led to a great degradation of water quality, compromising the varied uses of this natural resource. The conditions of use of Querer Beach in the Tocantins River basin in Santa Rosa - TO were evaluated and classified by means of objective criteria based on the monitoring of the fecal coliform group indicators and the results obtained

were compared to the defined parameters by CONAMA Resolution No. 274/00, to determine if the water destined for bathing purposes are considered proper or improper for recreational activities.

Water bathing condition is an instrument for checking the parameters that indicate if the water has quality for primary contact recreation. It is relevant to raise questions about the theme, considering that the process of environmental degradation triggers high levels of pollution and contamination of water resources, which directly affects people's life quality.

Hirata (2001) argues that in relation to water resources, there are recurrent problems of overexploitation of water bodies and consequently their contamination. The use of water bodies improperly, such as waste receptacles, domestic sewage, agricultural and industrial waste, compromise its use.

Therefore, the development of studies regarding water quality enables evaluations of the real conditions of the water resources in relation to the proper supplying of water bathing demand, besides serving as subsidy for the advance of effective measures of environmental conservation and preservation that allow to the municipality of Santa Rosa the expansion of its economical activities in a sustainable way.

II. MATERIAL AND METHODS

This work has analyzed the water quality in Querer Beach. It was performed a descriptive analysis with an experimental approach. This kind of research was significant for raising data of the variables of water quality and the evaluation of water bathing conditions in the beach of the municipality of Santa Rosa.

Study Area

The chosen area of this study was Querer Beach, located in the Tocantins River basin in the municipality of Santa Rosa - TO.

The municipality of Santa Rosa has the following geographical features: 1796.3km² of area; 4568 inhabitants; population density of 2.5 inhabitants per km². It is located 88 km south-east of Porto Nacional, the largest city in the vicinity. It is located at 288 meters of altitude, from Santa Rosa do Tocantins the geographical coordinates of the municipality: Latitude 11 ° 26 '31' 'South, Longitude: 48 ° 7' 2 " West.

The municipality is located at the Manuel Alves River Basin and is part of the Tocantins River Hydrographic System (right bank), corresponding to the T5 unit, with a drainage area of 14,894.7 km².



Fig. 1: Map Location from the Municipality of Santa Rosa from Tocantins.

Source: Google Maps (2017)

Sample collecting

The present study evaluated the water bathing conditions of Querer Beach, located in the municipality of Santa Rosa-TO. The CONAMA Resolution No. 274/00 recommends that the sampling collecting should be performed in a place that presents the isobath of one meter and where there is a greater concentration of bathers. However, it is known that the time of greatest concentration of bathers is in the period of beach season, from June to September. Therefore, it was not possible to perform the research in this period, thus defining the collecting between the months (March and April), which represents rainy season in the region.

The raining season represents one of the main causes of contamination of the river body through the transportation of materials over the soil. With this scenario, a collecting point was selected with the assistance of a GPS device according to the legal standards established by Resolution 274, as demonstrated in figure 2.



Fig. 2: Sample collection location in Querer Beach.

Source: From the author (2018).

The geographical coordinate of the chosen collecting points described in Table 1. It was performed collections in this specific place, in virtue to the beach access in the rainy season.

Table.1 - Geographical Coordinate of the marked point

POINTS	COORDINATES	
	Latitude (ϕ)	Longitude (λ)
P1	12°40,801'S	46°20,802'W

In each week a sample of water was collected at the selected spot in a suitably sterilized 100 ml glass vessel, approximately 1 meter deep. Sampling was carried out during 6 consecutive weeks, from March to April 2018: (03/08, 03/15, 03/22, 03/29, 04/05, 04/12), in the morning period as shown in the table 2.

Table.2 - Relation of the water collection dates of Querer beach.

DATES OF WATER COLLECTION				
WE EKS	MON THS	DAY OF THE WEEK	DAY OF THE MONTH	SCHE DULE
1 ^a week	Marc h	Thursday	08	07:00 to 09:00
2 ^a week	Marc h	Thursday	15	
3 ^a week	Marc h	Thursday	22	
4 ^a week	Marc h	Thursday	29	
5 ^a week	April	Thursday	05	
6 ^a week	April	Thursday	12	

For sample collection, disposable gloves and sterile vials were used. After the collection, the samples were stored in an icebox and transported immediately to the IFTO chemistry laboratory. The analyzes were performed following the methodology described by the APHA (*Standard Methods for the Examination of Water and Wastewater*), to determinate the concentration of fecal coliforms (thermotolerant) and *E. coli*.

Microbiological analysis

Among the methods used for the analysis of coliforms, we have the technique of fermentation in multiple tubes (FTM), which is very laborious and depends on a large number of materials, having up to 96 hours to disseminate the results and the quick Colilert (IDEXX) and Colitag (HEXIS) methods, which are more practical techniques with time to deliver the results in 24 hours (GREGHI, 2005).

The analysis methodology adopted was the Colilert technique for simultaneous detections, specific and confirmatory identifications of total coliforms and *E. coli*. It is a technique based on the principle of identification of

the microorganisms, and the estimated time of 24 hours for determination of the Most Likely Number (NMP / 100ml) of bacteria of the total coliform group and *Escherichia coli* (IDEXX, 2016).

The procedures for collection, transportation and analysis followed the criteria recommended by the *Standard Methods for the Examination of Water and Wastewater* - APHA, 2007 / American Public Health Association. In total, six microbiological tests were performed using the methodologies recommended by APHA (2007). The density is expressed as *The Most Likely Number of E. coli* per 100 ml of water sample, where a positive dome is equivalent to one bacterium in 100 ml of water (IDEXX, 2016).

In this context, the laboratory results were analyzed and compared with the criteria established by CONAMA Resolution No. 274/00, which define the bathing conditions classified in the following categories: proper (excellent, very good and satisfactory) or inappropriate for primary contact recreation.

III. RESULTS

The process of evaluating water bathing conditions is essential and a clear set of criteria must be established for it to be performed in an efficient way. These criteria need to be based on supervised indicators and their values compared to predetermined standards to enable the identification of the appropriate dispositions in a given place (SEMA, 2010).

Therefore, it is sought to relate the existence of fecal pollution indicators in the aquatic environment and the potential threat of acquiring serious diseases when using water for recreation. These criteria must essentially be linked to the well-being, safety and health of society (CETESB, 2004).

Thus, the data obtained in the present study were tabulated and analyzed, indicating the classification of Querer beach's water, when compared to the water bathing parameters required by CONAMA Resolution 274/00.

The resolution No. 274 of November 29, 2000 defines the criteria for bathing in Brazilian waters to guarantee the conditions for recreation of primary contact and to analyze the development of water quality compared to established levels (CONAMA, 2000).

The monitoring of the microbiological quality of the water under study occurred between March and April 2018, a rainy season in the region of Santa Rosa do Tocantins. It was observed that in the rainy season the water had a dark coloration from the solids transported to the riverbed. However, it is emphasized that the dark coloration of the water is not a characteristic indicator of contamination since it may have a transparent color and be contaminated as well.

During the monitoring, it was observed that the beach was in bad conditions, with high woods, besides the absence of cleaning and maintenance, to the detriment of the rainy period. Thus, this can be considered a negative factor, since the tourist potential of the beach can be explored all year round, since the water level of the river usually remains constant.

According to CONAMA (2000), it is important to mention the second article of Resolution 274 that defines the conditions of evaluation in the proper and improper categories:

§ 1° Water considered proper can be subdivided into the following categories:

Excellent: when in 80% or more of the samples obtained in each of the previous five weeks, taken at the same place, there are at most 250 fecal coliforms (thermotolerant) or 200 *Escherichia coli* or 25 enterococci per 100 milliliters;

Very Good: when in 80% or more of the samples obtained at each one of the previous five weeks, taken at the same place, there are at most 500 fecal coliforms (thermotolerant) or 400 *Escherichia coli* or 50 enterococci per 100 milliliters;

Satisfactory: when in 80% or more of the samples obtained in each of the previous five weeks, collected at the same site, there are at most 1,000 fecal coliforms (thermotolerant) or 800 *Escherichia coli* or 100 enterococci per 100 milliliters.

§ 40 The water will be considered IMPROPER when one of the following occurrences is verified in the evaluated section:

- Failure to meet the criteria established for the waters;
- Value obtained in the last sampling is greater than 2,500 fecal coliforms (thermotolerant) or 2,000 *Escherichia coli* or 400 enterococci per 100 milliliters;
- High or abnormal incidence in the collection region of waterborne diseases indicated by the sanitary authorities;
- Presence of solid or liquid waste, including sanitary sewage, oils, greases and other substances capable of presenting health risks or making recreation unpleasant;
- pH <6.0 or pH > 9.0 (fresh water), except in natural conditions;
- flowering of algae or other organisms until proven not to pose a risk to human health;
- Other factors that contraindicate, temporarily or permanently, the exercise of primary contact recreation;

Table 3 presents the classification of the water in relation to its water bathing conditions, according to Resolution 274/2000.

Table 3 - Classification of water in relation to its water bathing conditions, according to Resolution 274

Category	Fecal coliforms (NMP / 100ml) *	<i>Escherichia Coli</i> (NMP/100ml)*
Excelent	< 250	< 200
Very Good	< 500	< 400
Satisfactory	< 1000	< 800
Improper	Above 2500	Above 2000

.*NMP: The most probable number per 100ml, in 80% or more of a set of samples obtained in each of the previous five weeks.

Source: CONAMA RESOLUTION No. 274/2000.

The resolution 274/2000 states in its third article on the prohibition of stretches of beaches and resorts if the environmental control agency determines that the poor quality of primary contact recreation waters justifies such a measure. Excavations should also be banned if there are accidents such as: oil spillage and sewage leakage, toxicity or cream formation due to flowering of algae or other organisms and, in the case of fresh water, the presence of potential transmitting mollusks of schistosomiasis and other waterborne diseases.

Thus, the environmental control agencies are responsible for the disclosure of the bathing conditions of the beaches and resorts and for inspecting the application and compliance of this resolution (CONAMA, 2000).

In this sense, the results obtained in the research were presented and discussed through the indicators of total coliforms and *E. coli*, considering the classification criteria of the CONAMA Resolution No. 274/00, for waters with the proper or improper classification for bathing purposes, based on the average of six consecutive samples.

During the monitoring period a high percentage of total coliform concentration was evidenced. The results obtained at the collection point remained above the values recommended by CONAMA Resolution 274/00.

The concentration of *E. coli* present in the water it is believed to happen due to elements pertinent to the physical characteristics present at the point of collection selected for the study, such as the presence of fuel oil from vessels, animals in their environment and bathrooms with septic tanks, as well as waste brought by rain. It is important to consider that the access of these effluents to the water body causes changes in water quality for recreation of primary contact as well as for other activities in this sense

Soon after the samples being submitted to the presence of ultraviolet light at 365 nm, the fluorescence characteristics were observed, so the result was positive for the presence of fecal coliforms. The Resolution of CONAMA 274/00

(2000), states that when 80% or more of a set of samples obtained in each of the six weeks, a maximum of 200 *Escherichia coli* is found, the waters are considered proper and fit the category of "excellent" for bathing purposes. The table 4 presents the results of the analyzes obtained.

Table.4 - Overall result of the analyzes obtained.

PARAMETERS	03/08 /2018	03/15 /2018	03/22 /2018	03/29 /2018	04/05 /2018	04/12 /2018
	PI	PI	PI	PI	PI	PI
pH	6,98	6,93	7,07	6,97	7,02	7,05
Temperature (in locu)	27,5	27,3	27,1	27,7	26,5	27,2
Electric Conductivity (µmbo/cm)	51,87	53,82	56,34	51,29	55,42	54,61
Turbidity (NTU)	28,3	28,1	30,3	29,7	27,8	31,1
Total of Thermotolerant Coliforms (NMP/100 mL)	>241 9,6	>241 9,6	>241 9,6	>241 9,6	>241 9,6	>241 9,6
<i>Escherichia coli</i> (NMP/100 mL)	17,7	27,5	19,9	23,4	30,9	25,7

In the analyzed data collection period, the Querer beach of natural waters presented little or no concentration of visitors or bathers due to the analyzes having been performed in the middle of the week and outside the beach season. To carry out the classification of the samples analyzed in the respective categories established by the CONAMA resolution n° 274/2000, the results obtained for *Escherichia coli* at the location during the period of six weeks were compared with the limits established by said resolution, as presented in table 3. In the research in all samples analyzed from the place of the collection, after the incubation period of 24 hours, the presence of the total coliforms was observed throughout the study period.

From this perspective, for WHO (2003), there are exposures to both chemical and physical risks, as well as the possibility of accidents, such as the presence of venomous animals, drownings, etc. Among the exposed risk groups, children are more susceptible, as they often do not have adequate hygiene and health knowledge, as well as remaining more time in the water and drinking it,

sometimes in great quantities. Another high risk group is the elderly, exposed to great health damage due to the existence of microbiological deterioration of the water properties, because of the exposure to pathogenic organisms in these environments.

The risks in which individuals are exposed in relation to their contact with water, primary or secondary, can vary according to Quintela (2004), as shown in table 5.

Table.5 - Eminent risks to users

Cold, heat and sunlight	Chemical and physical agents
Contamination of beach sand	Water quality (especially when contaminated by sewage, as well as exposed to pathogenic microorganisms that inhabit the water in recreations)
Dangerous aquatic organisms	Physical hazards (such as injury or drowning)
Algae and their toxins	

Source: Quintela (2004)

IV. DISCUSSIONS

When analyzing the water samples, values of *E. coli* with great variation during the monitoring period were found from 17.7 to 30.9 per 100 ml of water. The values of the analyzes are lower than 200 *E.coli*; therefore, in this period, the waters are considered suitable for recreational use. The highest presence of *E. coli* was observed on the fifth (05/04) and sixth (04/12) week, during which there was a big incidence of rainfalls. The rain may have interfered with the result, considerably increasing the contamination rate by approximately 189%.

Coliforms are bacteria used as a microbiological indicator of water quality control - monitoring of pathogenic microorganisms. The survival of these microorganisms depends on the quality of the water in relation to the temperature, amount of oxygen, turbidity and nutrients present in the water. The pathogens may be adhered to the sand particles and sediments, increasing the concentration of these organisms in rivers and lakes (HERMES and SILVA, 2004).

The *Escherichia coli* bacteria were found in all samples analyzed during the study period. The place of the collection presented the lowest value of *E. coli*, 17.7 NMP/100ml in the first week of analysis (08/03) and in the fifth week (05/04) the highest value of 30.9 NMP/100ml. The place of collection during the six following weeks showed, during the rainy season (March - summer) and the transition period from summer to autumn (04/05/2016), an increase in the amount of fecal coliforms (*E. coli*) possibly due to the superficial drainage of rainwater on the soil

contaminated by waste and feces of warm-blooded animals or by the presence of private septic tanks and the absence of a sewage network in the surrounding establishments, thus compromising the quality of the waters for recreation. This is explained by the increase of rainfall flow in the summer and the consequent transport of microorganisms present in the surroundings of the springs (MORAIS and SILVA, 2012).

The CONAMA resolution 274/00 determines that at least 80% of the analyzed samples present an *Escherichia coli* count below 800 NMP/100 ml per sample for the water bathing conditions of the beach to be considered in the proper category and satisfactory subcategory.

According to Resolution No. 274 (CONAMA, 2000), in relation to the presence of *E. Coli*, in the given sample period, the Querer Beach was rated for bathing in the proper category and excellent subcategory, since more than 80% of the samples obtained in each of the six weeks presented lower values than those established by the Resolution, which means less than 200 NMP / 100ml.

In the analyzed period, all the water samples from the collection place of Querer Beach presented satisfactory conditions to receive their visitors and bathers, thus proving the excellent water bathing conditions in 100% of the samples, making the beach suitable for primary recreation activities.

According to Berg *et al.* (2013), streams of water contaminated by domestic sewage, when they encounter beach water, for example, can let the bathers exposed to bacteria, viruses and protozoa. It is important to consider that spa waters outside health standards increase the possibility of acquiring various diseases, leading in some cases to death. These microorganisms are the authors of waterborne transmission to bathers (Table 6).

Table.6: Water borne diseases

DISEASE	TRANSMISSION	SYMPTOMS
Cholera	Contaminated water, raw food and flies.	Diarrhea, feces similar to rice water, thirst, pain and coma.
Typhoid Fever	Contaminated water, milk, dairy, oysters, food and flies.	General infection, characterized by continuous fevers, pink spots, diarrhea.
Leptospirosis	Food, water or contaminated soil or excreta and urine of infected animals.	Fever, headache, nausea, muscle pain, vomiting, thirst and prostration.

Amoebiasis	Contaminated water, raw food, flies and cockroaches.	Abdominal discomfort, diarrhea, stool bleeding.
Ascariidiasis-Helminths	Food, contaminated water and sewage.	Feces in the stool, abdominal pain, skin rashes and nausea.
Schistosomiasis	Contaminated water	Diarrhea, dermatosis, cirrhosis of the liver, spleen disorders.
Ancylostomiasis	Water and raw food.	Intestinal disorders, abdominal pain, vomiting, sleep disturbance.
Infectious Hepatitis (A e)	Water, food, milk, direct contact.	Fever, nausea, headache, loss of appetite, possibly vomiting and fatigue.
Polio	Direct contact and through the sewage network.	Fever, headaches, malaise, and paralysis.

Source: CESA (2008).

The good water bathing conditions of Querer beach during the study period may have as justification the decrease of bathers, visitors and boats at the analyzed places. However, even though the *Escherichia coli* values are lower in the samples, their presence indicates fecal contamination, which represents a risk to the bathers' health, since contaminated water increases along with the growth of pathogenic microorganisms throughout the year in its several climatic seasons conditions and should be regularly monitored.

V. CONCLUSION

This research was performed in order to evaluate the quality conditions of the beach water for recreation of primary contact, through indicators of fecal pollution, such as bacteria of the total coliform group and *E. coli*.

The results obtained from the microbiological analyzes of the water samples collected at Querer beach in Santa Rosa do Tocantins confirmed that the total coliform bacteria were present at the monitoring point during the study period.

The levels of *E. coli* bacteria show low concentrations that allow to classify the waters regarding their water bathing conditions as proper, subdivided into the category of "excellent", according to Resolution No. 274/00 of CONAMA. Therefore, Querer Beach waters, during the analysis period, based on the bacterial indicator of the *E. coli* group, met the recommended standards for water bathing conditions (primary contact recreation).

Although the conditions for water bathing conditions meet the criteria established for proper waters, it is considered pertinent to recommend some practices, because the concentration of *E. coli* was detected during the period of analysis. The recommendations focus on establishing a water monitoring program as an appropriate practice to provide greater sanitary security for bathers and encourage the use of the beach in an yearly basis as an attractive place for recreation and leisure.

In addition to the application of legislation instruments to contain the advance of contamination, such as the criteria determined by Resolution No. 274/00 of CONAMA and Environmental Legislation. Another preponderant aspect to be observed is the periodic work of cleaning the banks of the river and waste, to avoid being transported to the water body during the rainy season; as well as the supervision of local commercial establishments, ie bars and restaurants, requiring the proper treatment of domestic sanitary effluents

It is also necessary to implement information devices (boards) by the public authority with indications of the water condition, thus offering better guidance and sanitary safety to bathers.

Finally, maintaining the monitoring of water quality should be a constant concern of the State and Municipal Secretariats of the Environment, seeking partnerships with Academic Institutions, in order to develop preventive actions through scientific research to provide a clean environment free of contamination for the tourists and local users, and also to foment the tourist development and economic of the municipalit.

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Study about Emotions, Passions and Feelings on a Military Organization

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Abstract— *The behavior of employees in the workplace is influenced by intervening variables, among them are the feelings, passions and emotions. This work is based on Management's Behavioral Theory, bringing the general objective of studying the behavior of employees focusing on feelings, emotions and passions in the research organization; and specific objectives treat intervening variables in human behavior in the organization studied (1) characterize the organizational behavior of the institution (2), and set up environmental SWOT analysis study focusing on emotions, passions and feelings (3). The organization analyzed is a military corporation in Candeias do Jamari municipality in the state Rondônia. It used the case study method, qualitative and quantitative nature. Data collection was performed by application form and visit onsite to generate the report points out, as the data collected, which employees agree that the organization is made up of soldiers who have emotions, passions and feelings, and organizational behavior it is influenced by external and internal factors; at the individual level they are motivated and satisfied; the group level there is a good relationship, but lack confidence in stakeholders in performing the services; at the organizational level it is observed that there is no consensus among respondents regarding the influence of organizational culture on behavior; the SWOT Matrix was possible to raise the strengths and weaknesses in the corporation, considering the focus of the approach. This research is an academic contribution to managers trying to*

influence the decision making of its employees and groups through organizational behavior.

Keywords— *intervening variables. Organizational behavior. Contributors. Feelings and emotions.*

I. INTRODUCTION

This investigative work involves relations of individuals and groups with the organization and the task performed by everyone in the corporation. Initial screening for the preparation of this report it was established that the military aware of their feelings, emotions and passions, and that these factors are part of the working environment. In his critical insights taken in structured interviews indicate they are informed that the organization this phenomenon may be a consequence of variables that affect significantly the motivation and mood. They realize further that must be worked on climate and organizational culture in order to obtain favorable reactions to individuals and groups working in this military corporation.

II. OBJECTIVES

The academy can bring knowledge that will contribute to the improvement of relations, and this brings this research that has as main objective to study the behavior of employees focusing on feelings, emotions and passions in a military organization; and the results proposes specific objectives address the intervening variables in human behavior in the organization under study focusing on emotions and feelings (1) characterize the organizational

behavior of the institution focusing on emotions, passions and feelings (2), and perform analysis environment SWOT study focusing on emotions, passions and feelings, and factors that influence them (3). The research question to be answered here is: How the feelings, passions and emotions influence the behavior of individuals in the military organization investigated? The task consists of topics and subtopics, with a theoretical-conceptual review, a methodological approach, results, conclusion and references.

III. THEORETICAL AND CONCEPTUAL REVISION

In this chapter we define the theoretical concepts used in this study. It is observed that to answer the research question you must set the Behavioral Management Theory, Organizational Behavior in the face characterize the feelings of emotions and passions, bring concepts of Burnout Syndrome finally set SWOT analysis. Concepts and complementary definitions join so that one can interpret the state of the art and bring properly treated feasible results.

3.1 Management Behavioral Theory

The Management of Behavioral Theory is known primarily as a theory applied to management of the company. According to Chiavenato (2014), the Behavioral Theory and Management Behaviorist theory presented a new understanding and a new perspective on the Administrative Theory; It has emphasis in addressing the behavioral sciences or behavioral sciences approach, Abandoning the normative and prescriptive positions of the Classical Theory, Human Relations and bureaucracy; will adopt explanatory and descriptive position, as this task comes now elaborate. The behavioral approach to management has highlighted the people, but under a comprehensive organizational content, which emphasizes those of his predecessors prescriptive Herbert Alexander Simon, Chester Barnard, Douglas McGregor, Rensis Likert and Chris Argyris. Students of Management Behavioral Theory, as Abraham Maslow, Frederick Herzberg and David McClelland also contribute by approaches focusing on human motivation. According Chiavenato (2014., P 125 to 144), the result is a behavioral theory Theory of Human Relations, focusing Theory Behaviorist Watson, focusing on human behavior focused on learning, stimulating and reactions of responses, habits, among others.

3.1.1 Behavior, emotions, passions and feelings.

Feelings, emotions and passions are placed in the organizational context as a vision for the emotional issue at work. Studies such as these in the work environment has been highlighted by many scholars as Machado (2009); for this author, the emotional field involves complex diversity,

whose approach is not neutral in the cultural or political aspects, as alloy interest in power in situations and resilience of individual and group conflicts in organizations. Said author explains that emotions, feelings and passions são tratadas in procedures involving the assessment of subjects, about a situation that he experienced, resulting in the acceptance or rejection on his part, reflected in harmony and group performance in organizations.

To Brum (2015) behavior reflects the perspectives of how the human being experiences the reality in which lives. This perception is not the same for everyone, and is influenced by culture, values, emotions, feelings, passions and expectations by different reflections in each individual. The author further states that human behavior is the way by which the individual interacts before the reality around them, even if their actions are right or wrong. This process results in the construction of organitacionale or group culture, as it is repeated several times to create passes identity characteristics of the formation and its own institutional culture.

Robbins (2010) defines emotions as intense expressions of affection directed to people or something: may be, still, a sudden disruption of the balance of a person who can generate impulse attitudes. They are usually short-lived, intense and accompanied by physiological reactions such as rapid heartbeat, crying, cold sweats, trembling legs and other reactive consequences for the individual. For Kaplan, Sadocke and Grebb (1977) emotions constitute a state of complex feelings, somatic, psychological and behavioral components; According to them there are two aspects that influence the emotions, that is humor and affection, both subjective in nature and depend on individual experiences; are revealed by behavioral emotion expression demonstrates how this reagent. Fiorelli (2004) identifies six types of emotions, namely, fear, sadness, anger, surprise, happiness and disgust. Emotions are by nature be short-lived and is a form of reaction that generally beyond the control.

Literature allows conceptualize passion as a deep and intense human feeling that generates significant interest of the individual for something; therefore, this human might be able to change their behavior, which will cause causing excessive admiration for the object of his passion. When a person feels passion for specific topics, it presents excessive enthusiasm, which will focus on a possible fanaticism.

Search in Almeida (2012) indicates that the feelings are similar to the emotions, but differ by their lasting condition; are built in a long process, like a friendship, and less intense, they do not generate attitudes on impulse. This author states that feelings guide the way of acting and thinking with optimism or pessimism; are these thoughts that influence personal development. Unlike the

emotions, the feelings do not require stimulus contextual to manifest.

3.1.2 Burnout Syndrome

Study of human behavior in organizations requires theoretical interpretation elements located in the vicinity of the subject in the environment where it operates. One of these concepts refers to burnout syndrome, also known as Burnt Syndrome. A kind of occupational stress that according to Carlotto (2002), refers to professionals involved in some form of care in a relationship of direct attention, continuous and deeply emotional, being composed of three aspects, namely, emotional exhaustion, depersonalization and low personal accomplishment at work; thus the burnout syndrome is linked directly to organizational behavior in relation to feelings, emotions and passions of a particular individual. The author defines the three aspects of the syndrome; including emotional exhaustion, defined by lack or shortage of energy, enthusiasm and a sense of resource exhaustion, depersonalization, which is defined by treating customers, co-workers and the organization where he works as objects; and low personal accomplishment, defines the employee to self-assess negatively, they individuals or people are dissatisfied with their professional development and are unhappy with himself.

3.2 Organizational Behavior

Chiavenato (2014) believes that organizational behavior is the study of the movement of organizations and how groups and individuals to behave in them, that is, act, think, feel and respond in the organizational environment. The factors that determine organizational behavior are divided into three: individual, group and organizational. The author also defines the study of organizational behavior at three levels of approach: the microorganizational studying the individual's behavior in the organization; the mesoorganizational it comes to studying the behavior of groups of organizations; and macro-organizational, studying as a whole the behavior of individuals and integrated organizational structure groups. Table 1 shows the topics covered in this paragraph.

Table.1: Organizational Behavior Levels

Individual (micro-organizational)	Organizations are formed by people who have characteristics that influence their behavior, which are: age, personality, perception, emotional structure, motivation and many others.
Group (meso-organizational)	The behavior of people in the group is more than the sum of its members, these are influenced by group behavior pattern.

Organizational system (Macro-organizational)	The highest level is the sum of the formal structure, corporate culture, organization's policies and practices with individuals and groups that comprise it.
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Source: Authors based on Robbins (2010).

3.3 Concepts SWOT analysis

SWOT analysis appeared in the United States at Harvard Business School, created by professors Kenneth Andrews and Roland Cristensen. It is a management and strategic planning tool that evaluates the environment as four variables: Strengths (forces), Weaknesses (weaknesses), opportunities (opportunities) and threats (threats). To Daychouw (2007) is a simple tool to measure and verify the strategic position of the organization in the environment to which it belongs. So it became quite popular because of the versatility and ease of application is used not only by large companies, but also for small businesses.

The environmental analysis is performed from two perspectives and one internal and one external. To perform the analysis of the internal environment the manager checks in the organization's strengths and weaknesses of it, so you can leverage your strengths and take strategic measures to minimize or eliminate their weaknesses. The external perspective assesses the threats and opportunities to Martins (2007) external variables can not be controlled and it is up to the manager to use the opportunities and avoid the threats. The following terms Table 2 demonstrates that the SWOT diagram and its division into internal and external environment.

Table.2: SWOT Diagram

Elements	Help	Disrupts
Internal environment	Strengths	Weaknesses
External environment	Opportunities	Threats

Source: Prepared by the authors based on Silva (2009).

IV. METHODOLOGY

This research will be limited to the study of the behavior of individuals in a military organization, focusing on emotions, passions and feelings. To develop this study was brought concepts in the methodology used as setting method and the case study method, methodological procedures and concepts focal group Likert scale. This is an exploratory, descriptive research, which applies a perspective analysis of qualitative and qualitative data.

4.1 Method

Method is a word of Greek origin meaning direction and way to reach a particular goal, to Figueiredo and Souza (2011) "means the process or rational order to get a particular purpose." The method will determine how to proceed along the task you want to perform, the method determines the beginning to the end of the research every step in a systematic and streamlined way. It notes that the method is the set of systematic activities that serve to guide the researcher, provide greater safety and economy of time and resources during the search, but does not guarantee the success of research to Figueiredo and Souza (2011) the success of research It depends on the intelligence, creativity, talent, willingness and desire to science and the world.

4.2 Case Study Method

According to Figueiredo and Souza (2011) case study "is a deep and comprehensive study of facts, situations or objects in a way that allows its broad and detailed knowledge." The case study is widely used in exploratory field research and may raise questions of other studies by qualitative data. Because of this case study is not limited to a single form of data collection, you can relate to free interview and participant observation.

An exploratory study consists of: a) describing the facts of the case; b) reflect on the alternative explanations of the facts; c) conclude based on that explanation that seems more appropriate to the facts.

4.3 Focus Group

Focus group is characterized as a qualitative research procedure which consists in doing group interviews, in order to carry out the collection of information through the interactions between individuals, can be the main source of data or an additional option for research. To Gaskell (2002) focus groups provide an open debate and accessible to participants, where everyone can express their perceptions and opinions about a subject of interest group. So there is interaction more naturally and there is no inhibition among participants should create a favorable environment, Trad (2009) argues that the status differences among the participants should not be taken into account.

4.4 Likert Scale

The Likert scale is one of the most used scales in marketing research as it helps to measure and understand attitudes and behavior of the respondent. Silva Junior and Costa (2014) prescribes the Likert scale as a resource to have a construct, and develop a set of statements related to its definition, for which respondents issue their level of agreement. It promotes the combination of the statistic with

Psychology and thus can extract both quantitative and qualitative information.

They are displayed to the respondent on a scale, by weighting scores in 5: (1) Strongly disagree, (2) disagree, (3) indifferent, (4) accept and (5) totally agree. 5 points are the original proposal of Likert and can increase the number of options. The points listed are innovation created by RensisLikert may go beyond just agree and disagree, and measure the level of respondent satisfaction to question that may agree with restriction, partially disagree and have indifferent or neutral response.

4.5 Procedure method

The following method may be methods approaches or methods procedures. The methods of approach are: deductive, inductive, and deductive method hypothetical dialectic method. The methods are divided into the following: historical method, comparative method, monographic method, the statistical method, typological method funcionalista method and structuralist method. The methods define what should be done during the research to reach the target. The qualitative and quantitative methods are used as the object of study for Figueiredo and Souza (2011), the quantitative method is indicated at the time that the object want to focus on the knowledge of concrete, objective, measurable, since qualitative method is proposed in the way that object is translated in his egotism, that is, one not measurable phenomenon.

The procedures used in this work were the bibliographic review, if seefetuou search on the topic in books, websites, including previously carried articles which includes the subject, the data collected were analyzed under the theoretical framework set up. Been applied inquiry form to the respondent, with assertive closed based on the Likert scale, with the population involved in this study to collect data and make it possible to characterize and understand organizational behavior variables involved in human behavior in the organization estudo. Por means of Excel software were generated graphics and tables of results, this practice allows you to make and critical analysis of the data collected through the form; therefore occurs measuring attitude or opinions of respondents. Another procedure was the report of production, which are characterized organizational behavior focusing on emotions, passions and feelings; and the identification of intervening factors and their relationship to organizational behavior. And to complete was accomplished environmental SWOT analysis study.

**V. CONTRIBUTORS BEHAVIOR STUDY
 WITH FOCUS ON FEELINGS, EMOTIONS
 AND PASSIONS**

The military organization under consideration is subject to administrative and operationally to the Department of Security, Defense and Citizenship of the State of Rondônia, through the military body of your bond. The unit searched is headquartered in the city of Candeias do Jamari, a municipality with about 25,000 inhabitants, as recorded on the IBGE site in 2017, located 25 kilometers away from the capital Porto Velho. The corporation has 17 firefighters effective, providing services in emergency room visits, and technical inspection for the prevention of accidents. The target audience for this emergency service are the residents who enjoy protection, and companies that use the technical services. The fronts of work are scheduled to reduce the occurrences, and still provide emergency pre-hospital care services, as well as fire fighting activities. This military corps began its activities for less than ten years in the locality, building housing for military service and the cars of the task force. These their

activities came to be interrupted due to the need for adjustments on the premises.

For the preparation of this research, we adopted the implementation of the inquiry form to twelve individuals of the corporation, by ethical protocol of informed consent, in a sample of 80% of all employees of the section. The age of 91% of these elements is 26 to 39; only one respondent was in the age group of 40 to 52 years corresponding to 8%, and all respondents are male. As for the level of education, 75% have completed secondary education, and 25% have a college degree. A percentage of 75% of the respondents are in the range of monthly family income from 4 to 10 minimum wages, and 17% from 10 to 20 minimum wages, and 8% are above 20 salaries mínimos. Dos respondents 67% lies with the three people, and 25% live with four to seven people, and only 8% lives unattended.

Responses applied in the Inquiry Form respondents were treated by Likert Scale, and then taken to the Excel software that offered the graphics performance of the constant content in Table 3 below.

Table.3: Tabulation of query data to the research group.

Affirmatives	TD (%)	PD (%)	I (%)	PA (%)	TA (%)	Total (%)
1. The organization is made up of soldiers who have emotions, passions and feelings	0	0	0	33	67	100
2. My behavior is influenced by internal and external factors	0	0	17	50	33	100
3. The organizational climate produces positive and negative effects on my behavior	0	8	17	25	50	100
4. evaluate my professional development in a negative way.	58	17	8	8	9	100
5. I feel emotionally exhausted in relation to my work.	42	42	8	8	0	100
6. I have enthusiasm and motivation to carry out the tasks that are passed.	0	17	0	58	25	100
7. The profession that I exercise requires control of my emotions.	0	0	8	8	84	100
8. My reactions in the workplace are influenced by emotions, feelings and passions.	25	8	50	0	17	100
9. Depending on my mood (positive or negative) act more cautiously.	0	17	25	25	33	100
10. I like the people who work independent of hierarchical level.	0	0	33	25	42	100
11. I trust my fellow workers in the performance of functions.	34	8	8	25	25	100
12. My actions at work are influenced by the group being able to contain my emotions and feelings.	8	17	25	33	17	100
13. The organization has a well-defined command structure.	17	17	17	32	17	100
4. Work in a stable environment that gives me confidence to perform my duties.	8	8	25	33	26	100
15. Organizational culture influences my behavior, my feelings, emotions and passions.	0	33	17	25	25	100

TD * (Totally Disagree); PD (Partially Disagree); I (indifferent); PA (Partially agree); and TA (Totally Agree).

Source: Research Data.

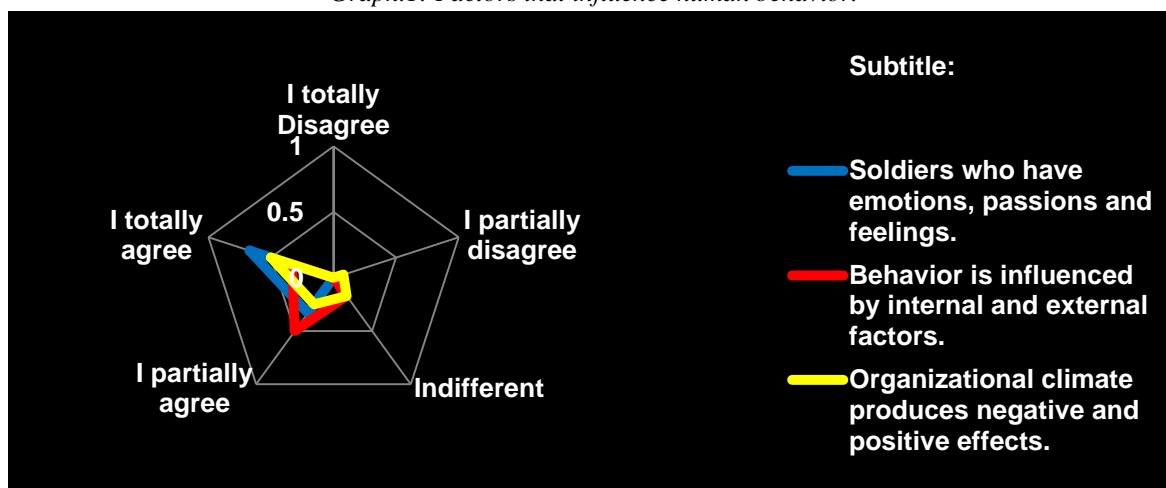
5.1 Treatment of intervening variables in human behavior in the study environment focused on feelings and emotions.

This topic is treated the intervening variables such as motivation, satisfaction and emotional exhaustion that manifest in the behavior of individuals in the corporation. The treatment of these variables follows the scrolling presented here.

5.1.1 Treatment in the perception of the factors that influence the behavior

The study shows the perception of the feelings revealed by stakeholders, their interpretation as to the influences of the internal and external factors, and also about the climate in the corporation. affirmative those shown in Chart 1 allow interpret as respondents evaluate this approach.

Graph.1: Factors that influence human behavior.



Source: Research Data.

Criticism of the graphics performance above shows that all respondents agreed that the military organization is composed of people who have emotions, passions and feelings; thus reveal a clear consciousness of its position as a whole person in the corporation. Indeed, this is consistent agreement with the statement in Robbins (2010), that factors such as age, emotions, values and perceptions influence the behavior of individuals in organizations, and that the unit manager can be used these factors to achieve the behavior organizational desired.

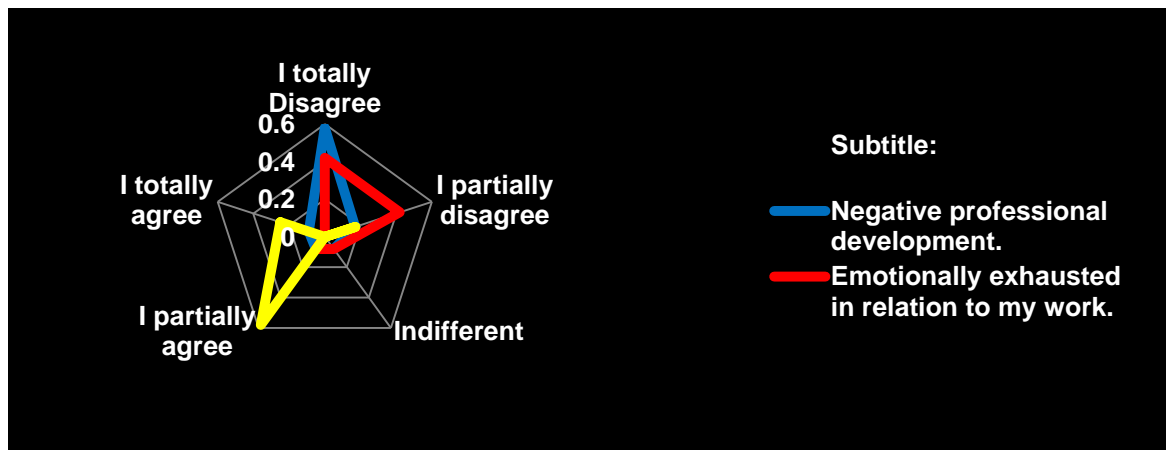
Under the influence on behavior, a percentage of 83% say that is influenced by internal and external factors. Identified himself even to 75% of stakeholders, organizational climate produces negative and positive effects on the behavior of respondents, revealing an

indication that the respondents are sensitive to a cause-effect relationship of behavioral inductors. It is confirmed dynamics of behavioral reagents relations explicit since Chiavenato (2014).

5.1.2 Treatment of intervening variables in individual behavior

This approach is in line in França et al. (2014), which registers on the low job satisfaction due to satisficientes factors related to feelings of incompetence and inadequacy to the profession. Although factors related to the study of leadership influences, they can join behavioral studies that result in favorable or not the expectations of individuals attitudes. As intervening variables such as satisfaction, stress and motivation, perception of respondents is revealed in Figure 2 below.

Chart.2: Variables involved in individual behavior



Source: Research Data.

As the perception of the respondent in the evaluation of their professional development in a negative way, a percentage of 75% of respondents partially disagreed; in direct interview point satisfied with their development in the corporation. A percentage of 8% is positioned as indifferent, and makes clear that interests you the perceived wage; and 17% agree Partly with its low professional accomplishment, considering that entails low productivity and quality at work.

This study turns to the result of Burnout Syndrome in charges involved with the corporation, returning to the concern of França et al (2014). For this author the unmotivated guys just do the necessary, there is a reduction of service, and there is a greater prone to accidents due to lack of attention. Respondents position themselves on this issue concerning your emotional exhaustion at work. A percentage of 42% totally disagreed, and 42% partially disagree; in fact the task undertaken in the sector under study does not present the same pressure common routine to industries located in the Capital; in the section studied are few checks in view of the distance from the seat, and the occurrences of accidents are minimal. A percentage of 8% realize how indifferent this situation; 8% partially agree to their state of stress, but it was clear from these respondents the task of accumulation operating in routine administrative and operational simultaneously when an agent does not attend the service. A percentage of 25% totally agree and 58% partially agree with your current motivation and enthusiasm to carry out the tasks; remains clear that certain missions fascinate, such as

looking for lost individuals in the woods, lifeguards activity on the beaches of rivers, in times of Sundays and holidays, when watching the Amazonian young people in their underwear while bathing, and others point his enthusiasm for capturing wild animals that invade the community. However 17% of respondents partially disagree as to his state of motivation and enthusiasm, and declare that the less mission for them will be better.

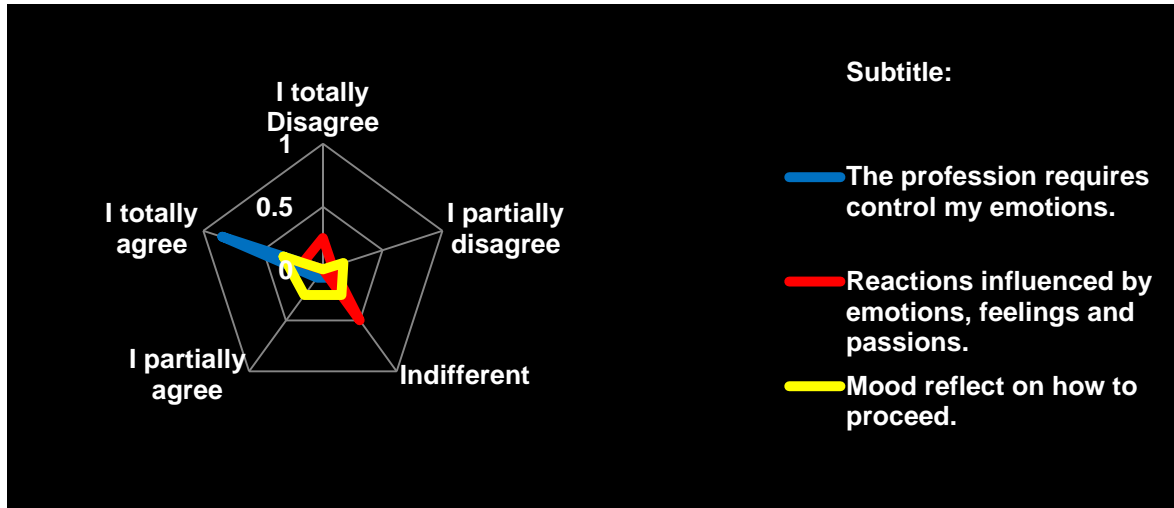
5.2 Characterization of organizational behavior of the institution focusing on emotions, passions and feelings.

The organizational behavior in the organization study will be featured in three organizational levels, with a focus on emotions, passions and feelings. Starting from the individual (micro-organizational), after the behavior level group (meso-organizational), and to complete the organizational level behavior (macro-organizational).

5.2.1 Study of micro-organizational behavior focusing on emotions, passions and feelings.

This approach is in line Robbins (2010), to characterize the behavior at the individual level, when analyzing. They involve characteristics that influence behavior and biographical characteristics of respondents. These features are related to personality, implies control of emotions and feelings that imply limitations in micro-organizational level. Figure 3 shows this performance in the face of the perception of respondents.

Chart.3: Emotions and feelings in micro-organizational behavior



Source: Research Data.

The research seeks to interpret the perception of *stakeholder* as the requirement for control of emotions. A percentage of 84% of respondents totally agree, and 8% partially agree and 8% is positioned as indifferent. In fact, the work activity requires attitudes favorable to performance, what matters fitness when the control of emotions; in addition it is significant that the agent demonstrate calm to generate confidence to assisted primarily at risk. The individual who works in the administrative area does not require as much liability as to emotional control.

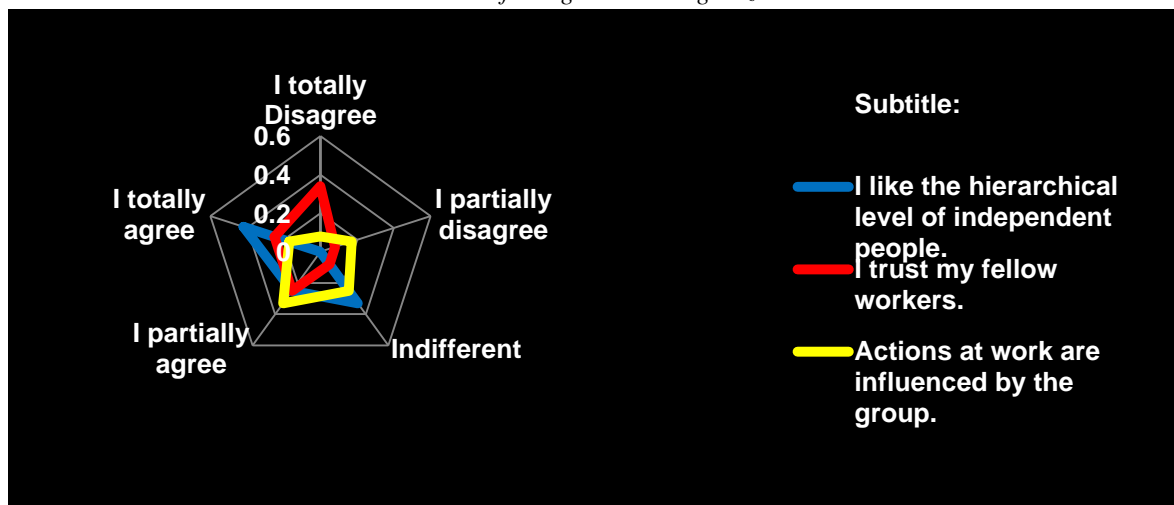
The answers to the reactions in the workplace are influenced by feelings, passions and emotions, a percentage of 17% totally agree, while 50% is positioned as indifferent and 8% partially disagreed and 25% totally disagree. Interview reveals that most are already used to the rigor of emotional control, that due to the routine that points such cautious performance and copied the most experienced.

Concerning the influence of the heart to a more cautious conduct a percentage of 33% totally agree, 25% partially agrees and 25% ranks as indifferent and 17% partially disagree. The occurrences are complex, often involve the family of the victims and these facts can generate negative evaluation of the rescuer; caution in these cases is fundamental and can not remain in misunderstanding. The mind alert becomes a measure required for the effectiveness of the task. Inobstante inexistia a protocol of care, tempers should follow adequately service the humanitarian minimum.

5.2.2 Study of meso-organizational behavior focusing on emotions, passions and feelings.

This approach is in line Robbins (2010), to characterize the behavior at group level when analyzing the interactions of individuals together, their interpersonal relationships, and the group's influence on the behavior of its members, to reflect the group performance. Figure 4 shows this performance in the face of the perception of respondents.

Chart.4: Emotions and feelings in mesoorganizational behavior



Source: Research Data.

As for the claim have good relationship between independent participants of senior, a percentage of 42% of respondents totally agreed, while 25% agreed Partialmente 33% pointed indifference. Most have good relationship with corporate members, there is a good climate in the organization, the indifferent show that the relationship in the group does not interfere in the performance of functions in the organization.

Following statement about trust in co-workers in their duties, 25% totally agreed, 25% partially agreed, while 8% indifferent, 8% partially disagreed and 34% totally disagreed.

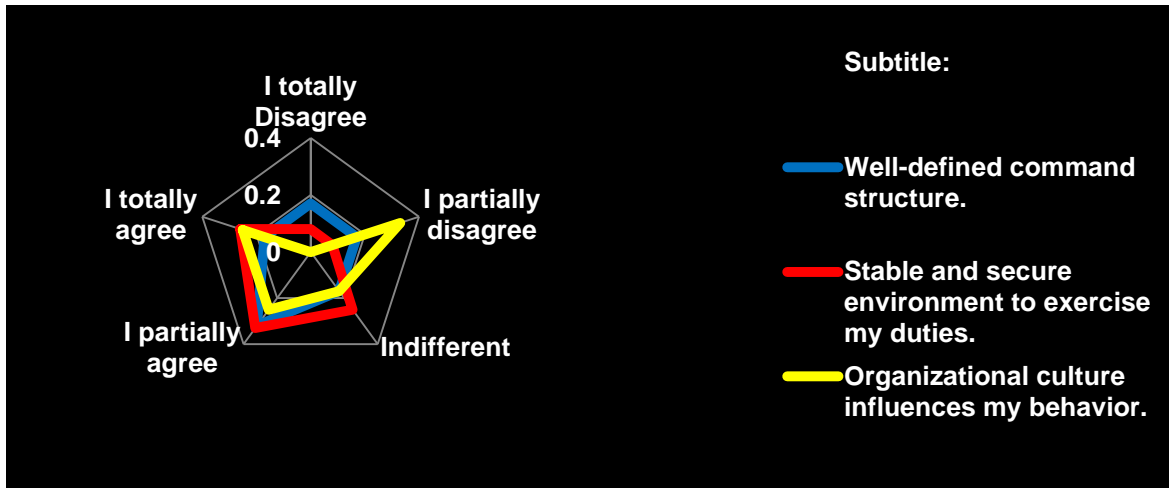
Discordants not feel confidence because they think the companions act carelessly in the performance of functions. For a profession that work is done in teams that feeling of distrust can generate insecurity in instances of calls.

To claim the actions in the workplace are influenced by the group and may contain the emotions and feelings, a percentage of 17% agreed Fully 33% agreed Partially, 25% that marked indifferent, and 17% partially disagreed and 8% totally disagree. Concordants are integrated with the work team with their emotions often controlled to avoid disagreements. For discordant group does not influence their actions, because they act only based on their values and perceptions.

5.2.3 Study of macro-organizational behavior focusing on emotions, passions and feelings.

This approach is in line Robbins (2010), to characterize the behavior at the organizational level, which analyzes the interaction of individuals and groups with the formal structure of the organization, to achieve the desired organizational performance. Figure 5 shows this performance in the face of the perception of respondents.

Chart.5: Emotions and feelings in macro-organizational behavior



Source: Research Data.

As the organization has a well-defined command structure, a percentage of 17% totally agreed, 32% partially agreed, 17% stood indifferent, while 17% partially disagreed and 17% totally disagreed. Despite being a military organization whose first the control unit (which each child can only be a superior to give orders) to Chiavenato (2014) this principle is the core of military organizations, there was no consensus on the command structure.

The answers to the working environment to be stable and safe to perform the duties, a percentage de26%totally agreed, 33% partially agreed as 25%indifferent, 8% partially disagreedand 8% totally disagreed. For disagreed that the working environment has to be improved in respect of materials and effective; and external influences hinders the implementation in the pattern of occurrences of regulation.

As for organizational culture influence behavior, feelings, emotions and passions of the respondents, a percentage of 25% totally agreed, 25% partially agreed, 17% indifferent and 33% partially disagreed. Respondents who disagree said organizational culture still is little influence and the need to work on it.

5.3 SWOT Analysis focusing on emotions, passions and feelings, and factors that influence them.

After characterizing the organizational behavior of the organization under study, with data collected and visit in place, there was a SWOT Analysis of the organization focusing on emotions, passions and feelings, as Chiavenato (2014) states the SWOT analyzes both the internal environment as external, by describing the strengths and weaknesses in the internal environment and the opportunities and threats in the external

environment; strengths should be maintained and operated, and correct and inhibit weaknesses that are harmful to the organization; and still seek seize opportunities and counter potential threats try to neutralize them to avoid affecting the organization. And in Table 4 below contains the results of this analysis.

5.3.1 Internal environment

The analysis of the internal environment identified the organizational strengths of which are worth mentioning that a percentage of 75% of respondents who said they felt satisfaction for their professional development, as well as those to feel motivated to carry out the work stood at 83% of respondents . The weaknesses in the organization that must be corrected: the low level of trust in fellow in the execution of activities, organizational structure may not be well-defined and effective low allied with equipment failure. A point to note is the income of all respondents were in the range above 4 minimum wages above the national average which is 1.4 minimum wage according to the National Survey by Household Sampling Continuous (Continuous PNAD), referring to 2016, the IBGE;to Chiavenato (2014) the salary and one of the factors that generate dissatisfaction of employees in the organization is above the national average, and well-defined career progression and known by all.According to Robbins (2010) With the motivated employees and reduced dissatisfaction factors, organizational behavior

tends to achieve results as human satisfaction, lower absenteeism and increased productivity.

5.3.2 External Environment

In the external environment opportunities are conducting training courses and updates that are offered by organizations in other states operating in the same industry through the training reduce the sense of insecurity in relation to their partners in carrying out assignments. As there is a contest that is in the second stage which is the basic training course for the training of new professionals will be able to alleviate the lack of effective with the appointment of trainees Candeias unit. In the municipality there are several places for tourism and celebrations at these sites can be performed by the relevant fellowship to reward achievements. As for the threats political influences on assignments generate negative feelings and even lack of motivation in performing technical inspection and occurrence of regulation, Chiavenato (2014) states that it is need of the employees have a safe working environment, as well as well-defined policies and standards. transfer and constant threat for many years was to contain practical demonstration of dissatisfaction with the policies and practices governing bodies. The comparison with other organs of the same office for often ends up causing dissatisfaction because they have a duty roster with more clearance.

Table.4: SWOT Matrix.

Internal environment	External environment
Strengths	Opportunities
- Staff motivated and satisfied with the functional progression; - Control of emotions in the profession; and - Remuneration above the Brazilian average.	- course of realization of improvement and update; - Training of new professionals in progress; and - Celebrate relevant achievements.
Weanesses	Threats
- Low Confidence in service companions; - Organizational structure creates doubt; and - Effective Low and equipment failure.	- Political influence in the organization; - transfer of military threat; and - Comparison with other bodies in the same Department.

Source: Prepared by the authors.

VI. CONCLUSION

Through behavioral analysis in the military organization it was found that the organization is made up of soldiers who have feelings and emotions. Most military are satisfied and motivated, but some feel emotionally exhausted, unmotivated and dissatisfied with their professional development, these are symptoms of burnout syndrome. As for the organizational behavior at the individual level

should be crafted to influence the group values and individual attitudes, because half of the respondents disagreed or were indifferent about the group's influence on their behavior; level group no relationship problems but there is a low degree of trust in fellow in exercise of the powers, which can be reduced with the completion of courses and with simulations; at the organizational level command structure raises doubts in the respondents as well

as external interference in the powers of the body, it is necessary to reduce the political influence on the activities of the agency.

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A Novel Constraint Narrowing Technique for MIMO Unstable System

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Abstract— Frequency response data collection can be a boon for modeling of MIMO uncertain plant. System stability can be assessed either by transfer function or by state-space method. Both will arrive at matrix transformation and further decision approach. Both can be considered for diagonalization of matrix. It is a proven fact that when the matrix is diagonalized the elements of the principle diagonal are the Eigen values and these Eigen values are closed loop poles from which stability can be assessed. The feature of such a diagonal matrix is that its principle diagonal elements contain gains of all the feedback paths. Singular value decomposition is used here for diagonalization. Singular value decomposition technique has been demonstrated by many authors but, application of PCA with Euclidian norm has not been paid attention so far. The systems numerical array is fed to a digital processing tool such as Mat lab and SVD-PCA (Singular Value Decomposition- Principal Component Analysis) is applied to determine the reduction of disturbance or noise and to provide minimum sensitivity and error correction. There are Hull, Box and KB consistency narrowing techniques used previously and the idea is extended further and an SVD-PCA-Norm technique which is now referred as LA criteria has been demonstrated here.

Keywords— Constraint Narrowing, Degree of Freedom, Hull consistency, ICST, MIMO, Pre-filter, QFT.

I. INTRODUCTION

Good performance of control system is the result of combination of feed-forward and feedback control systems. Stability is the constraint applicable to feedback control due to the uncertainty in tracking and measured noise filtering, whereas sensor availability and modeling errors limit the performance of feed-forward system.

Generally, a 2-DOF is selected for demonstration in which the output of the plant and reference are available to the control system. The number of degree of freedom is defined as the number of closed loop transfer function that can be designed independently. In 2-DOF closed loop systems, there are transfer functions from disturbance to

output and reference to output can be designed independently.

Many control requirements are assessed in frequency domain. The ability of the control system to reject the disturbances whose frequency components are concentrated on a certain band determines its performance. It is a proven fact that the effective control band is the one whose worst-case sensitivity is below 6 dB which indicates a minimum attenuation of 50% of output disturbance. In PCA actually very few components are selected which is as good as rejecting frequency components in a particular band and thus amounts to 50% of disturbance rejection. For disturbance rejection a comparison of the worst case open loop response and the closed loop response will determine how effective control design has been. In other words, there are finite set of constraints which specify which value combination from given variable domains are admitted and the value combination satisfying all constraints, that means rounding off errors and this has been done by PCA-Euclidian Norm.

II. DESIGN CONSTRINATS AND SATISFACTION

Quantitative Feedback Theory (QFT) is for robust stability, tracking and disturbance rejection. The constraints applied over certain intervals are sensitivity $S(j\omega)$, Complementary Sensitivity $T(j\omega)$, Gain Margin, Phase Margin, Resonant Peak, and Bandwidth. These constraints over the interval are satisfied in order to get good stability and disturbance rejection by having:

- High Gain at Low Frequency
- Low Gain at High Frequency
- Sensitivity must lie between 1 - 1.5
- Complementary Sensitivity must lie between 1.2 - 2.0
- Gain Margin should be in the range of 1.7-4.0
- Phase Margin should be in the range of 30⁰- 45⁰
- Damping Ratio $\zeta = 0.64$ for maximum response speed

- Peak Resonant Frequency $\omega_p = \omega_n \sqrt{1 - 2\zeta^2}$
- Bandwidth BW=

$$\omega_n = \sqrt{1 - 2\zeta^2 + \sqrt{2 - 4\zeta^2 + 4\zeta^4}}$$

Referring to above inferences a conclusion is reached whereby High gain, low sensitivity and larger bandwidth provides stability. In this paper a LA criterion is demonstrated which suggest application of SVD-PCA Norm technique to reduce noise and disturbance and uncontrolled variables elimination by pairing.

III. INFERENCES AND VALIDATIONS

This section brings out the proven inferences and its validation with respect to LA criteria.

A. Sensitivity must be minimized to get good disturbance rejection

The plant, the controller and the pre-filter are the components of a control system which are governed by noted equations $Y(s) = \frac{P(s)C(s)}{1+P(s)C(s)} F(s)C(s) +$

$$\frac{P(s)}{1+P(s)C(s)} D(s) - \frac{P(s)C(s)}{1+P(s)C(s)} N(s) \text{ ----- (1)}$$

If $N(s) = 0$, then desired output is achieved as $Y(s) = F(s)R(s)$; the output follows the reference input.

Let us consider $C(s) = -\frac{3(1-2s)}{s+1}$ and $P(s) = \frac{0.5}{1-2s}$

The characteristics equation is given by $1+P(s) C(s) = 0$ which becomes $1 + \frac{3(1-2s) \cdot 0.5}{s+1 \cdot 1-2s} = 0$

That implies $s+2.5=0$; a single root by which the system is said to be stable.

For $N(s) = F(s) R(s) = 0$ then

$$Y(s) = \frac{P(s)}{1 + P(s)C(s)} D(s) = \frac{-0.5(s + 1)}{(1 - 2s)(s + 2.5)} D(s) \text{ ----- (2)}$$

A pole at $s= +0.5$ implies that output response to a disturbance is unstable; this is because the characteristic equation does not include pole-zero cancellation.

If $|P(s) C(s)| \gg 1$ then $\frac{1}{1+P(s)C(s)} \approx 0$ and $\frac{P(s)C(s)}{1+P(s)C(s)} \approx 1$

If $\frac{Y}{D} \approx 0$, then output response to disturbance is good and $\frac{Y}{F(s)R(s)} \approx 1$ implies that set point tracking occurs.

The constraint on sensitivity and complementary sensitivity is that $S(s) + T(s) = 1$. High loop gain at low frequency and low gain at high frequency are some of the inferences related to sensitivity and complementary sensitivity which requires that:

- For tracking of reference signal and good rejection of disturbance it is required that $S(s) \approx 0$; $T(s) \approx 1$, which can be met by having loop gain say $|L(s)| \geq 1$
- To prevent propagation of measurement noise to the error and output signals it is required that $T(s) \approx 0 \Rightarrow S(s) \approx 1$ which is met by having loop gain say $|L(s)| \leq 1$
- In general, $|L(s)| \geq 1$ s required at low frequency and $|L(s)| \leq 1$ is required at high frequency.

B. Maximum Gain corresponds to the Eigen Vector associated with maximum Eigen Value.

In the above equation (1) to make $N(s) = 0$ the system gain must be maximum and maximum gain corresponds to the eigenvector associated to the maximum Eigen value.

Let us consider a 2x2 matrix to assess this concept: $A =$

$$\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$$

The characteristics equation is given by $|A - \lambda I| = 0$, arranging the equation we get,

$$\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix} - \lambda \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = 0 \text{ solution of which gives } \lambda = 6 \text{ and } \lambda = 1 \text{ as Eigen values and the largest Eigen value is 6.}$$

The Eigenvectors can be found by $|A - \lambda I| \begin{bmatrix} x \\ y \end{bmatrix} = 0$

Solving for the above equation we get

$$\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix} - \lambda \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = 0 \rightarrow \begin{bmatrix} 5 - \lambda & 4 \\ 1 & 2 - \lambda \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = 0$$

Putting $\lambda = 6$ and $\lambda = 1$ in the above equation we get

$$\frac{x}{4} = \frac{y}{1}$$

And hence the Eigen vectors are (4, 1).

The maximum Eigen vector corresponding to the maximum Eigen value is 4 and hence the maximum gain is 4.

The maximum gain implies minimum sensitivity which is required for stability of a system.

C. Rejection of frequency components in a particular band amounts to minimum 50% of attenuation of Noise and Disturbance.

To assess, consider the following matrix

$$K = \begin{bmatrix} 0.48 & 0.90 & -0.006 \\ 0.52 & 0.95 & 0.008 \\ 0.90 & -0.95 & 0.020 \end{bmatrix}$$

It's SVD which gives:

$$U = \begin{bmatrix} 0.5714 & 0.3766 & 0.7292 \\ 0.6035 & 0.4093 & -0.6843 \\ -0.5561 & 0.8311 & 0.0066 \end{bmatrix}$$

$$\Sigma = \begin{bmatrix} 1.618 & 0 & 0 \\ 0 & 1.143 & 0 \\ 0 & 0 & 0.0097 \end{bmatrix}$$

$$V = \begin{bmatrix} 0.0541 & 0.9984 & 0.0151 \\ 0.9985 & -0.0540 & -0.0068 \\ -0.0060 & 0.0154 & -0.9999 \end{bmatrix}$$

And Its PCA gives

$$PCA = \begin{bmatrix} 0.2082 & -0.9386 & 0.2749 \\ -0.9780 & -0.2026 & 0.0489 \\ 0.0089 & -0.2791 & -0.9602 \end{bmatrix}$$

As can be seen the SVD- PCA gives out compressed data array amounting to minimum 50% reduction and hence a comprehensive reduction of noise disturbance. It is a proven fact that the effective control band is the one whose worst-case sensitivity is below 6 db which indicates a minimum attenuation of 50% of output disturbance. In PCA actually very few components are selected which is as good as rejecting frequency components in a particular band and thus amounts to 50% of disturbance rejection. SVD matrix provides three matrices U, the row matrix, Σ, the diagonal matrix V, the column matrix maximum, minimum gain and its ratio the condition number N. The first column of matrix V from controller output transfer matrix is the combination of manipulation with highest effect on the control objective and the first column of matrix U from disturbance output matrix points out better measure of controlled variables. Minimum condition number N (close to 1) must be achieved to have gain and sensitivity stability. The condition number with K is 197.8571, the condition number with V is 0.9999 and it has been referred to as V can be fed back to attain stability and its CN number is near unity, which can contribute to stability and the condition number with PCA is 1. The SVD-PCA are helping to bring down the highest condition number from 197.8571 to near unity. An SVD gives an idea of system matrix acting upon an input at

particular frequency and PCA treated as Euclidian Distance which can be used to pairing and deleting the uncontrollable values.

The Algorithm

Input: Array Gain Matrix

- Get SVD of the gain matrix $SVD = U\Sigma V^T$
- Get condition number $CN = \frac{\delta}{\delta}$
- Get lowest singular value λ_{min}
- Assign columns of U (V) with most weighted output (input) vector.
- Compare different sets of input/output (pairing) which is achieved by norm.
- Another inference is that the larger the condition number of the diagonal matrix the more unstable is the system. In the above example Σ is the diagonal matrix and its condition number $N \approx 198$ which is quite large and the system oscillates and hence it should be kept as low as possible to attain stability.

D. One Transfer Function is enough to assess the stability

The stability can be drawn at by Nyquist plot and in that if Eigen value locus does not encircle the point (-1, 0) the MIMO system is closed loop stable.

The state space representation of a system in standard format is:

$$\begin{aligned} X &= Ax + Bu \\ Y &= Cx + Du \end{aligned}$$

The equations above gives rise to four matrices namely; A – State Matrix; B – Control Matrix; C – Output Matrix and D – Transmission Matrix. For closed loop stability only one transfer matrix must be checked instead of four.

Consider an example

$$\begin{bmatrix} X_1 \\ X_2 \end{bmatrix} = \begin{bmatrix} -1 & -1 \\ 6.5 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \end{bmatrix}$$

$$\begin{bmatrix} Y_1 \\ Y_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \end{bmatrix}$$

From the Transfer Matrix $Y(s) = G(s) U(s)$ and taking the Laplace transform of state equations

$$sX(s) - x(0) = AX(s) + BU(s) \text{ ----- (3a)}$$

$$Y(s) = CX(s) + DU(s) \text{ ----- (3b)}$$

Putting $x(0) = 0$ and simplifying we get a generalized equation

$$Y(s) = (SI - A)^{-1}BU(s) \text{-----}$$

--- (4)

Substituting equation (4) in equation (3b)

$$Y(s) = [C (SI - A^{-1}) B + D] U(s) \text{ and from the transfer matrix}$$

$$G(s) = C (SI - A^{-1}) B + D \text{ which becomes as } D = 0$$

$$G(s) = C (SI - A^{-1}) B \text{ and from the given example this}$$

equation can be put as:

$$G(s) = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} s+1 & 1 \\ -6.5 & s \end{bmatrix} \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix} = \frac{1}{s^2 + s + 6.5}$$

$$\begin{bmatrix} s & -1 \\ 6.5 & s+1 \end{bmatrix} \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$$

$$G(s) = \frac{1}{s^2 + s + 6.5} \begin{bmatrix} s-1 & s \\ s+7.5 & 6.5 \end{bmatrix} \rightarrow \begin{bmatrix} Y_1(s) \\ Y_2(s) \end{bmatrix} =$$

$$\begin{bmatrix} \frac{s-1}{s^2 + s + 6.5} & \frac{s}{s^2 + s + 6.5} \\ \frac{s+7.5}{s^2 + s + 6.5} & \frac{6.5}{s^2 + s + 6.5} \end{bmatrix} \begin{bmatrix} U_1(s) \\ U_2(s) \end{bmatrix}$$

This 2x2 system gives rise to four transfer functions and it is enough to work on one transfer function to assess stability.

$$\begin{bmatrix} Y_1(s) \\ U_1(s) \end{bmatrix} = \frac{s-1}{s^2 + s + 6.5}$$

$$\begin{bmatrix} Y_1(s) \\ U_2(s) \end{bmatrix} = \frac{s}{s^2 + s + 6.5}$$

$$\begin{bmatrix} Y_2(s) \\ U_1(s) \end{bmatrix} = \frac{s+7.5}{s^2 + s + 6.5}$$

$$\begin{bmatrix} Y_2(s) \\ U_2(s) \end{bmatrix} = \frac{6.5}{s^2 + s + 6.5}$$

If we plot and analyze Nyquist plot for all the transfer functions which are as shown below and it can be observed that the plots do not encircle (-1, 0) point and hence the systems is said to be closed loop stable and the point that only one transfer function is enough to conclude the stability of the system can be satisfied. The transfer functions show negative real values of pole (positive real values for unstable system) and when tested for stability they all show value 1 (0 for unstable), which are arrived at by using Matlab.

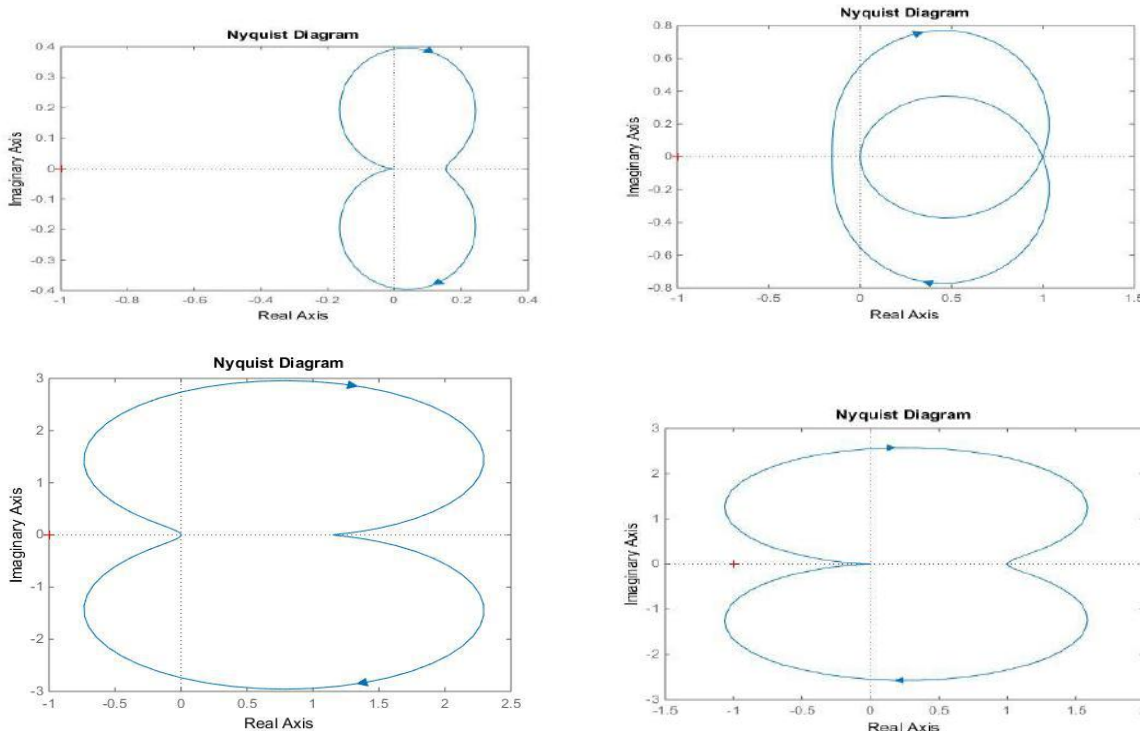


Fig.1-4: Nyquist plots for Transfer functions

IV. POINTS OF DISCUSSION

Feedback control compensates for disturbance and modeling errors. Set points always change with disturbances. Satisfactory reference tracking can be

achieved with a high gain feedback. Stable controller design can be had by maintaining a high gain feedback system and the tracking of reference signal i.e., pre-filter design can be done by proper loop shaping in which the

closed loop stability is determined by closed loop polynomial determinant and its characteristics loci which can be plotted by using Nyquist plots. The characteristics loci are the Eigen-values of the transfer matrix and in that if Eigen value locus does not encircle the point (-1, 0) the MIMO system is said to be closed loop stable.

Zero steady state error is obtained for a constant reference signal or disturbance signal by having low frequency slope of loop gain $|L(s)|$ at -20db/dec and for a linearly increasing reference signal or disturbance signal a low frequency slope of -40 db/dec is required. Adequate phase margin must be provided which can be achieved by having the slope of the magnitude curve at the gain crossover frequency at -20db/dec.

Bandwidth indicates the frequency range for which satisfactory set point tracking occurs and it should be large enough for speedy response. The performance specifications of closed loop control system are robust stability for which high gain and low sensitivity must be maintained and robust tracking for which bandwidth must be high.

V. CONCLUSION

The paper demonstrates how LA criteria propose to solve closed loop stability at constrained intervals. The constraints may represent various bounds of control system stability. Uncontrolled systems behavior can be fed in the shape of numerical array to the processing tool such as Matlab. The SVD-PCA-NORM (LA criteria) is applied to the array until satisfactory compressibility is observed and the ultimate result is reduction in measurement noise and disturbance. The challenge of this criterion now lies in extending the idea to unknown source of disturbance and measurement noise, tracking and sensitivity minimization along with gain maximization when calculations goes unpredictable. Our first paper laid the foundation for this research work, whereas this paper illustrates the conceptual ground work and the upcoming paper will demonstrates this LA criterion for a real time dynamic system.

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Music Algebra: Harmonic Progressions Analysis and CAT (Cataldo Advanced Transformations)

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Abstract—In this article we formally introduce an original method, the purpose of which fundamentally lies in providing musicians with a reliable instrument that may effectively assist them in carrying out, as simply and intuitively as possible, the analysis of whatever chord progression, without resorting to the so-called "modal interchange". Net of a single exception (a routine named "structure reduction"), the whole method is based on a series of harmonic transformations. The above-mentioned transformations, named CAT (the acronym stands for Cataldo Advanced Transformations), turn out to be nothing but inverse chord substitutions characterized by specific conditions and restrictions. The method arises from the analysis of a considerable number of chord progressions, devoting particular (although not exclusive) attention to traditional jazz compositions: in this regard, it is worth highlighting how a significant improvement of CAT has been achieved by conducting an extremely thorough analysis of the so-called LEGO Bricks (public domain harmonic patterns).

Keywords—Music Algebra, Chord Progressions, Chord Substitutions, Plagal Cadence, Perfect Cadence, Jazz, Harmonization, Reduction, Diminished Substitutions, Expansion, Tritone, Secondary Dominants, Diatonic Substitutions, CAT.

I. SHORT INTRODUCTION

The purpose of the method fundamentally lies in providing musicians with a reliable instrument that may effectively assist them in carrying out the harmonic progressions analysis. The method is primarily based upon the application, carried out by following a specific order, of a series of transformations, named CAT (Cataldo Advanced Transformations), by means of which whatever harmonic progression may be converted, within certain limits, into a mere sequence of Plagal and Perfect Cadences [1]. As far as jazz is concerned, a significant improvement of the method has been achieved by conducting an extremely thorough analysis of the so called LEGO Bricks (public domain harmonic patterns) [2] [3].

II. LIMITATIONS OF THE METHOD

The method is characterized by the following limitations:

The Key of any song must be considered as being major. Consequently, if the key of a song is manifestly minor, the analysis must be carried out by referring to the relative major key (for example, *C Major* instead of *A Minor*). It is worth specifying how a direct analysis of the songs written in minor key is obviously feasible: however, the procedure would require slight modifications concerning the conditions related to some transformations, herein not addressed in order not to weigh down the discussion.

Each Minor Major Seventh chord must be instantly replaced by a Minor Seventh one; similarly, each Augmented Major Seventh Chord must be instantly replaced by a Major Seventh. In other terms, the analysis is carried out by taking into consideration, exclusively, the first five kinds of Seventh Chords.

In the light of their extreme subjectivity, the (inverse) substitutions based on the so-called "Modal Interchange" are herein intentionally ignored. In fact, the outcomes usually obtained by resorting to the modal interchange can be alternatively deduced by exploiting the Quality (Dominant to Major) and Similitude Substitutions. [1]

The time signature must always be imagined as being equal to 4/4. For example, even if we deal with a 3/4, we have to consider four pulses per measure (four beats per bar): each beat, in this case, will be characterized by a duration equivalent to a dotted quaver (see *fig.1*)



Figure 1. Beats in 3/4 (three-four time)

III. DESCRIPTION OF THE METHOD

The method consists of ten consecutive phases:

1. Selection of the Key (bearing in mind that the global tonal centre is herein regarded as necessarily major).

2. The writing of the Ionian Scale Vector (the components of which coincide with the notes that constitute the Ionian Scale) [4] [5]. If we denote with X the Global Tonal Centre (the Key) and with t a whole tone interval, we have:

$$s^{Ion}(X) = \left(X, X + t, X + 2t, X + \frac{5}{2}t, X + \frac{7}{2}t, X + \frac{9}{2}t, X + \frac{11}{2}t \right) \quad (1)$$

For example, if we set $X = C$, we can banally write:

$$s^{Ion}(C) = (C, D, E, F, G, A, B) \quad (2)$$

3. The writing of the Ionian Harmonization Vector. If we denote with $h^{Ion}(X)$ the Ionian Harmonization Vector [4] [5] (the components of which are nothing but the seventh chords that arise from the harmonization of the Ionian Scale of X), with $M^{Ion}(X)$ the Ionian Modal Tensor (of X) [4] [5], and with $d^{1357} = (1, 0, 1, 0, 1, 0, 1)$ [4] [5] the so-called Seventh Chord Fundamental Vector, we have:

$$h^{Ion}(X) = M^{Ion}(X) \cdot d^{1357} \quad (3)$$

For example, by setting $X = C$, we obtain:

$$h^{Ion}(C) = \begin{bmatrix} C & D & E & F & G & A & B \\ D & E & F & G & A & B & C \\ E & F & G & A & B & C & D \\ F & G & A & B & C & D & E \\ G & A & B & C & D & E & F \\ A & B & C & D & E & F & G \\ B & C & D & E & F & G & A \end{bmatrix} \begin{bmatrix} 1 \\ 0 \\ 1 \\ 0 \\ 1 \\ 0 \\ 1 \end{bmatrix} = \begin{bmatrix} Cmaj7 \\ Dm7 \\ Em7 \\ Fmaj7 \\ G7 \\ Am7 \\ Bm7b5 \end{bmatrix} \quad (4)$$

4. Structure Reduction (net of which a correct application of *CAT* would be de facto impossible). Very simply, the number of bars, as well as the duration of the chords, must be iteratively halved. The procedure is stopped the moment in which even a single chord characterized by a duration equal to a beat appears. Actually, the structure reduction should be applied every time it is possible, so as to obtain the highest simplification level.

5. Diminished Chords Elimination. These chords are herein regarded as deriving from Dominant Seventh Chords subjected to Diminished Substitution. [6] [7] [8]

6. Elimination of Chords that arise from Expansion Substitutions. [6] [7] Actually, the procedure should be applied every time it is possible, so as to obtain the highest simplification level.

7. Transformation of Extraneous Chords (not related to the key of the analysed song) into Diatonic Chords. This phase consists in applying Quality, Similitude, Tritone and Secondary Dominants Inverse Substitutions. [6] [7]

8. Diatonic Transformations of the remaining chords. The analysis of a significant number of traditional jazz compositions has allowed us to accurately determine some

restrictions [1] concerning the Diatonic Substitutions. The above-mentioned restrictions are exclusively finalized to obtaining an outcome as simple and coherent as possible.

9. Optional Final Elimination of Chords that arise from Expansion Substitutions [6] [7] (for obvious reasons, this phase exclusively involves chords that coincide with the second component of the Ionian Harmonization Vector).

10. Elimination of the Reduction(s) and Final Outcome. Number of bars and duration of chords must recover their original values.

IV. TRANSFORMATIONS

Inverse Diminished Substitutions

Diminished Chords followed by Dominant Seventh Chords

If we denote with Z a generic note, with a_n and a_{n+1} , respectively, the n -th examined chord and the subsequent one, and with $sub^{dim} [dom. chord]$ the set constituted by the Diminished Chords (four altogether, net of the enharmonic equivalences) arising from the Diminished Substitution of the Dominant Seventh Chord in square brackets, we have:

$$\begin{cases} a_{n+1} = Z7 \\ a_n \in sub^{dim}[Z7] \end{cases} \Rightarrow a_n \xleftarrow{dim.} Z7 \quad (5)$$

$$\begin{cases} a_{n+1} = Z7 \\ a_n \in sub^{dim} \left[\left\langle Z + \frac{5}{2}t \right\rangle 7 \right] \end{cases} \Rightarrow a_n \xleftarrow{dim.} \left\langle Z + \frac{5}{2}t \right\rangle 7 \quad (6)$$

$$\begin{cases} a_{n+1} = Z7 \\ a_n \in sub^{dim} \left[\left\langle Z + \frac{7}{2}t \right\rangle 7 \right] \end{cases} \Rightarrow a_n \xleftarrow{dim.} \left\langle Z + \frac{7}{2}t \right\rangle 7 \quad (7)$$

In order to explain how to interpret the notation we have been resorting to, the last relation is equivalent to the following assertion: if a Diminished Chord, denoted by a_n , is followed by a Dominant Seventh Chord, denoted by $Z7$, and if a_n , concurrently, belongs to the set of the Diminished Chords that can be obtained by applying a Diminished Substitution to the Dominant Seventh Chord distant an ascending perfect fifth from $Z7$, a_n must be replaced exactly by this chord (a_n must be regarded as deriving from a Diminished Substitution applied exactly to this chord).

Diminished Chords followed by Minor Seventh Chords

According to *CAT*, with obvious meaning of the notation, we have to consider the following transformations:

$$\begin{cases} a_{n+1} = Zm7 \\ a_n \in sub^{dim} \left[\left\langle Z + \frac{3}{2}t \right\rangle 7 \right] \end{cases} \Rightarrow a_n \xleftarrow{dim.} \left\langle Z + \frac{3}{2}t \right\rangle 7 \quad (8)$$

$$\begin{cases} a_{n+1} = Zm7 \\ a_n \in sub^{dim} \left[\left\langle Z + \frac{5}{2}t \right\rangle 7 \right] \end{cases} \Rightarrow a_n \xleftarrow{dim.} \left\langle Z + \frac{5}{2}t \right\rangle 7 \quad (9)$$

$$\begin{cases} a_{n+1} = Zm7 = h_i^{lon}(X) \\ a_n \in sub^{dim} \left[\langle Z + \frac{7}{2}t \rangle 7 \right] \end{cases} \Rightarrow a_n \xleftarrow{dim.} \langle Z + \frac{7}{2}t \rangle 7 \quad (10)$$

$i = 2,3,6$

$$\begin{cases} a_{n+1} = Zm7 \neq h_i^{lon}(X) \\ a_n \in sub^{dim} \left[\langle Z + 5t \rangle 7 \right] \end{cases} \Rightarrow a_n \xleftarrow{dim.} \langle Z + 5t \rangle 7 \quad (11)$$

$i = 2,3,6$

Diminished Chords followed by Major Seventh Chords

According to CAT, we have:

$$\begin{cases} a_{n+1} = Zmaj7 \\ a_n \in sub^{dim} \left[\langle Z + \frac{5}{2}t \rangle 7 \right] \end{cases} \Rightarrow a_n \xleftarrow{dim.} \langle Z + \frac{5}{2}t \rangle 7 \quad (12)$$

$$\begin{cases} a_{n+1} = Zmaj7 \\ a_n \in sub^{dim} \left[\langle Z + \frac{7}{2}t \rangle 7 \right] \end{cases} \Rightarrow a_n \xleftarrow{dim.} \langle Z + \frac{7}{2}t \rangle 7 \quad (13)$$

$$\begin{cases} a_{n+1} = Zmaj7 \\ a_n \in sub^{dim} \left[\langle Z + \frac{9}{2}t \rangle 7 \right] \end{cases} \Rightarrow a_n \xleftarrow{dim.} \langle Z + \frac{9}{2}t \rangle 7 \quad (14)$$

Diminished Chords followed by Half-Diminished Chords

Albeit the case has never occurred during the analysis of more than 300 jazz harmonic progressions, we admit the possibility that a Diminished Chord may be followed by a Half-Diminished one. If this happens, the Diminished Chord cannot be immediately replaced by a Dominant Seventh: in this case, in fact, we have to necessarily wait for the Half-Diminished Chord to be subjected to an inverse substitution, so returning the analysis to one of the cases previously considered. [1]

Minor Seventh Chords and Half-Diminished Chords deriving from Expansion Substitutions

According to CAT, denoting with Y a generic note, with bar_k the k -th bar, with $T(chord)$ and $beat(chord)$, respectively, the duration and the metric placement of the chord in round brackets, we have:

$$\begin{cases} a_n = Ym7, Ym7b5 \\ a_{n+1} = \langle Y + \frac{5}{2}t \rangle 7 \\ a_n, a_{n+1} \in bar_k \\ T(a_n) = T(a_{n+1}) \\ beat(a_n) = on \end{cases} \Rightarrow a_n | a_{n+1} \xleftarrow{exp.} a_{n+1} | a_{n+1} \quad (15)$$

Quality (Dominant to Major) Inverse Substitutions

According to the method [1], if a Major Seventh Chord does not belong to the Harmonization Vector, it must be considered as deriving from a Quality Substitution (Dominant to Major). [6] [7] Consequently, we have:

$$a_n = Ymaj7 \neq h_1^{lon}(X), h_4^{lon}(X) \Rightarrow a_n \xleftarrow{dom. to maj.} Y7 \quad (16)$$

Similitude Inverse Substitutions

According to the method [1], if a Minor Seventh or Half-Diminished Chord does not belong to the Harmonization Vector, it must be replaced by a Dominant Seventh chord distant an ascending perfect fourth. We can write:

$$a_n = Ym7 \neq h_i^{lon}(X) \Rightarrow a_n \xleftarrow{sim.} \langle X + \frac{5}{2}t \rangle 7 \quad (17)$$

$i = 2,3,6$

$$a_n = Ym7b5 \neq h_7^{lon}(X) \Rightarrow a_n \xleftarrow{sim.} \langle X + \frac{5}{2}t \rangle 7 \quad (18)$$

Tritone (Inverse) Substitutions

$$\begin{cases} a_n = Y7 \\ Y \neq s_i^{lon}(X) \end{cases} \Rightarrow a_n \xleftarrow{tri.} \langle Y + 3t \rangle 7 \quad i = 1, \dots, 7 \quad (19)$$

$$\begin{cases} a_n = s_4^{lon}7 \\ a_{n+1} = h_5^{lon}(X), \langle s_5^{lon}(X) + 3t \rangle 7 \end{cases} \Rightarrow a_n \xleftarrow{tri.} s_7^{lon}(X)7 \quad (20)$$

In order to clarify the last transformations, let's suppose we are dealing with a song in the key of C . The above-mentioned transformation simply requires that the chord $F7$, if preceded by $G7$ or D^b7 , must be regarded as deriving from a Tritone Substitution applied to $B7$ (that, in turn, will be regarded, at a later time, as deriving from a Secondary Dominant Substitution [6] [7] applied to $Bm7b5$).

Secondary Dominants Inverse Substitutions

$$a_n = s_i^{lon}(X)7 \Rightarrow a_n \xleftarrow{sec. dom.} h_i^{lon}(X) \quad i \neq 5 \quad (21)$$

Diatonic (Inverse) Substitutions

Transformations involving h_6

$$a_n = h_6^{lon}(X) \Rightarrow a_n \xleftarrow{dia.} h_1^{lon}(X) \quad (22)$$

Transformations involving h_7

$$\begin{cases} a_n = h_7^{lon}(X) \\ a_{n+1} = h_3^{lon}(X), h_5^{lon}(X), \\ a_n, a_{n+1} \in bar_k \\ beat(a_n) = on \end{cases} \Rightarrow a_n \xleftarrow{dia.} h_2^{lon}(X) \quad (23)$$

$$otherwise: a_n \xleftarrow{dia.} h_5^{lon}(X)$$

Transformations involving h_3

$$\begin{cases} a_n = h_3^{lon}(X) \\ a_{n+1} \neq h_2^{lon}(X), h_4^{lon}(X) \\ a_{n-1} = h_2^{lon}(X), h_4^{lon}(X) \\ a_{n-1}, a_n \in bar_k \end{cases} \Rightarrow a_n \xleftarrow{dia.} h_5^{lon}(X) \quad (24)$$

$$otherwise: a_n \xleftarrow{dia.} h_1^{lon}(X)$$

Transformations involving h_2

$$\begin{cases} a_n = h_2^{Ion}(X) \\ a_{n+1} = h_1^{Ion}(X) \end{cases} \Rightarrow a_n \xleftarrow{dia.} h_4^{Ion}(X) \quad (25)$$

Transformations involving h_4

$$\begin{cases} a_n = h_4^{Ion}(X) \\ a_{n+1} \neq h_1^{Ion}(X) \end{cases} \Rightarrow a_n \xleftarrow{dia.} h_2^{Ion}(X) \quad (26)$$

V. FINAL REMARKS

Furthermore, all harmonic progressions could be further simplified by applying the Similitude Substitutions to h_2 and regarding the so-called Tonicization [6] [7] [8] [9] [10] as being a real substitution. Let's consider, for example, the Plagal Cadence $Fmaj7 / Cma7$ (we are in the key of C). $Fmaj$ can be regarded as deriving from a Diatonic Substitution applied to $Dm7$ that, in turn, may be regarded as deriving from a Similitude Substitution applied to $G7$. Finally, the Perfect Cadence so obtained may be considered as deriving from a single chord, $Cmaj7$, subjected to Tonicization. [11] [12] [13]

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Critical Evaluation of Individual Hearing Protectors of Workers in Civil Construction

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Abstract — *The hearing protection of workers is of great concern to occupational health and safety professionals because of the irreversible damage caused by prolonged exposure to noise. This work seeks to determine whether the hearing protection equipment used in the construction industry today is adequate, considering that, in addition to the intense noise, other risk factors are present in the typical environment of a construction site. For this, a survey was conducted on how workers in the industry recognise and prevent exposure to noise and how they use hearing protection. Subsequently, laboratory experiments were used to study, how the main contaminants interact with the material of which this equipment is composed. In laboratory tests, both foam and silicone plugs gained weight when exposed to contaminants typically found in construction. This fact evidenced the need for training regarding the hygiene of hearing protectors. Regarding the performance of the foam earplugs in the tests, it was verified that, even though they went through the cleaning process, the equipment also increased in mass. This fact demonstrates that cleaning helps but does not eliminate the contamination of the hearing protection devices (HPD). Finally, it was concluded that the both types of earplugs are efficient in relation to noise attenuation and protection of the hearing of the workers. However, the way they are used and cleaned can influence the contamination of these protectors and the research detected both a lack of information from the manufacturers and little or no training of the workers.*

Keywords — *civil construction, work safety, hearing protection equipment, hearing protection.*

I. INTRODUCTION

The construction industry in Brazil has been modernising the tools and methods used to carry out its processes. New execution times and quality parameters, as well as the need to optimise costs, have required the emergence of new and more modern tools, but they are no less noisy than their predecessors.

To eliminate or minimise worker exposure to noise, a number of measures can be implemented by employers.

Engineering controls, such as enclosing noisy machines and implementing acoustic barriers in the environment are expensive and often unfeasible during the production process. In other words, the use of individual protection equipment is still the main means used to minimise the damage to health caused by noise.

Different types of hearing protection devices (HPD) are available on the market. Earmuffs and plugs, disposable or not, can be found at industry-specific stores varying in price, quality, and protection capability. The choice of HPD is fundamental to the success of hearing protection for construction workers. The scenario found in works in Brazil usually involves high temperatures, use of volatile chemicals such as paints and solvents, and certainly involves high levels of suspended particles.

Figure 1, below, shows a flagrant breach of health and safety procedures at civil works, where workers are subject to noise and dust but do not use the obligatory ear protection during these operations.



Fig. 1: Construction workers not wearing ear protectors

This work aims to analyse whether the hearing protection devices used in the civil construction industry today are adequate, considering that, in addition to the intense noise, other risk factors are present in the typical environment of a construction site. In order to answer this question, it is first necessary to study the working environment and the people who work in it. To do so, it is necessary to identify how construction workers recognise and prevent exposure to noise and to study, in practice, how the main contaminants interact with the material of which this equipment is composed.

II. CONTEXTUALISATION

2.1 Noise in construction

The construction industry, according to Maia [1] uses "increasingly fast machines, has made the tasks of workers in this branch noisier and, consequently, generated hearing loss and other effects in an increasing number of workers". This author identified the main sources of noise for the general helper, bricklayer, and carpenter and assessed the sound pressure levels to which they were exposed during the typical tasks of these types of service through dosimetry. The maximum levels found for each of the functions studied and the corresponding activities to which they are related can be observed in Table 1, below.

Table.1: Maximum Levels (L_{Max}) for each function in construction and its respective activity.

Function	Activity	$L_{eq}(Max)$
General helper	Concrete mixer operation	84.3 dB
Bricklayer	Granite cutting and laying	104.3 dB
Carpenter	Assembly of slab forms	100.0 dB

Source: adapted from Maia [1].

Farias, Buriti, and Rosa [2] investigated the occurrence of noise-induced hearing loss in carpenters in Brazilian civil construction. The study found that 35% of the professionals presented unilateral or bilateral losses in the frequencies of 3 kHz, 4 kHz, and/or 6 kHz.

The research of Seixas et al. [3] concluded that in some countries 16 to 50% of construction workers are affected by noise-induced hearing loss, and for a certain age range this percentage reaches at least 75%. There are several studies based on noise exposure in works which show noise levels of 75 to 113 dB (A) at the operating points of the machines and noise levels between 65 and 91 dB (A) in the work environment [4–6].

2.2 Hearing protection devices

Earmuffs completely cover the worker's ears. They consist of shells, usually plastic, lined with foam pads on the sides (which come into contact with the user's head) and inside the shells. Its band consists of plastic or metal, which serves to keep the shells tightly sealed against the region of the user's ears. The band can also be separated and attached to the user's helmet.

Insertion hearing protectors, which are popularly known as earplugs, are equipment inserted into the ear canal. They may be of the preform type with a format composed of three flexible silicone, copolymer, or rubber; or mouldable flanges made of flexible foam that adapt to the size of the user's ear canal. The insert protectors may be disposable or

reusable and may or may not have a cotton cord, depending on the make and model. Beltrame [7] listed the advantages and disadvantages of earmuffs and earplugs (Table 2).

Table.2: Main advantages and disadvantages of HPD models.

Model	Benefits	Disadvantages
Earmuffs	Easy to fit and wear; Convenient for intermittent exposure; Small risk of infection; Good adaptation to users; Good durability; Comfortable in cool environments; Easy to use correctly.	High cost; Heavy; May not be comfortable in very hot and humid climates; Occupies a lot of space; Maintenance and more complex hygiene;
Earplugs	Low cost; Light; It takes up little space; Small and easy to carry; Comfortable in warm environments; Ease of substitution; Simple maintenance and cleaning.	Complexity in placement; Need for prior training; The size must be appropriate to the user's ear canal; Difficult identification for the user; Difficult to verify correct use; High risk of infection; Accumulation of dirt.

Source: adapted from Beltrame [7].

III. MATERIALS AND METHODS

As a data collection instrument, a survey structured through a questionnaire was used. The objective was to investigate the types and models of HPD most used in construction works; evaluate the perception and the habit of workers regarding the use, maintenance, and hygiene of the equipment; and to verify for how long these workers use the same HPD until their replacement, including those considered disposable by their manufacturers. The complete survey can be found in Dantas [8].

Based on the answers obtained in the survey, a suspended particle contamination test was proposed, which seeks to simulate the situation of an HPD that remains in an inappropriate place after its use, such as inside a helmet, exposed in the construction environment. This test was performed in two different ways: with and without daily cleaning of the specimens.

The specimens comprised five models of each type of insertable earplug of different national and imported manufacturers, never used before.

This study is focused on the construction industry; therefore, common products of the sector such as concrete, red ceramics, mortar, soil, sand, and sawdust were used in the tests. A mixture with equal parts of 10 g of each contaminated crushed and with granulometry standardised by means of sieve with 18 mesh opening was used. The trials described below are part of the study by Dantas [8].

3.1 Suspended Particle Contamination Test without Hygienisation Process

The purpose of this test is to simulate the exposure of hearing protection equipment to suspended impurities in the environment surrounding the work site over a period of several days. First, the weight of each HPD was determined using a digital scale with an accuracy of 0.0001 g. In a container of approximately 2000 cm³, 10 g of the contaminant mixture was placed. After closing the container, it was shaken for 30 seconds in order to lift the lighter particles. After suspension of the particles, the HPD were inserted into the vessel so that they came into contact with the formed dust without touching the particles accumulated in the bottom, as shown in Figure 2, below. After remaining for one hour inside the container, the HPD were removed and the weights re-measured. This process was repeated for five days, with a 24-hour interval between each contamination and weighing.

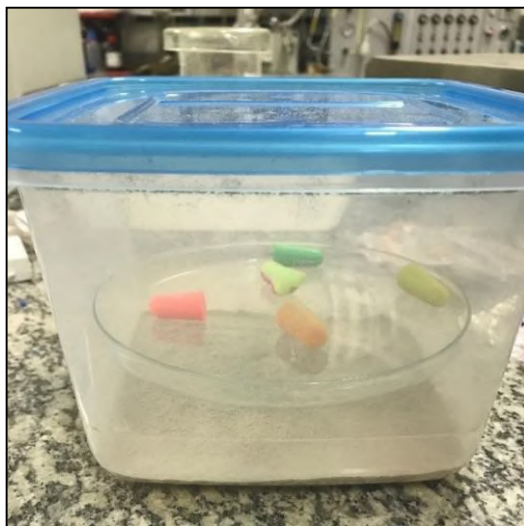


Fig. 2: Test for the dust contamination of ear protectors

The mass gain, represented by the difference between the final and initial weights of the protectors, is due to the accumulation of suspended particles deposited on the surface of the ear protectors inside the test vessel.

3.2 Suspended Particle Contamination Test with Hygienisation Process

The sanitised particle contamination assay was performed in the same manner as in the first step. On each test day, the test specimens were weighed and subsequently placed into the vessel with the suspended contaminant mixture for 40 minutes. After passage through the test vessel, the specimens were weighed again.

The difference in this test is that, after contamination and weighing, the guards went through a standardised cleaning process. The hygienisation process sought to simulate washing with soap and water, which is recommended by most manufacturers. For this, a mixture of 50 mL of distilled water and 5 mL of neutral detergent was used in each wash. Each HPD was inserted into a 100 mL glass beaker containing the blend and agitated by vortexing using a magnetic bar for 30 seconds.

After the sanitisation, the equipment was again weighed in order to verify how much water was absorbed by the material. Finally, the specimens were placed for 24 hours in a greenhouse with controlled temperature and humidity (35°C and 55%) so that the water absorbed in the hygiene process could be eliminated. After the time in the greenhouse, the equipment was again weighed to measure the amount of contaminants that remained adhered to the HPD after the hygiene process.

The cycle described above was repeated for five days, representing the average time of use of the equipment by the workers.

IV. RESULTS AND DISCUSSION

4.1 Survey carried out with civil construction workers

A total of 113 responses were obtained from workers from three different civil construction companies in the cities of Rio de Janeiro and Niterói, state of Rio de Janeiro, Brazil. The sample contained responses from people with different functions, different levels of experience, and different levels of schooling. They were mid-level/technical, fundamental, and with no complete training.

The Survey was divided into three clusters, and the results will be presented in Figure 3, divided as follows:

- Profile of respondents;
- Scenario found in civil construction works related to hearing protection; and
- Habits and perceptions of workers related to the use of hearing protection devices.

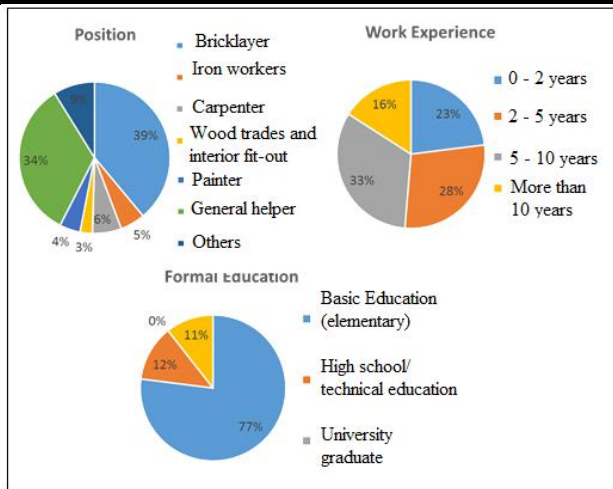


Fig.3: Respondent profile

It should be noted that, at the end of this first cluster, it is possible to verify that the majority of workers in the sample are bricklayers. Most respondents have more than five years of experience in the field and the most common training among respondents was full elementary education. Thus, it is noted that the sample actually reached the desired audience in the survey, which were the professionals who work directly in the operational part of civil construction works.

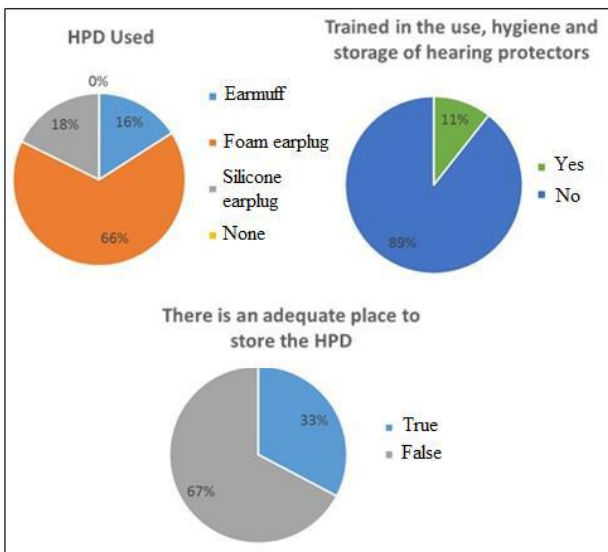


Fig.4: Scenario found in civil construction works related to hearing protection

As can be seen from the graphs depicted in Figure 4, above, the most commonly-supplied HPD are foam and silicone earplugs. None of the respondents stated that they did not receive hearing protection equipment from their company.

Training is a major segmental failure point—89% of respondents reported having not been trained in the use, hygiene, and storage of hearing protectors.

Finally, the third question in this cluster referred to the existence of an adequate place to store the HPD when not in use. This statement was answered as false by 67% of the respondents, so a large number of workers do not have a clean place to store the equipment after use. This means that the HPD end up being stored in pockets, cabinets, drawers, tied to the helmet, and other places that are subject to contamination by the work environment. When they use the dirty protector again, the contaminants can come into direct contact with the auditory canal of these workers.

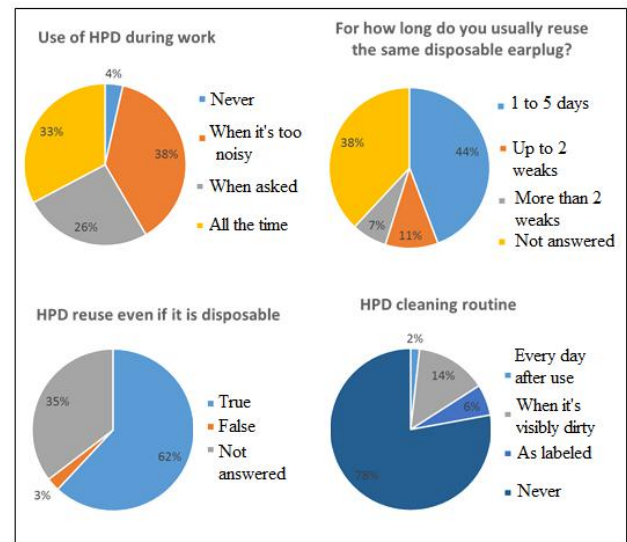


Fig. 5: Habits and perceptions of workers related to the use of HPD.

The third and last cluster (Figure 5) aimed to capture the behaviour of the civil construction worker. It can be seen that the vast majority of respondents only use the HPD when they perceive some loud noise. This fact demonstrates that the safety culture is not yet fully integrated into the day-to-day work of construction workers.

Regarding the time they use the disposable protector until it is replaced, 44% reported that they use the same equipment for one to five days, 11% for up to two weeks, and 7% for more than two weeks of work. Respondents who did not use the disposable HPD had their responses described as "not answered" in the graphic. Considering only the valid answers, that is, the workers who use the disposable HPD, the percentages go up to 71% who use the equipment for one to five days, 17% who use it for up to two weeks, and 11% for more than two weeks of work. The vast majority of respondents, 78%, admitted that they never clean the HPD and only 2% reported washing the equipment daily after use. The percentage of respondents who never do the HPD sanitisation or do so only when they visually notice that the equipment is dirty, is very high, 92% of the sample analysed. This fact may also be

directly related to the lack of training and guidance. Examining only this group, it is noticed that the percentage that never received training is 98%.

4.2 Results of laboratory tests

4.2.1 Suspended particle contamination test without cleaning process

For the results, the arithmetic mean of the values obtained for the three different test specimens of each manufacturer was considered. The complete tables of results for this assay can be found in Dantas [8].

It is possible to observe that all the protectors presented an average weight gain between 0.98 and 1.47% of the initial weight, with each test day. The total weight gain was 6.19% between the first and the last test day, representing a mean aggregation of 0.031 g of contaminants on the mouldable protectors during the period.

Analysing the graphs shown in Figure 6, it is also possible to notice that models 2 and 5 were the ones that had the greatest addition to their initial masses: 6.44% and 6.25% gain, respectively, during the five days of tests. These percentages, however, are not far from those observed for the other models, which remained close to 6%.

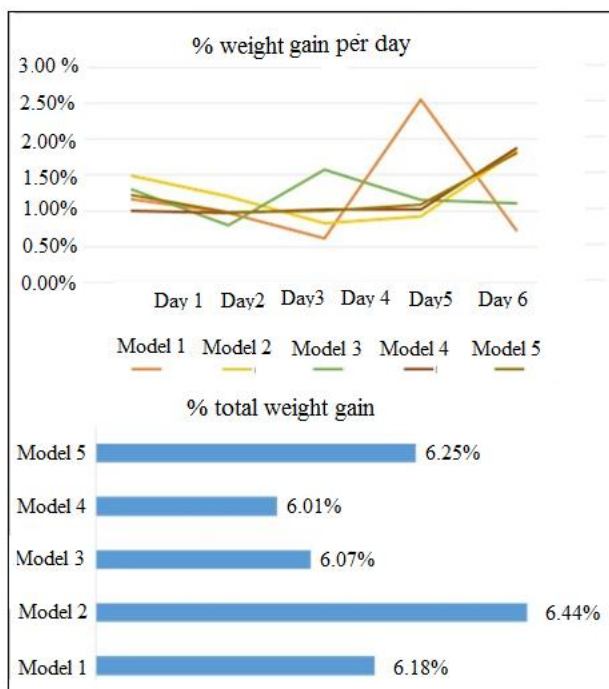


Fig. 6: Results of the mass gain tests of contaminants

4.2.2 Suspended particle contamination test with cleaning process

For the results, the arithmetic mean of the values obtained for the three different test specimens of each manufacturer was considered. The complete tables of results for this assay can be found in Dantas [8].

On average, the water uptake by the test specimens was similar, close to 15% of their weights after passage through the contaminant box. This absorbed water mass

was eliminated by drying the specimens in an oven for 24 hours. The final calculations of the amount, by weight and mass percentage, of contaminants added to the test specimens at the end of the test days are shown in the following table 3.

Table.3: Final results of the suspended particle tests with cleaning process for foam earplugs.

FINAL RESULTS: DAY 5 X DAY 1			
Model	Final Weight (g)	Total Aggregation (%)	Total Aggregation (g)
1	0.4044	5.72%	0.0230
2	0.6266	7.12%	0.0420
3	0.4901	4.06%	0.0194
4	0.5932	5.02%	0.0288
5	0.5572	5.87%	0.0315
Mean	0.5343	5.56%	0.0290

It is possible to verify, from the results presented in the tables, that despite cleaning, all of the protectors showed mass gain. This increase at the end of the five test days varied between 4.06 and 7.12% more than the initial weight of the specimens. The mean total gain was 5.56% between the first and last test day, representing a mean aggregation of 0.029 g of contaminants in the mouldable pads during the period.

It is noted that the aggregation of material to the protectors was very similar to the result obtained without daily cleaning of the same, which was 0.031 g on average (Figure 7).

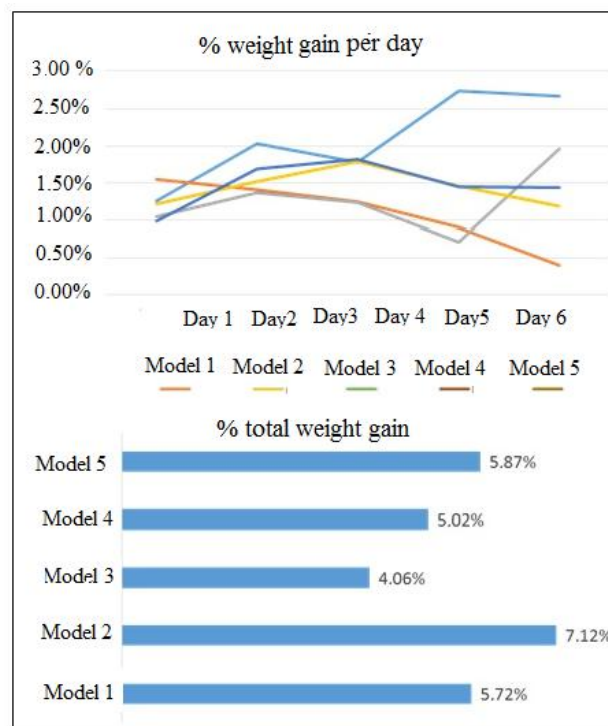


Fig. 7: Results of the cleaning of contaminated samples

4.2.3 Comparison between HPD contamination results with and without cleaning process

Based on the assumption that the hygiene process of the hearing protection equipment has the purpose of removing the accumulated contaminants, it was expected that, after drying, the weights of the specimens would be similar to those before the passage through the chamber of solid particles; that is, the protector would have its mass increased by the accumulation of the solid particles on its surface, but after cleaning and evaporation of the accumulated water, it would return to some value close to its original weight as these particles would have come off during washing. Following the logic of this reasoning, at the end of the five test days, the equipment would present a mass gain much lower than those that did not go through the hygiene.

However, this was not the behaviour presented by the specimens that were submitted to the cleaning process. They reached increases of mass similar to those that were not washed after exposure to dust, as can be seen in the comparative graph of Figure 8, below.

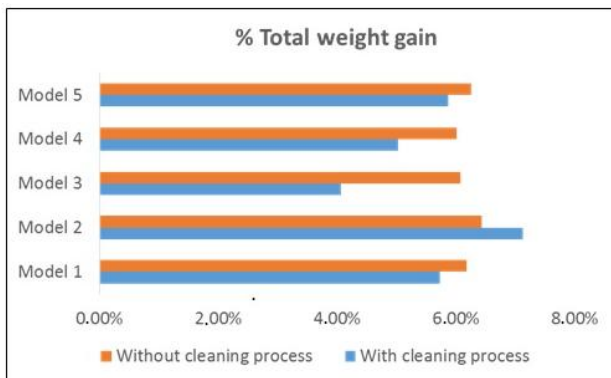


Fig. 8: Comparison of results with and without sample cleaning

Finally, based on the tests carried out, it is possible to admit that the dust present in civil construction when adhering to the ear protectors, when not removed, can cause problems in the auditory canal and consequently hearing diseases as shown in the diagram in Figure 9.

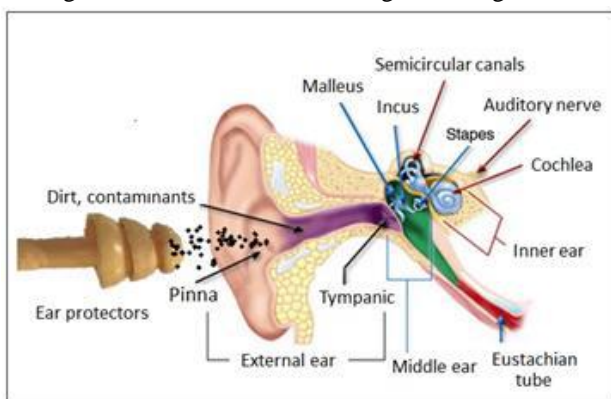


Fig. 9: Diagram of contamination of ear of worker

V. CONCLUSION

It should be noted that the worker's education level influences his or her concern with work safety norms and, consequently, the use of HPD during working hours. It was also an influence factor in the responses of the experience time in the function. Among the workers who do not use hearing protection, we highlight the group of professionals with little experience, 0 to 2 years, and those with more than 10 years, where the change of habit is more difficult. For example, many of these workers use phrases such as "I have always done so."

In the laboratory tests, the equipment gained mass when exposed to the contaminants found in civil construction. This fact evidenced the need for training regarding the hygiene of the hearing protector. This item is of concern, as the survey revealed that 89% of respondents do not have training in the correct use, hygiene, and custody of the HPD.

Regarding the performance of the moulded auditory protectors in the tests, it was verified that, even though they went through the washing process, the equipment also had an increase in mass. This fact demonstrates that sanitation decreases but does not eliminate the contamination of the equipment. This can be explained by the porous material of which the foam protectors are formed. The water carries the solid particles into the foam cavities, where they settle more and more deeply until the cleaning process is not able to eliminate them.

Based on the results of the surveys and trials, it can be concluded that the mouldable insertion hearing protection equipment is efficient in relation to the noise attenuation and protection of the hearing of the workers. However, the way they are used and sanitised can influence the contamination of these protectors, and both a lack of information from the manufacturers and little or no training of the workers on these factors were noted.

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Brazilian Companies and the Grade of Investment

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Abstract— This study is featured in the context of applied typology, of descriptive goal with bibliographic outlining, in the extent of the issue it is features as quantitative, comprising the population of 70 Brazilian corporations recognized by the international certifying agents Standard & Poor's, Moody's and Fitch Ratings, which held the corporate investment grade in the year of 2012. Regarding the goal, the scope of this study was the development of an economic and financial indicator aiming to delimit the investment grade that companies present in their corporate structures, through a set of economic and financial indexes linked to liquidity, profitability, debt, and yield, from economic and financial demonstrations of the corporations studied.. The conclusions of the study were based in the results presented by the evolution of the statistical treatment, which were shown to be consistent for the model developed. The reliability of the model of corporate investment grade from the factorial analysis was testified by the Cronbach's Alpha coefficient that presented value of 0.768, therefore indicating satisfactory consistence to the study.

Keywords— Investment Grade. Indicator. Corporations.
Scientific Area: Corporate Finance.

I. INTRODUCTION

The economic development goes through the constant evolution of corporations that generate employment, income, and development, under this competence the State, which gets resources from all institutions that are directly or indirectly in its control, is maintained through this juncture and seeks to socialize resources so they will return to this producing society in the form of benefits.

A developed economy necessarily involves consistent corporations, so the investment grade takes on importance in the economic context in view of the attractiveness of new corporate investments generating new ventures, thus leading to a complete economic development. The investment grade may be seen as synonym for strong economy, because it reflects the financial and economic situation of the corporations that support the internal market.

Generically, individuals think and speak about economy during much of their time, because economy consists in millions of people involved in many activities such as buying, producing, working, selling and distributing.

The economic gear is developed by economic agents, who are natural or legal persons that contribute to the functioning of the economic system, through their actions.

In one hand, corporations produce and sell goods and services, on the other hand, individuals as consumers who are, at the same time, owners of productive resources provide corporations with production factors such as: labor, land, capital, and business capability, receiving salaries, rents, interests, and profits in return. With these yields they acquire new goods and services produced by corporations, so moving wealth generation.

In a globalized and competitive economical context, organizations need to evolve in order to follow the changes the environment imposes, seeking sustainability and perpetuity. As the rhythm of changes increases, the durability of business strategies decreases, causing the need for uninterrupted transformations with permanent restructuring processes.

In this context, economic and financial instruments play relevant importance to decision making, hence, the proposal of building an economic and financial indicator that aims to analyze and assess the investment grade of a corporation meets on the actual moment in which information and decision are united within the process of development and assertion in the market, and on the other hand, the pressure for self-sustainable development in national and international markets is not lower.

II. THEORETICAL REFERENCE

With crescent enterprise competitiveness, along with business dynamics boasted by globalization of economy, it has been observed the increase of the need for measures that better prove economic positions and the organizational performance. However, it is noteworthy that the performance of an organization may suffer economic

interferences from governmental politics, which could cause modifications of strategies and other difficulties to achieve goals (Sims, 1980).

Facing that “companies are rediscovering traditional indicators in the field of economy and finances, however formulated in a very modern and sophisticated mode, globally spreading their use” (Assaf Netto, 2002, p. 206).

2.1 – INVESTMENT GRADE

Regarding contemporary international finances dominated by a system determined by markets (*market led finance*), in the view of Prates and Farhi (2009), the agents’ need for information has considerably widened. The generalized access to information, especially the one that allows assessing financial solidity and corporations’ risks, began to play a crucial role.

Many mechanisms that seek to lessen asymmetries of information have been developed. First, private companies were created (*Credit Rating Agencies*) with the specific goal to provide comparative indicators of the risks of a universe of debt instruments (credit risks classifications) of businesses and, later, of countries, which sought to obtain resources in financial markets (Lyon, 2009).

Its development reached exponential rates from the 1970’s on, with the process of financial internationalization and securitization of public and private debts. It returned to be emphasized with the expansion of securitization of credit assets (*asset backed securities*) and with the approval and implementation of the Basiléia II agreements, which incorporated the ratings of determined agencies in the rules of bank credit risks assessment.

The accomplishment of the investment grade by international certifying rating agencies is still a landmark for corporations or countries, once an emission classified as investment grade will have easier access to credit at lower costs (Prates, Farhi, 2009).

As an effect, many corporations, by means of status, may only invest in assets considered low risk. However, the performance of these agencies depends a great deal on their reputation. Such reputation was seriously shaken in performance at the 1997 Asian crisis, in the episodes of fraudulent accounting of corporations such as Enron and WorldCom in 2001/2002, as well as at the subprime loans crisis, which may lead to significant changes in its importance and/or its operation (Cantor, Parker, 2005).

The financial market, especially the international, became so more integrated, facilitating resources transference, either for speculative or commercial purposes. Therefore, investors who apply their savings in public or private securities, move resources globally, should value to know the risks assumed in each operation.

These investors not always have time and money available to perform the collection of macroeconomic, sectorial, or even corporation data, which would certainly decrease the barriers of their resources. This work is supplied by risk agencies, which are institutions that search and analyze information about different kinds of credit titles in different parts of the world and classify the risks of each one of investments. Thus, investors that adopt risk classifications from agencies do not need to worry in performing a detailed data collection to execute their operations, they just have to read the reports and observe the notes provided by the agencies for a decision making of investment, since they do not have yet an indicator that can provide a tendency of credibility for the investment.

The title of “good payer” is given to companies and countries through the investment grade. The name references to a quality stamp that indicates really low risk of non-compliance. Companies or countries, once they received the investment grade, may obtain better credibility references in the market. Specialized companies that operate worldwide concede this classification; the three risk classification agencies with greater visibility are *Standard & Poor’s Service*, *Moody’s Investors Service* and *Fitch Ratings* (Ferreira, 2010).

These companies provide the risk classification service, promoting a rating to a certain debtor. A rating, according to Hill (2004), is seen as an opinion of the certifying agency regarding quality, especially credit liquidity, which tries to estimate the future default probability, or the non-payment of financial obligation. Therefore, rating does not concern an indication of purchase, sale or maintenance of any asset.

The rating activities have been developed by many agencies 1909, when John Moody founded the first agency, the *Moody’s Investors Service*. Later were founded the *Standard & Poor’s* in 1916 and the *Fitch* in 1924 (Hill, 2004). The ratings are divided in sovereign and corporate investment grades.

2.1.1 – Sovereign investment grade

The most widespread mode of risk calculated by risk agencies is the sovereign risk that aims to assess the debt paying capacity of a country. Agencies classify paying capacity of countries assigning them a determined score, which is inserted in some grade.

Governments with difficulties of honoring their compromises may receive scores situated in the speculative grade; as for countries with good paying capacity they receive scores inserted in the investment grade. This grade division is important because according to Vieira (2008, p.3), “there are pension funds in many countries, especially Asia and Europe, which may only apply in markets that already count on the investment grade.

There is not any ready formula to determine the probability of non-compliance of a government, the sovereign credit rating is considered most important and the one that causes greater effect on the financial market. Cantor and Packer (2005, p.38), explain this importance: Sovereign ratings are important not only because some of the greatest operators in the international capital market are national governments, but also because their announcements affect the ratings conceded to loan borrowers from the same nationality.

When announcing a change of any score in sovereign rating, risk agencies discuss, even if briefly, about the reason for that upgrade. According to Gomes (2008), the difference between the rating of sovereign credit or sovereign risk and the country-risk is based on the fact that the country-risk is the difference of bond yields of a country from the so-called risk-free rate. The market considers as risk-free rate the rate paid by the United States treasury. The sovereign risk is nothing more than the opinion of risk agencies on the quality credit of the country. It has a long-term feature, being only influenced by the short-term changes if these affect the juncture in the

long-term. However when it comes to country-risk, it is a lot more vulnerable to short-term changes. Although they are two completely different concepts, they are correlated. If the sovereign risk is very low, that is, if the country presents good conditions of honoring its commitments, it is probable that the country-risk is also low. The sovereign investment grade may influence the corporate investment grade, for its credibility relevance to corporations.

2.1.2 – Corporate investment grade

Corporations are classified in a scale that goes from high probability of non-compliance to the total capacity of paying debts within the deadline. Technically, they are arranged in a ranking with scores and are grouped in categories, divided in investment grade and speculative grade. The best qualification that a corporation may achieve is Aaa (for *Moody's*) or AAA (for *Standard & Poor's* and for *Fitch*, as they use the same symbols). On the other hand, the worst is C (*Moody's*) or D (*Standard & Poor's* and *Fitch*). Figure 1 shows the risk scale used by companies.

Fig.1: Used risk classification

Scale of agencies' global ratings			
Moody's	Fitch Ratings	Standard & Poor's	Meaning
Aaa	AAA	AAA	Highest quality
AA	AA	AA	High quality
A	A	A	Medium/high quality
Baa	BBB	BBB	Medium quality
BA	BB	BB	Predominantly speculative
B	B	B	Speculative, low classification
Caa	CCC	CCC	Close default
C	C	C	Lowest quality, no interest
	DDD	DDD	Defaulting, overdue, questionable
	DD	DD	Defaulting, overdue, questionable
	D	D	Defaulting, overdue, questionable

Source: *Standard & Poor's, Moody's and Fitch Ratings* (2008).

Agencies practically use the same system of equivalent letters and signals. Thus, the best classification a country may obtain is Aaa (*Moody's*) or AAA (*Standard & Poor's*), which conceptually mean “extremely strong capacity of meeting financial commitments”. In the opposite edge, a bond classified as “C”, for *Standard & Poor's* or *Moody's*, has a very high risk of not being paid. The “D” classification is assigned by *Fitch Ratings* and by *Standard & Poor's* regarding default.

It is admitted that the market does not create a consensus around companies that might become investment grade and also does not declare this expectation such as in the assessment of countries. However, since the analysis is done case by case, an observation of the

company's characteristics may indicate whether the company is on track for that and serves as a warning to the investor market. The investor must be aware to the credit quality of the company regarding its local currency, as well as the international markets juncture. Carvalho (2008) explains that specialist state that this is the first analysis to be done because the company may have different scores in local and foreign currency and the investment grade in local currency is needed before receiving it in foreign currency. Furthermore, it is imperative to evaluate how the transparency of this corporation in the market is presented and if it has conditions of honoring the commitments, local and international.

With the investment grade classification, corporations are considered more reliable and, therefore, may obtain funds at lower costs, generating benefits to their economic and financial results. According to Freitas (2006), classifying agencies of corporate investment grade consider to its achievement, that they must combine many factors, among which are: capacity for cash flow generation, liquidity grade, stable debt, profitability compatible to yield, position of leadership in the market, costs competitiveness, significant volume of exportation, favorable scenario of demand of its main products, among other factors.

One of the factors that help creating higher demand for the role of these corporations, and consequently, greater appreciation potential, is their inclusion in the range of options of foreign funds which can only negotiate shares from companies with investment grade. For that, analysts state to be a good investment option to bet in companies with high investment grade or that are close to achieving it.

According to Albanez and Valle (2009) high-risk corporations tend to be less indebted, since the higher the risk, the higher the probability of default, as well as the reduction of their funding capacity.

According to Rogers (2008) companies that improve their debt situation and start to negotiate shares on the new market are well regarded by foreign investors. This may be the first step, since the investment grade title is a consequence to the company that was already demonstrating these characteristics. When a company

reaches the investment grade, it represents low credit risk and reduced vulnerability. The main drive for companies to achieve a better classification of their debt is based on cost reduction for fund raisings, still with the ongoing pressure of competitiveness increase, especially comparing to international competitors. Companies that gained the investment grade start to access the market differently. All companies seek the classification because it represents a competitive advantage in the way they are financed.

To achieve the investment grade, a corporation needs to basically prove that it has conditions to honor its commitments with external and internal markets despite of government moves. Receiving the investment grade is just a start point to corporations. The improvement in capital structure and improvement of investors' interest does not happen overnight.

Over the last decades important changes happened regarding corporation management, such as the productive restructuring, aiming higher profits and therefore improved yields. Among these changes, there is the spreading of the certification process, in which corporations try to inform and signal consumers that are meeting quality standards and rules expected by the market, presenting a brand or stamp given by an assessment body.

Besides countries, corporations also receive the so-called investment grade. In the year of 2008 base of this article, there were 70 Brazilian corporations that presented the "stamp of approval" certification, in at least one of the agencies. Figure 2 presents this group.

Fig.2: Brazilian companies that presented the investment grade in 2012

Fitch Ratings Corporations	Standard & Poor's Corporations	Moody's Corporations
Aracruz Celulose S.A. Indústria Florestal	Aços Villares S.A.	B2W – Companhia Global do Varejo S.A.
Natura Cosméticos S.A.	Cosan S.A. Industria e Comercio Agroindústria	Bandeirante Energia S.A.
Gerdau S.A.	Cimento Tupi S/A	Brasil Telecom S.A.
Braskem S.A.	AES Sul Distribuidora Gaucha de Energia S.A.	Cemig Distribuição S.A.
Rio Grande Energia S.A.	Andrade Gutierrez Participações S.A. Engenharia e Construção	Duke Energy Int'l Geração Paranapanema S/A
Camil Alimentos S.A.	BR Malls Participações S.A.	Magnesita Refratários S.A.
Companhia de Bebidas das Américas (AmBev)	MAXITEL S.A.	Sadia S.A.
Construtora Tenda S.A.	Camargo Correa S.A.	
Duratex S.A.	Companhia Siderúrgica Nacional (CSN)	
Amil Participações S.A. (Amil)	ALL - América Latina Logística S.A.	
GOL Linhas Aéreas Inteligentes S.A.	Bertin S.A.	
Lojas Americanas S.A.	Diagnósticos da America S.A.	
Minerva S.A.	Gafisa S.A.	

Trisul S.A.	Globo Comunicação e Participações S.A.	
Construtora Norberto Odebrecht S.A. - CNO	Iguatemi Empresa de Shopping Centers S.A.	
Petróleo Brasileiro S.A. - Petrobras	Imcopa Importação, Exportação E Industria De Óleos S/A	
Redecard S.A.	J. Macedo S.A. Produtos Alimentícios e Afins	
Suzano Papel e Celulose S.A.	Klabin S.A.	
TAM S.A.	Forjas Taurus S.A.	
RBS Comunicações S.A.	Localiza Rent a Car S.A.	
Unipar – União de Indústrias Petroquímicas S.A.	Lupatech S.A.	
Vale S.A.	MRS Logística, S.A.	
Fabricas de Alimentos Vigor S.A.	MRV Engenharia e Participações S.A.	
Wtorre S/A.	Eletrobras – Centrais Elétricas Brasileiras S.A.	
Votorantim Celulose e Papel S.A.	Net Serviços de Comunicação S.A.	
Votorantim Cimentos S.A.	PDG Realty S.A.	
Unidas S.A.	Rossi Residencial S.A.	
	Santher-Fábrica de Papel Santa Therezinha S.A.	
	Santos Brasil Participações S.A.	
	Tecnisa S.A.	
	Tele Norte Leste Participações S.A.	
	Telemar Norte Leste S.A.	
	Ultrapar Participações S.A.	
	Usinas Siderúrgicas de Minas Gerais S.A.	
	Vanguarda do Brasil S.A.	
	Vivo Participações S.A.	

Source: Research data.

Through the analysis of Figure 2 it is noted that in 2012 there was already a significant number of Brazilian companies that presented the investment grade, showing the importance of this factor.

With the goal to develop an investment grade indicator, it has to be based on the analysis of economic and financial indexes made by liquidity indexes, *Ebitda* adjusted profitability, yield and corporate debt, which are part of the set of economic and financial quotients responsible for reflecting the performance of an organization.

With changes occurred mainly from the 1980's on, organizations entered a new context featured by an open and dynamic market in which competition and changes were intensified, especially regarding technology (Gomes, Salas, 1999).

Leidfried and McNair (1994) state that organizations began to promote product alterations, managerial processes and techniques, so these were not an

option anymore, but a survival mode. Facing this reality comes the need for new indicators, since they can contribute to the permanence of companies.

One of the challenges for organizations regards to the use of appropriate measures in the business assessment process. Gomes and Salas (1999) mentioned that using inadequate measures damages the performance assessment process of organizations, considering the environment they are inserted in and the risks involved in the process. Therefore it is necessary to establish criteria for economic and financial analysis.

2.2 – ECONOMIC AND FINANCIAL INDEXES

The creation of an economic and financial index that contemplates the investment grade was based in studies performed regarding the issue, reinforced by the observation of inexistence of such indicator. The last decades experienced important changes regarding global economy, corporation management, with the example of

the productive restructuring, new ways to manage a business, aiming the process of financial globalization.

Currently, according to Wernke and Lembeck (2004), the professionalization of corporation management has increasingly demanded economic and financial models able to produce useful and relevant information to support the decision by which the corporate investment grade is extremely relevant.

Regarding the economic market, it is observed that there is not a consensus when it comes to corporations that might become investment grade, without any open expectation about it as it happens in the assessment of countries. However, since the analysis is done case by case, an observation of the corporations' features may indicate if the company is on track to achieve the investment grade.

Facing this scenario, the analysis focus of this article is based on the economic outcome, yield, debt, and cash flow, considering that an organization that aims perpetuity in business must maintain its operational results from end activities positives, so being able to maintain its income, attracting investors and generating dividends. These indexes are literally known as profitability, yield, debt, and liquidity indexes.

These variables may provide increased cash flow capacity where the results are reinvested on the operational structure, causing new outcomes and, therefore, keeping the business' liquidity, which in turn will generate liabilities that will decreasingly compromise the capital structure. Thus, indexes that serve as base to the creation of an investment grade indicator are treated individually, them being: liquidity indexes, profitability indexes, debt indexes, and income indexes, based on quotients of immediate liquidity, current ratio, quick ratio, Ebitda, solvency, asset turnover, total debt, net equity debt, asset income, and net equity income.

III. METHODOLOGY

Concerning methods and procedures, firstly the correlation analysis was used, which according to Corrar, Paulo and Dias Filho (2009) is a measure that shows the relationship level between two variables. This analysis shows the relationship level between variables, providing a number, indicating how variables range jointly. There is no need to define the relations of cause and effect, or, which one is the dependent or independent variable. The method usually known to measure the correlation between two variables is the Pearson's Linear Correlation Coefficient, also known as Product Moment Correlation Coefficient. This was the first correlation method, studied by Francis Galton and his student Karl Pearson, in 1897 (Schultz, Schultz, 1992). This correlation coefficient is used in the Principal Components Analysis, Factorial Analysis, Reliability Analysis.

This study used the base of corporations recognized by the international certifying agencies, *Standard & Poor's*, *Moody's* and *Fitch Ratings*, which had the investment grade in 2008, with random choosing of 11 indexes linked to the cyclical economic and financial structure, covering aspects of liquidity, profitability, debt, and income.

The model was construction base the confirmatory factor analysis, which is a method used to investigate the dependence of a set of variables expressed in relation to a smaller number of latent variables. It concerns to a technique of multivariate statistics analysis created to identify structures within sets of variables observed (Hair. *et al.*, 2005).

This analysis is applied at the moment there is a large number of correlated variables, with the objective to identify a smaller number of new alternative variables, not correlated and that, somehow, summarize the main information of the original variables finding the factors or latent variables (Mingoti, 2005).

IV. DATA DESCRIPTION AND ANALYSIS

This chapter presents the Pearson's correlation analysis and the factorial analysis.

4.1 – FACTORIAL ANALYSIS OF INDEXES ANALYZED

To justify the use of factorial analysis one must have a substantial number of correlated variables. Pearson's correlation matrix (Chart 3) aims to show the number of correlated variables and indicate the possible use of factorial analysis. The correlation matrix (Pearson) predominantly shows weak correlation among many variable indexes (indexes under 0.3), however, statistically considerable ($p < 0.05$).

According to Johnson and Wichern (2002), one of the objectives of factorial analysis is the combination of variables that create new factors, constructs, or analysis dimensions. These variables, according to Lachenbruch (1985), are grouped because of their correlations. Hence, the goal was to, facing the application of the factorial analysis technique, replace the initial set of 11 indexes by a smaller number of factors, maintaining a meaningful explanation for the original variables, so to indentify the latent dimensions of the phenomenon.

In this study, the *Kaiser-Meyer-Olkin Test (KMO)* and the *Bartlett Test of Sphericity (BTS)* were applied. The KMO tests the adequacy of the factorial analysis use. If the correlation between the tested variables is small, or, the result of the KMO test is close to 0, the use of the factorial analysis is inadequate. On the other hand, if this value is close to 1, the factorial analysis may be employed. Thus, it indicates the level of data explanation from the factors found in the factorial analysis. The test verifies if the

correlation matrix in an identity matrix, which would indicate that there is no correlation among data. According to Hair Jr. et al. (2005), a practical significance criterion is met at an assumed level of significance of 5% and rejects the hypothesis of identity correlation matrix. In all reported cases, the samples showed to be inadequate to the factorial analysis application ($KMO > 0.5$). However, the *Bartlett Test of Sphericity (BTS)* verifies the hypothesis that the correlation matrix is an identity matrix (diagonal equals 1 and all other measures equal zero), in other words, there is no correlation between variables (Pereira, 2001).

The *Bartlett Test of Sphericity* is used to analyze the correlation matrix as a whole. Noronha (2005) states that the null matrix of this test stresses the fact that the correlation matrix is equal to the identity matrix, or that there is not enough correlation between variables, it is

recommended this significance value to be smaller than 0.05.

In the factorial analysis, the correlation-rotated matrix was used; it is also known as Varimax Rotation with Kaiser Normalization, using the *Statistical Package for the Social Sciences (SPSS)* software version 16.0. The intention is that, through this process, for each main component there are only a few significant weights and all others are close to zero, through the maximization of variance among the factors to the factorial matrix rotation (Malhotra, 2006).

KMO and Bartlett tests – base indexes

Table 1 presents the results of the KMO and Bartlett tests obtained in the first analysis performed with the 11 (eleven) initial variables.

Table.1: KMO and Bartlett results – studied variables

Test	Value Found	
Kaiser-Meyer-Olkin	0.572	
Bartlett Test of Sphericity	Approximate Chi-square	743.198
	Significance	0.000

Source: Research data – SPSS program

The KMO test indicated an explanation level of 0.572 among factors and variables, which therefore are valid in the view of Malhorta (2001) ($KMO > 0.50$). However, the Bartlett Test of Sphericity indicates if there is enough relation among indicators to the factorial analysis application. For this to be possible, it is recommended that the significance value is smaller than ($Bartlett < 0.05$) and in this case, was ($p = 0,000$) (Hair. et al., 2005; Pereira, 2001).

Communalities Calculation – base indexes

According to Hair et al. (2005), communalities represent the amount of variance explained by the factorial solution for each variable, in order to indicate the importance of every variable within the model, and the total variance explained by each component. It must be evaluated if the communalities meet the explanation levels considered as minimum acceptable over 0.50. Table 2 shows the respective values:

Table.2: Communalities Calculation – base indexes

Indexes	Initial	Extraction
Total Debt	1.000	0.899
Immediate Liquidity	1.000	0.693
Asset Income	1.000	0.825
Profitability	1.000	0.889
Current Ratio	1.000	0.914
Quick Ratio	1.000	0.915
Overall Ratio	1.000	0.511
Solvency	1.000	0.753
Net Equity Debt	1.000	0.782
Net Equity Income	1.000	0.862
Asset Turnover	1.000	0.858

Source: Research data – SPSS program

By Table 2 it is noted that most indicators got a high explanation power, considering all factors obtained,

only the overall ratio presented a small value (0.511). It is observed that the initial communalities were 1 and for the

extracted factors, the variance percentage of each indicator explained by the common extracted factors is superior to 69.30% for all indexes. By the communalities matrix it is noted the important influence of variables of debt, income, profitability, and liquidity ratios used as bases in the model.

Kaiser-Meyer-Olkin Test and Bartlett Test of Sphericity – adjusted indexes

Although the BTS test indicates the possibility of application of the factorial analysis to the analyzed

variables, it was preferred to increase the explanation power of factors removing the overall ratio indicator (0.511), searching a better association between the analyzed variables, for there are other indexes within the base of study, which will certainly not damage the analyzed context. Thus, the indexes with 10 (ten) variables were recalculated, so the *Kaiser-Meyer-Olkin* test and the *Bartlett Test of Sphericity* were composed as shown in Table 3.

Table.3: KMO and Bartlett results – adjusted indexes

Test	Value Found
Kaiser-Meyer-Olkin	0.728
Bartlett Test of Sphericity	Approximate Chi-square
	Significance
	1423.746
	0.000

Source: Research data – SPSS program

The KMO test presented a significant improvement going from (0.572) to (0.728), therefore the factorial analysis is an adequate technique to be applied to the data of this research, as confirmed by Pestana, Gageiro (2005), and Malhorta (2006). For the Bartlett Test of Sphericity, a significance level of $p = 0.000$ was found, inferior to the significance level of 0.05, guaranteeing the rejection of the hypothesis that the correlations matrix is an identity matrix, showing, therefore, that there is

correlation among variables, and factorial analysis may be used.

Communalities Calculation – adjusted indexes

New communalities were calculated and presented in Table 4. The initial communalities were 1 and for extracted factors the variance percentage of each indicator explained by common extracted factors is superior to 70% for all indexes.

Table.4: Communalities Calculation – adjusted indexes

Indexes	Initial	Extraction
Total Debt	1.000	0.891
Immediate Liquidity	1.000	0.714
Asset Income	1.000	0.950
Profitability	1.000	0.879
Current Ratio	1.000	0.890
Quick Ratio	1.000	0.937
Solvency	1.000	0.739
Net Equity Debt	1.000	0.920
Net Equity Income	1.000	0.886
Asset Turnover	1.000	0.854

Source: Research data – SPSS program

Once the adequacy of the factorial analysis was found for the statistical treatment of the financial indicators studied and their internal consistency, the factors were identified through the method of principal components analysis, which transforms a set of variables in a new set of composed variables that are not correlated by the common extracted factors superior to 71.40% (Cooper and Schindler, 2003).

Table 5 presents the proper values for each factor (principal component since the method of principal

components was used to extract factors) and the percentage of the explained variance. With the removal of the overall ratio index, the explanation power was improved, going from a minimum original value of 69.30% to 71.40%. It is noted that from the 10 (ten) indexes, 80% of them are above 85% of the explanation power. For defining the number of factors, which had not been previously defined, Table 5 is presented:

Table.5: Eigenvalues

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.953	39.531	39.531	3.953	39.531	39.531	2.813	28.126	28.126
2	2.264	22.638	62.169	2.264	22.638	62.169	2.561	25.607	53.733
3	1.403	14.033	76.203	1.403	14.033	76.203	1.880	18.799	72.532
4	1.041	10.413	86.616	1.041	10.413	86.616	1.408	14.083	86.616
5	.625	6.253	92.868						
6	.397	3.970	96.838						
7	.187	1.866	98.704						
8	.054	.541	99.245						
9	.050	.500	99.745						
10	.026	.255	100.000						

Source: SPSS - Extraction Method: Principal Component Analysis

According to Hair et al. (2005) it is only considered those, which present eigenvalue superior to 1. Hence, 4 factors were considered, once they explain 86.63% of the data variance. After an eight stages

procedure, the identified factors and respective eigenvalues were obtained, which are found in the following Table 6:

Table.6: Identified factors and respective eigenvalues

Factors	Eigenvalues		
	Total	% of Variance	% Cumulative
1	2.813	28.126	28.126
2	2.561	25.607	53.733
3	1.880	18.799	72.532
4	1.408	14.083	86.616

Source: Research data – SPSS program

The eigenvalues, eigenvectors length, corresponding to its importance for the explanation of the total data variance, in this thesis meant 86.63%. Later, the “Scree” graphic, developed by Catelli was analyzed, where the number of factors was confirmed (Litwin, 1995).

Aiming to get a better interpretation of factors, the Varimax rotation was chosen because it assesses the maximization of the variance squares of loaded factors,

according to Johnson and Wichern (2002), it reduced the number of variables presenting high loads over one factor (Malhotra, 2006).

Hence, after 5 interactions, there was a reduction of number of 10 variables in 4 factors or analysis dimensions. The factors found, as well as the attributes belonging to each one of them and their respective factorial loads, are presented in Table 7.

Table.7: Factors and loaded factors of indexes

Indexes	Identified Factors			
	1	2	3	4
Total debt	0.802	-0.112	-0.483	0.011
Solvency	-0.642	0.084	0.558	-0.096
Net equity debt	0.953	-0.049	-0.036	-0.093
Net equity income	0.869	-0.111	0.012	0.344
Immediate liquidity	0.014	0.840	0.006	-0.093
Current ratio	-0.148	0.927	0.068	-0.062
Quick ratio	-0.114	0.951	0.092	-0.105
Profitability	-0.093	-0.014	0.858	0.367
Asset turnover	0.169	-0.169	-0.768	0.452
Asset income	0.108	-0.170	0.037	0.953

Source: Research data – SPSS program

The first factor (F1) was responsible for 28.126% of variances. It is composed by the total debt, net equity debt, net equity income, and solvency. It is noted that the factor is predominantly linked to debt indexes because it presents greater factorial loads. The factor proves debt commitment regarding the investment, as well as the reflex in its premium. For this reason the name of this factors is “DEBT”. The solvency index is negative, therefore moving in opposite direction from the other indexes indicating that the higher the debt the lower the solvency, and this situation is basically a standard within the context of financial economy.

The second factor (F2) that explains 25.607% of the total variation is composed by indexes of immediate liquidity, current ratio, and quick ratio according to Table 8. The great correlation among the variables mentioned can be explained by the fact that all of them refer to corporations’ liquidity. This factor shows the base of the financial situation of a company, and if it offers a good base for payment of its current obligations. Due to this, the second factor was denominated “LIQUIDITY”.

The third factor (F3) explains 18.799% of the total variation and is made by profitability and asset turnover. Both indexes are linked to the corporation’s performance, one relating to performance and the other to operational speed. Thus, this factor was denominated “PROFITABILITY”. In this factor the asset turnover is presented negatively, once as profitability increases asset turnover decreases, featuring operations with higher margin and low turnover.

Finally, the fourth factor (F4) explains 14.083% of the total data variation and is made by asset income, once it is the reflex of the corporation’s capital juncture. This factor is understood as “INCOME”.

By the composition of the factors, it is noted that the variables that will make the investment grade indicator were all contemplated, divided in factors, and allocated by their higher weights, both positive and negative, totalizing the 10 (ten) indexes. Coming from the idea of creating an indicator that would cover the levels of investment grade derived from the application in economic and financial variables, the factors are formed according to the indexes, as Table 8 shows:

Table.8: Base factors of the indicator

Factors	Equation
FACTOR 1	0.802 * total debt - 0.642 * solvency + 0.953 * net equity debt + 0.869 * net equity income;
FACTOR 2	0.840 * immediate liquidity + 0.927 * current ratio + 0.951 * quick ratio;
FACTOR 3	0.858 * profitability - 0.768 * asset turnover;
FACTOR 4	0.958 * asset income.

Source: Prepared by the author

It is noted that 10 (ten) economic and financial indexes contemplated on the resulting factors (F1-F2-F3-F4), all have different weights that consider the investment grade indicator, where:

a) Analysis indexes are:

F1 = Debt

- F1.1 - (Outstanding Liability/Total Asset);
- F1.2 - (Total Asset/Outstanding Liability);
- F1.3 - (Outstanding Liability/Net Equity);
- F1.4 - ("Ebitda" Profit/Net Equity).

F2 = Liquidity

- F2.1 - (Availabilities/Current Liability);
- F2.2 - (Current Asset/Current Liability);
- F2.3 - (Current Asset (-) Inventories/Current Liability).

F3 = Profitability

- F3.1 - ("Ebitda" Profit/Net Operating Revenue);
- F3.2 - (Net Operating Revenue/Total Asset).

F4 = Income

- F4.1 - ("Ebitda" Profit/Total Asset).

b) Weights

Table 9: shows the weights that must be multiplied by the result obtained by each index:

Table.9: Weights and results obtained by indexes

Weight	Index
0.802	F1.1
-0.642	F1.2
0.953	F1.3
0.869	F1.4
0.840	F2.1
0.927	F2.2
0.951	F2.3
0.858	F3.1
-0.768	F3.2
0.958	F4.1

Source: Prepared by the author

The result of the investment grade indicator comes from the sum of factors. With the objective to standardize and homogenize the classification, its

numerator was divided by 1000 (one thousand), converting the result into thousandths; hence the following expression is achieved:

$$\text{Investment Grade Indicator} = \{(\mathbf{F1} = 0.802 * \text{total debt} - 0.642 * \text{solvency} + 0.953 * \text{net equity debt} + 0.869 * \text{net equity income}) + (\mathbf{F2} = 0.840 * \text{immediate liquidity} + 0.927 * \text{current ratio} + 0.951 * \text{quick ratio}) + (\mathbf{F3} = 0.858 * \text{profitability} - 0.768 * \text{asset turnover}) + (\mathbf{F4} = 0.958 * \text{asset income}) / 1000\}$$

Briefly, the following expression is achieved:

$$\text{Investment Grade Indicator} = (\mathbf{F1} + \mathbf{F2} + \mathbf{F3} + \mathbf{F4}) / 1000$$

Once the factorial analysis was completed, the reliability test was applied; according to Churchill Jr. (1979) and Hair Jr. (2005), it is the statistical resource capable of verifying the internal consistency of a variable with which to be measured. To do so, the internal

consistency of each one of the factors was verified by the *Cronbach's Alpha* (Chart 4).

It is important to highlight that the value found in each one of the factors was shown to be adequate since it is over 0.7. Factor 4 does not present the value of *Cronbach's Alpha* because it has only one index.

Chart.4: Internal consistency of identified factors

Factor	Number of indexes	Cronbach's Alpha
Factor 1	4	0.777
Factor 2	3	0.905
Factor 3	2	0.744
Factor 4	1	

Source: Research data – SPSS program

The *Cronbach's Alpha* value ranged from 0.777 to 0.905 in general, scales with alpha value smaller than 0.70 must be avoided, on the other hand, for Hora, Monteiro, and Arica (2010) superior values bring out an "optimist" estimate of reliability.

For the model considering all the factors, the *Cronbach's Alpha* was presented with the value of 0.768, indicating internal consistency of the study, because even if there was not a definite guiding scale with an acceptable value, studies indicate that it should not be inferior to 0.70, because it is seen as a tool for reliability estimation, therefore the value presented is superior to the minimum reliability index.

V. FINAL REMARKS

In the current context where economy is connected to the performance of corporations, especially in the financial field, it is essentially important to ensure the survival of both, because they are highly dependant.

Changes assumed dynamic features, regarding intensity and speed, the so wished balance goes from static to dynamic, local and national markets are not enough most of the time, so it is necessary to search globally, ongoing update and reinvention are increasingly urgent, corporate architectures change and demand economy and corporations to be open to these transformations.

The evolution of statistical treatment from the correlation analysis through Pearson's Linear Correlation Coefficient that initially presented a mostly weak correlation within a universe of fifty-five occurrences, where five were strong, sixteen were moderate, and thirty-four were weak. However, this does not invalidate Pearson's correlation once all coefficients presented some significance ($p < 0.05$).

The results, after the adjustment of indexes from eleven to ten, presented a KMO of 0.728, hence, confirming the application of data factorial analysis. In the Bartlett Test of Sphericity a significance level of $p = 0.000$ was found, inferior to the significance level of 0.05, ensuring the rejection of the hypothesis that the correlation matrix is an identity matrix, therefore, the factorial analysis may be used.

Once the adequacy of the factorial analysis was found for the statistical treatment of the financial indicators studied and their internal consistency, the number of 10 indexes analyzed became 4, explaining 86.62% of data variance, where the ones that presented eigenvalue were superior to 1.

After the factorial analysis was performed, the reliability test through Cronbach's Alpha was applied to individual factors from 0.777 to 0.905, in general, scales with alpha value smaller than 0.70 must be avoided. The

results, therefore, may be seen as optimists in reliability. For the model considering all the factors, the Cronbach's Alpha was presented with the value of 0.768, indicating internal consistency of the study; therefore the value is superior to the minimum reliability index, confirming the model created.

Thus it is safe to affirm that, based on the variables of the study (profitability, income, liquidity, and debt) it is possible to base the investment grade of a corporation.

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Adhesive and abrasive wear resistance evaluation of a ABNT 52100 steel from a Stretch Bending Roll coated with WC-Co and NiCCr applied by the HVOF Process

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Abstract—The tungsten carbide coatings in the cobalt matrix (WC-Co) and nickel-chromium carbide (NiCCr) are widely used to give greater resistance to abrasive wear to carbon steel. In this work, the possibility of applying these two coatings in the ABNT 52100 steel of a stretch bending roll, with the addition or not of an intermediate NiAl layer, using the thermal spray process HVOF (High Velocity Oxygen fuel), since this process has a small thermal input and allows the possibility of applying a great variety of coatings, including non-metallic ones. It was proposed to evaluate the performance of the samples in situations of high abrasive wear, also evaluating the role of the intermediate layer to improve adhesion of the coating to the substrate. For the evaluation of the resistance to abrasive wear and adhesive, the pin-on-disc tests (ASTM G99-17) and tensile tests (ASTM E8E8M-16a), respectively, were used. The surfaces of the samples were also evaluated by optical microscopy and electronic scanning. In addition, the hardness of each sample was also evaluated. With the tests, it was concluded that the samples with higher hardness and the presence of intermediate layer presented faults in the interface of the substrate with coating, and the resistance to abrasive wear did not deviate much from the values in the literature.

Keywords—HVOF, Pin-on-Disk, Stretch Bending Roll, ABNT 52100.

I. INTRODUCTION

The field of engineering that studies the use of coatings over metal components has been growing over the years due to the cost of structural materials and life cycle requirements of high performance components. Carbide

based coatings applied by thermal spraying are used in the aeronautics, automotive, oil and steel industries. Thermal spraying is referred to as a group of processes in which finely divided metallic or non-metallic materials are deposited in a molten or semi-molten condition on a prepared substrate to form a sprinkled deposit [1]. According to Papst[2], as part of the industrial knowledge about the processes of coatings by thermal spraying is practical, this study is the result of the need to evaluate the effect of the use of intermediate layers and the choice of the coating with better resistance to abrasion, thus enabling both material savings and increased performance of mechanical components.

The study of this work is characterized by the occurrence of displacement problems in the coating process carried out by SMS Group® on rolls of a forming machine. This machine is, as shown in Figure 1, a tensioning planer present in the pickling area of the milling process of a steel mill. The roller needs a high hardness and resistance to wear, since it works in contact with the steel coils for its performance.

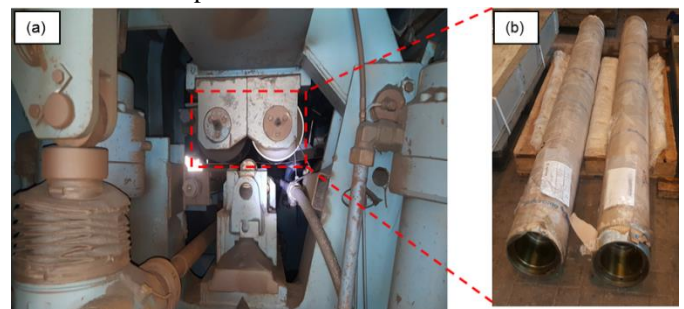


Fig. 1: Studied equipment. a) Stretch bending; b) Roll

II. BIBLIOGRAFIC REVISION

High Velocity Oxygen Fuel deposition (HVOF) is based on a special torch design, as shown in Figure 2. In it, oxygen and fuel are burned, thus melting the powder that also enters the combustion chamber axially. The flame expands through the nozzle at the end of the combustion chamber, which causes it to reach high speeds. According to Ladeira[3], after the impact the particles flatten and adhere well to the substrate and neighboring particles, making the coating dense and with good adhesion.

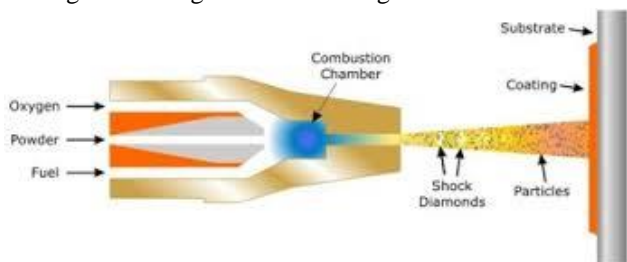


Fig. 2: HVOF thermal spray torch.

According to ASTM [4], the specimen typically used in this test is regular in shape of 25 mm wide by 76 mm long (1 by 3 in) and a thickness of 3.2 mm to 12.7 mm (0.12 to 0.50 in). The wear is evaluated through the mass loss which is subsequently converted to volumetric loss through Equation 1.

$$\text{VolumetricLoss}(mm^3) = \frac{\text{Massloss}}{\text{Density}(g/cm^3)} \times 1000 \quad (1)$$

A widely used method of abrasive wear evaluation is the Pin on Disc test, governed by the standard ASTM [5], which consists in positioning a pin or a sphere of certain material and with certain dimensions perpendicularly on a moving disc. The pin typically used in the test is cylindrical in shape and has a spherical tip, having a diameter of 2 to 10 mm, whereas the disk has diameters ranging from 30 to 100 mm and thickness from 2 to 10 mm.

There are some ways to assess the wear resistance of a material. One of the simplest and most effective ways is the evaluation through the tensile test. This test, as stipulated in the standard in ASTM [6], consists of subjecting a test piece, of standard dimensions, to an axial load of increasing value until its rupture. It gives the value of the elongation of the test piece as a function of the applied load. This makes it possible to compare the maximum load supported by a given material, as reported in the catalog, without detachment of the coating with the actual maximum load the material supports being subjected in a tensile test to the point of detachment.

III. METHODOLOGY

For the wear resistance analysis of the proposed materials, the results of abrasive wear and adhesive tests, hardness

and Scanning Electron Microscopy (SEM) of four samples were compared, according to Table 1.

Table 1: Samples used in the tests.

	Hardening	Middlelayer <i>r</i>	Coating
Sample 1	60 HRC	NiAl	WC-Co
Sample 2	60 HRC	NiAl	WC-Co + NiCCr
Sample 3	30 HRC	----	WC-Co
Sample 4	30 HRC	----	WC-Co + NiCCr

The HVOF thermal spray process was carried out at SMS GROUP ® using equipment manufactured by GTV®, consisting of the JP500 torch, integrated blasting and GTV-PF 2/2 WH powder feeder, according to Figure 3.

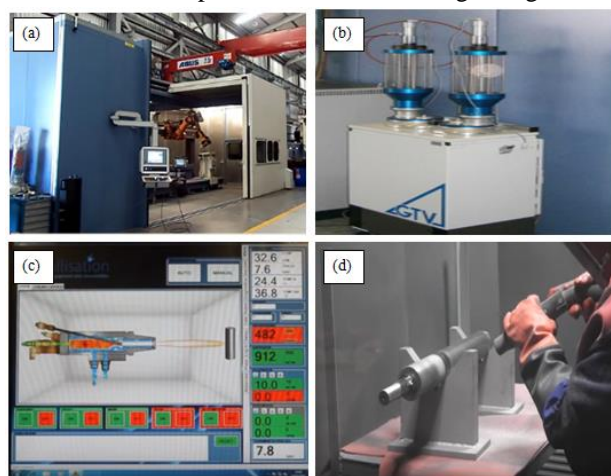


Fig. 3: HVOF Equipment. a) Thermal spray cabin; b) Powder feeder; c) Monitor; d) Integrated blasting.

In order to evaluate the sample's abrasive wear resistance, the Pin-on-disc test[5] was used, with the disc rotation value 1000 rpm, normal force against the disc of 10N, ball diameter of 10 mm made of hard metal and 20 minutes test time for each sample. For the resistance to abrasive wear, the sample test model with rectangular base was used, according to Figure 4.

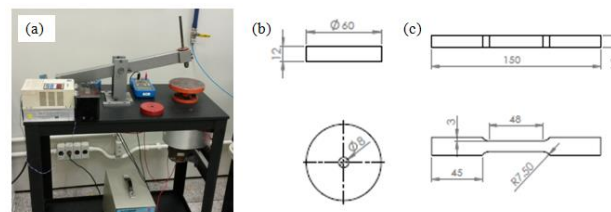


Fig. 4: Tests implementation. a) Pin-on-disk equipment; b) Disk dimensions; c) Tensile test sample dimensions.

IV. RESULTS ANALYSIS

After the hardening process in oil or salt, the microstructure changed to martensitic, as can be observed in Figure 5, with approximately 3 to 4% of undissolved cementite and 6% of retained austenite [7].

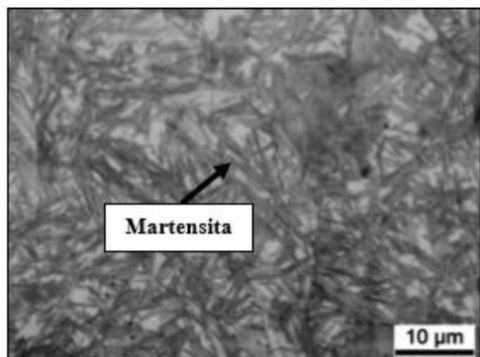


Fig.5: ABNT 52100 microstructure after hardening.

It can be observed that samples 1 and 2 - which have the highest substrate hardness and the presence of a coating intermediate layer - showed mechanical anchorage faults of the particles sprayed at the coating interface with the substrate. One of the justifications for this unsatisfactory result is the fact that the particles, when hitting the substrate, find it more difficult to plastically deform it since the material has a high hardness, making it difficult to anchor.

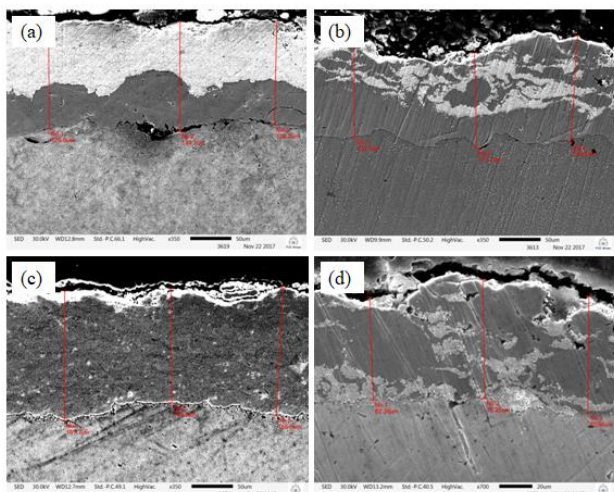


Fig.6: Scanning Electron Microscopy (SEM).

a) Sample 1; b) Sample 2; c) Sample 3 and d) Sample 4.

With the values of mass variation obtained after the pin-on-disc test, the value of the volumetric loss was calculated by density equation, its approximate value for the coatings is 14.03 g/cm³[8]. Analyzing the results of Table 2 and comparing them with the typical value provided by [1] for WC-Co sprayed by HVOF of 0.9 mm³, we can see that the values found are not very far from the expected values for the coatings studied.

Table 2: Abrasive wear rate.

	M_{Antes} (g)	M_{Depois} (g)	ΔM (g)	ΔV (mm ³ /1000rpm)
Sample 1	277,686	277,645	0,041	2,9223
Sample 2	272,512	272,487	0,025	1,7818
Sample 3	243,651	243,644	0,007	0,4989
Sample 4	234,727	234,715	0,012	0,8553

By performing a visual analysis, as can be seen in Figure 7, samples 1 and 2 presented good performance in relation to the adhesive wear, since they did not suffer any failure by coating displacement, not even in the imminence of rupture. Samples 3 and 4 have presented displacement of the coating.

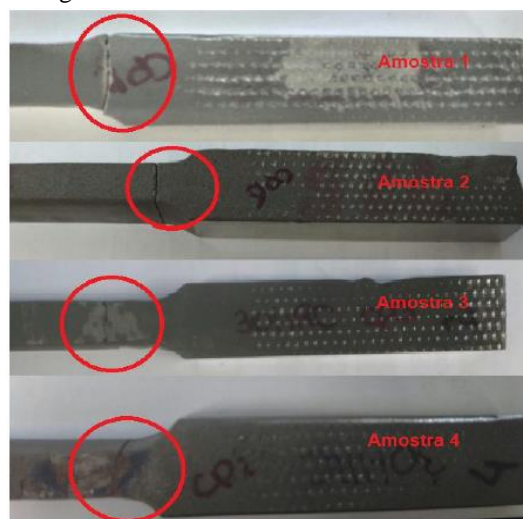


Fig.7: Samples after the tensile tests.

One of the spare samples ruptured during the machining process, even before the tensile test was carried out; which suggests that the samples are actually fragile in relation to the impact load and not to the application of loads in a continuous way. For this evaluation, it will be necessary to carry out a Charpy impact test. Another point that could have caused the rupture of the sample would be the concentration of stresses due to previous attempts of tensile test and possible influences of the type of cutting process used.

V. CONCLUSION

As for the evaluation of the coating adhesiveness to the substrate, after the tensile test it was found that samples 1 and 2 showed satisfactory performance. On the other hand, the samples 3 and 4 were observed displacements near the region of rupture. With respect to the voltage results

obtained, it was observed that in samples 1, 2 and 3 the values were even higher than those specified in the material datasheet. However, the document does not state under what conditions and what type of assay was used for such outcome, which makes the analysis difficult.

In the SEM analysis, it can be concluded that in samples 1 and 2 in which the intermediate layer was used, the presence of voids and faults in the interface between the coating and the substrate was observed. Therefore, it is necessary to control mainly the roughness and temperature of the process, since this roughness has a direct influence on the results, because depending on the value used, this difference of peaks and valleys can lead to this type of problem.

As for abrasive wear, it can be concluded that all samples meet the technical specification, as they have a relatively low wear rate relative to the reference values. Regarding the type of coating, it is verified that tungsten carbide was more efficient presenting a lower rate of wear, as observed in sample number 3 of Table 2, due to the high hardness and abrasion resistance provided by tungsten carbide.

Considering that all the samples were submitted to the same coating parameters - parameters of the thermal spray by HVOF, blasting, preheating, etc. - it can be affirmed that under current conditions there is excessive use of resources such as time and money spent in the hardening of high hardness and application of intermediate layer of coating without obtaining a result of better quality.

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Resistance Spot Welding of Dissimilar Steels: Temperature Curves

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Abstract— Resistance spot welding was used to joint AISI 316L austenitic stainless steel and AISI 1020 low carbon steel. During the welding process, temperature measurements were taken to obtain the temperature curves. Because of the different chemical compositions of the carbon steel and stainless steels, their thermal conductivity values are also different. Electrical resistivity is also an important parameter when carbon steel is spot welded to stainless steel. Differences in the thermal conductivity and in the electrical resistivity of metals lead to an asymmetrical weld nugget in the dissimilar joints. Dissimilar resistance spot welding can be more complex than similar welding due to different thermal cycle experienced with each metal.

Keywords— Carbon steel, spot welding, stainless steel, temperature curves, thermal conductivity.

I. INTRODUCTION

The spot welding process joints two or more metal sheets together through fusion at certain point. It is a simple process that uses two copper electrodes to press the work sheets together and high current to pass through it. The growth of weld nugget is, therefore, determined by its controlling parameter such as current, weld time, electrode tips, and force. The Fig. 1 shows the schematic of the spot weld.

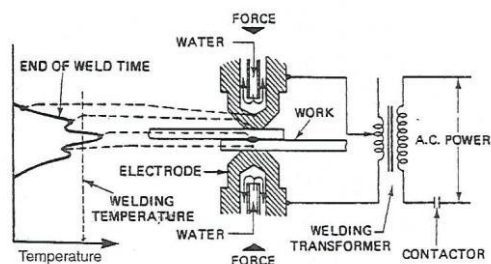


Fig. 1: Resistance spot welding

The generation of heat is due to resistance to current flow, this phenomenon is known as joule effect. The total thermal energy generated during the welding process can be calculated by Joule's law:

$$Q = \int_0^t I^2 R_T dt \quad (1)$$

Where:

J – 4,185 [J];

I – Welding Current [A];

R_T – Electrical Resistance [Ω];

dt – time interval [s].

The schematic of the electrical resistances of the spot welding process is shown in Fig. 2.

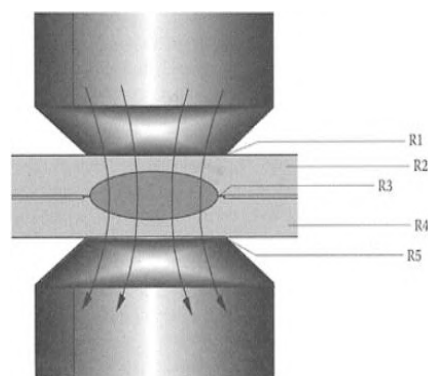


Fig. 2: Electrical Resistances

In dissimilar joints, one of the important features of the weld nugget is its asymmetrical shape such that fusion zone size and penetration depth of stainless steel side are larger than those of carbon steel side. Electrical resistance and thermal conductance control heat generation and heat

dissipation which in turn, effect weld nugget formation and its growth.

Differences in the thermal conductivity and electrical resistivity of two steel sheets lead to an asymmetrical weld nugget in dissimilar metal joints. Lower electrical resistance of carbon steel, and its higher thermal conductivity compared to stainless steel leads to smaller fusion zone in the former.

The joint region consists of three distinct structural zones: fusion zone (FZ) or weld nugget, heat affected zone (HAZ) and base metal (BM).

The Fig. 3 shows a typical geometric morphology of resistance spot weld.

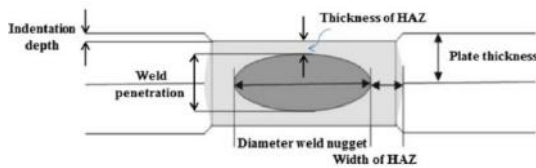


Fig. 3: Geometric morphology

II. EXPERIMENTAL PROCEDURE

The materials used in the present work were AISI 1020 carbon steel and AISI 316L austenitic stainless steel in the form of 1 x 25 x 100 mm sheets. The nominal chemical composition of both steels is presented in TABLE 1.

Table 1 – The Chemical Composition of materials, Wt.%

Steel:	C	Mn	Cr	Ni	Si
AISI 1020	0,18-0,23	0,30-0,60	-	-	-
AISI 316L	0,03	2,00	18,00	14,00	0,75

During welding, the length of the overlap between both sheets was 25 mm, as depicted in Fig 4.

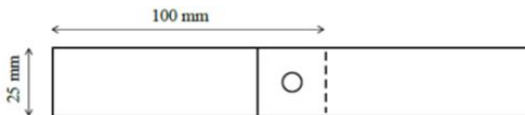


Fig. 4: Geometry of the overlap joints

The welding parameters were fixed, welding current 13kA, welding time 1 s and constant pressure. Fig. 5 shows spot welding machine used.



Fig. 5: Spot Welding Machine used in this investigation
 In the temperature measurement procedure, three thermocouples type K were used. The first thermocouple was placed in heat affected zone (HAZ), the second thermocouple 1cm distant from the (HAZ), the third thermocouple 2 cm distant from the (HAZ). Fig. 6 shows positioning of the thermocouples in the sheets.



Fig. 6: Thermocouples type k

III. RESULTS AND DISCUSSION

The Fig. 7 and Fig. 8 shown the values obtained in the measurements of temperature in the sheets of stainless steel and carbon steel, respectively.

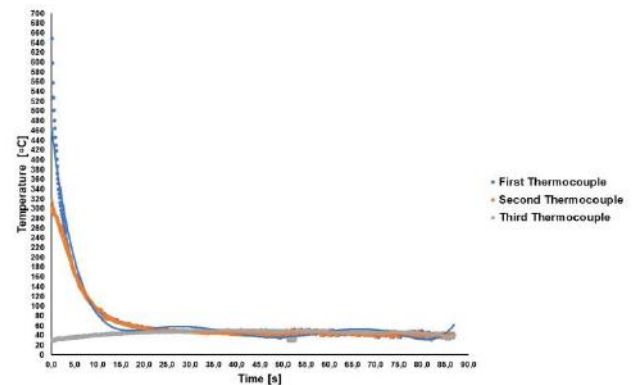


Fig. 7: Temperature curves – sheet 316 L

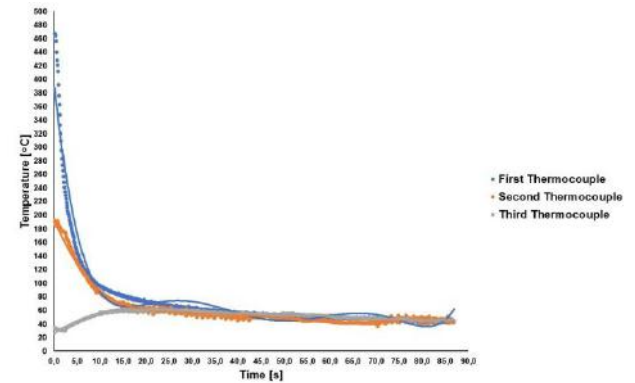


Fig. 8: Temperature curves – sheet 1020

One of the ways to evaluate the quality of fit of the model is through the coefficient of determination R². Basically, this coefficient indicates how much the model was able to

explain the data collected. The coefficient of determination R^2 is given by the expression:

$$R^2 = \frac{(\sum_{i=1}^n (x_i - \bar{x})Y_i)^2}{\sum_{i=1}^n (x_i - \bar{x})^2 \sum_{i=1}^n (Y_i - \bar{Y})^2} \quad (2)$$

Where,

$$0 \leq R^2 \leq 1 \quad (3)$$

The Fig. 9 and Fig. 10 shown the coefficient of determination R^2 values obtained in the curves of temperature. The 6th degree polynomial was used.

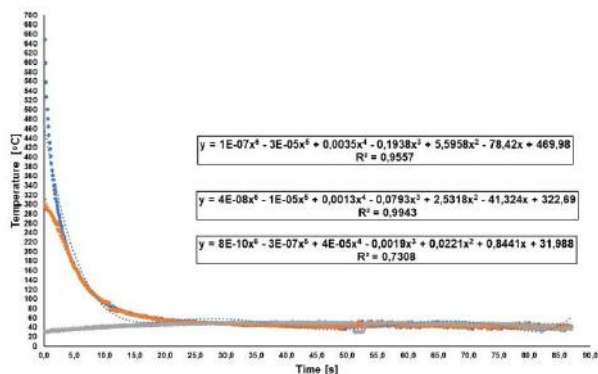


Fig. 9: Coefficient of determination R^2 – sheet 316 L

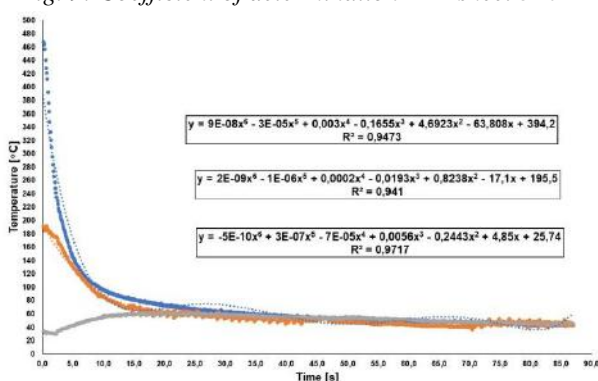


Fig. 10: Coefficient of determination R^2 – sheet 1020

The TABLE 2 and TABLE 3 show values of the coefficient of determination R^2 in relation to the position of the thermocouple in the stainless steel and carbon steel sheets, respectively.

Table 2 – Values of Coefficient of determination R^2 (sheet 316L)

Thermocouple:	Position	R^2
First	HAZ	0,9557
Second	1 cm of HAZ	0,9943
Third	2 cm of HAZ	0,7308

Table 3 – Values of Coefficient of determination R^2 (sheet 1020)

Thermocouple	Position	R^2
First	HAZ	0,9473
Second	1 cm of HAZ	0,941
Third	2 cm of HAZ	0,9717

IV. CONCLUSION

In the dissimilar spot welding of AISI 1020 carbon steel and AISI 316 L stainless steel, the temperature curves obtained show that the materials undergo different thermal cycles, this is expected because the steels have different chemical compositions and thermal properties. That is, the results are in agreement with the theory.

The coefficients of determination R^2 obtained in the 1020 carbon steel sheet and the 316L stainless steel sheet have values very close to 1, that is, the fit of the model was good. Except, the third thermocouple of the stainless steel sheet ($R^2 = 0,7308$).

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Evaluation on body weight and its relation with abdominal circumference in the diagnosis of obesity in school students in Cacoal municipality, RO, Brazil

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Abstract — Obesity in school-aged children has reached epidemic levels, which is considered a chronic disease. Researchers have been on alert, given the rising prevalence of obesity in the last few decades. The objective of this study is to evaluate the relation between body weight and abdominal circumference as a predictor for nutritional status in school students from 7 to 12 years of age in the municipality of Cacoal, RO, Brazil. The current study is of a descriptive nature, with cross-sectional and quantitative analysis. The study sample had 482 school students, of both genders, 230 male ones and 252 female ones, divided into school students from the urban and teaching rural teaching areas. Body Mass Index (BMI), abdominal circumference, and body weight were the variants analyzed. Reading with general comprehension strategies. It was possible to notice that 13% of the school students from the rural area were obese. On the other hand, 25% of the school students from the urban area, including both genders, were obese. There was a significant relation in body weight variant versus abdominal circumference in both genders, in the two areas studied. The body weight variant showed a significant relation with abdominal circumference and with body weight index in both genders.

Keywords— School students; obesity; body weight; abdominal circumference.

I. INTRODUCTION

Obesity in school-aged children has reached epidemic levels, which is considered a chronic disease. Researchers are on alert given the rising prevalence of obesity in the last few decades[1].

The obesity has been gaining even more space in scientific field, in the media and newspapers. According to scholars, the tools, research methods and evaluations, which are used for understanding the subject, have proven ineffective for its “handling”[2].

In the 1990’s, the gold standard used for evaluating the weight consisted of underwater weighing (underwater or hydrostatic weighing). Most recently, imaging techniques, such as magnetic resonance, computed tomography, dual-energy X-ray absorptiometry (DEXA), have been used as alternatives. However, the cost and lack of necessary equipment prevent the use of these techniques in clinical practice, especially by physics teachers[3].

Other techniques have been used for obesity diagnosis: BMI, abdominal circumference (or waist), and its relation with body weight. According to Mendonça *et al.*[4], these techniques have become reliable for studies involving children and teenagers besides having a low cost and their easy applicability.

The question guiding the study is: Is body weight related to abdominal circumference in the obesity

diagnosis in school students in Cacoal municipality, RO, Brazil?

Based on this, the study aimed to evaluate the relation between body weight and abdominal circumference as a predictor of the nutritional status in school students from 7 to 12 years of age in Cacoal municipality, RO, Brazil.

II. MATERIAL AND METHODS

The current study is of a descriptive nature, with cross-sectional and quantitative analysis. For the conduct of the research, list sampling technique was used. A percentage of 11.76% was used through Kazmier’s test (1982). The population was formed by 3,574 school students from 7 to 12 years of age. The study sampling included 482 school students of both genders, 230 male students and 252 female students, divided into students from urban and rural areas.

The selection process was performed by drawing lots from a roll call, which was performed in 16 city schools, and this resulted in 63 students per school, who were divided by the classroom numbers, among the students registered from 2nd to 7th grade.

For data collection, the students were questioned twice (2) per day on different days. On the first day, the Free and

Informed Consent Forms (FICF) were handed to the students so that they could take these forms to their parents for their due signatures. On the second day, evaluations on their weight, height, and abdominal circumference were performed.

For data analysis, SPSS 20.0 software was used and Kolmogorov-Smirnov test was applied for sampling normality, which made it possible to verify the samples within a normal level. In order to verify the differences among the groups, Student’s t-test was applied to check the differences between the groups and Pearson’s correlation coefficient was applied to relate the variants.

III. RESULTS

Overall, it was possible to notice that, for both locations, the school rates were not very distant from each other, considering their percentage, regarding the ages and male and female genders. There was a prevalence of the students who live in the rural area, because many of the students’ parents did not sign the Free and Informed Consent Forms. Also, the rural schools represent the majority; more than 60% of the institutions belonging to the areas studied are located in the rural area (Table 1).

Table.1: Distribution of students according to their gender and location.

SEX	AGE	URBAN AREA	RURAL AREA	BOTH			
MALE	7	9	17%	21	12%	30	13%
	8	5	10%	24	13%	29	13%
	9	18	35%	17	10%	35	15%
	10	15	29%	41	23%	56	24%
	11	4	8%	34	19%	38	17%
	12	1	2%	41	23%	42	18%
Average	9.7						
TOTAL		52	100%	178	100%	230	100%
FEMALE	7	15	25%	32	17%	47	19%
	8	11	19%	24	12%	35	14%
	9	13	22%	25	13%	38	15%
	10	18	31%	27	14%	45	18%
	11	2	3%	36	19%	38	15%
	12	0	0%	49	25%	49	19%
Average	9.5						
TOTAL		59	100%	193	100%	252	100%

Source: Authors, 2018.

Table 2 shows the rates for the variants for body weight, BMI, and abdominal circumference of the students in the Rural Area. It is possible to notice that, at ages lower

than 7 and 8, the girls have a slightly higher body weight than the boys, where these rates start to be balanced from 9 years of age onwards.

Table 2: Distribution of students in the rural area – gender, body weight, BMI, and abdominal circumference.

SEX	AGE	WEIGHT	BMI			ABDOMINAL CIRCUMFERENCE		
			Normal	Overweight	Obese	Without risk	Limit	Over limit
MALE	7	24,468	18	1	3	11	8	3
	8	27,334	15	8	0	16	7	0
	9	30,247	17	0	1	11	7	0
	10	35,210	32	3	5	29	10	1
	11	38,213	27	4	2	27	4	2
	12	49,321	29	9	4	25	15	2
Total			138	25	15	119	51	8
%			76,8	14,5	8,7	65,9	29,6	4,6
FEMALE	7	25,158	23	5	3	16	13	2
	8	29,783	18	2	4	15	5	4
	9	30,685	20	4	2	18	7	1
	10	34,010	21	5	1	21	4	2
	11	37,091	34	2	0	30	6	0
	12	47,110	41	7	1	30	17	2
Total			157	25	11	130	52	11
%			81	14	5	68,2	26,3	5,5

Source: Authors, 2018.

Table 3 shows rates for the variants for body weight, BMI, and abdominal circumference in students from the urban area. It was possible to notice that the boys, at age

12, outnumber the girls in body weight, and this suggests a late maturity in boys.

Table 3: Distribution of students in the urban area – gender, body weight, BMI, and abdominal circumference.

SEX	AGE	WEIGHT	BMI			ABDOMINAL CIRCUMFERENCE		
			Normal	Overweight	Obese	Without risk	Limit	Over limit
MALE	7	23,321	7	2	0	3	6	0
	8	30,031	2	3	0	3	2	0
	9	35,423	11	2	5	10	6	2
	10	34,654	12	2	1	8	6	1
	11	35,354	3	1	0	3	1	0
	12	43,500	1	0	0	1	0	0
Total			36	10	6	28	21	3
%			69	19	12	53,9	40,4	5,7
FEMALE	7	27,021	14	1	2	7	8	2
	8	25,321	11	0	0	8	2	1
	9	33,152	7	2	2	6	5	0
	10	36,023	13	2	3	12	3	3
	11	44,325	1	1	0	1	1	0
	12	42,511	1	0	0	0	0	0
Total			46	6	7	34	19	6
%			77	10	13	57,6	32,2	10,2

Source: Authors, 2018.

As shown in Table 4, the following variants are evaluated: weight, BMI, abdominal circumference in schools located in urban and rural areas. The results showed that, in the rural area, all the relations in male gender were significant, and there was a higher rate for body weight, BMI, and abdominal circumference variants with $r=0.89$. On the other hand, the students from the

urban area only showed a significant rate of $r=0.92$ for the relation between weight and BMI. In the female group from the rural area, the highest relation was for BMI with abdominal circumference variants of $r=0.91$. As for the female students from the urban area, the relation between body weight and BMI variants was $r=0.91$.

Table 4: Evaluation on the relation among body weight, BMI, and abdominal variants in male and female genders.

RURAL AREA				URBAN AREA		
SEX	WEIGHT	BMI	AC	WEIGHT	BMI	AC
MALE						
Average	36,4	18,3	62,7	32,7	18	59
r W x BMI		0,78*			0,92*	
r W x AC		0,89*			-0,019	
r BMI x AC		0,79*			-0,044	
FEMALE						
Average	35,5	17,4	61,2	31,3	18,4	62,2
r W x BMI		0,83*			0,91*	
r W x AC		0,88*			0,10*	
r BMI x AC		0,91*			0,11*	

r WxBMI= relation Weight vs. BMI; r WxAC= relation Weight vs. Abdominal Circumference; r BMIxAC= Relation BMI vs. Abdominal Circumference, *significant

Source: Authors, 2018.

IV. DISCUSSION

Overall, it is possible to notice that the rates did not show big significant differences in percentage for both locations, regarding the age and male and female gender. In both genders, it is possible to notice the prevalence in students who studied in the rural area. There was a small compliance proportion from the students' parents in the urban area, and this was noticeable at the moment many students failed to deliver the Free and Informed Consent Term, which resulted in more than 60% of students belonging to the rural area.

It is possible to notice that, in the last eight years, obesity numbers in school students have been rising in alarming rates. Romanholo *et al.*[3] estimated that 20% of the students were obese. Nowadays, according to OMS[5], it is possible to notice an increase from 5% to 8% in this proportion, that is, a total of almost 30% of students are obese or overweight.

Besides, some researches performed by Romanholo *et al.*[3], Veber[6], Herrmann[7], Del Vecchio *et al.*[8], indicate obesity can be influenced by environment, psychological, and social factors.

Herrmann *et al.*[7], evaluated school students upstate Paraná, and noticed that 10% of children from 7 to 12 years of age were affected by abdominal obesity. When we compare this with the current study, it is possible to

notice that the students from Cacoal municipality, when adding the gender and both areas studied, it is possible to reach the rate of 25% of students who are above the risk of developing heart diseases.

In another study, which was carried out by Del Vecchio *et al.*[8], in Santo André, in São Paulo state, the authors detected a strong association between obesity and abdominal circumference. They also noticed a significant rise in the students' blood pressure. The rates found in the study range around 20%, which shows approximate rates when compared with the current study.

Stamatakis *et al.*[9], who evaluated the obesity in Portuguese children, noticed that 12% of the children were obese by checking the Body Mass Index (BMI) and fat percentage. When comparing with the current study, evaluating BMI variant by adding the genders and the location where they study, the sample rate is 24%, which is double the rate of what was mentioned above.

Schommer *et al.*[10], evaluated the excess in body weight rates and the anthropometric variants by using abdominal circumference. In that study, the authors noticed a significant relation between the excess weight and the abdominal circumference $r=0.462$.

Nascimento *et al.*[11], evaluated the heart failure risk rate and blood hypertension in students by using abdominal circumference. That study showed a

significant relation of $r=0.345$ between the accumulation of abdominal fat (abdominal circumference) and the rise of the students' blood pressure.

Mendonça *et al.*[4], carried out a study about the nutritional status of public school children from the municipality of Japarutuba in Sergipe state. In that study, some relations were established between weight/abdominal circumference. In the study, there was a positive relation among the variants with a rate of $r=0.567$.

Souza *et al.*[12], evaluated the relation between body weight and abdominal circumference. Children and teenagers from four to 19 years of age, originated from rural and urban schools in a municipality in Rio Grande do Sul. There was a positive relation rate in the variants evaluated: $r=0.67$.

When comparing the studies mentioned above with the current one, we notice that there is a tendency of using these benchmarks as a predictor for nutritional evaluation. The current study showed a strong relation in all genders and in rural and urban areas.

V. CONCLUSION

We can affirm that these variants give us a reliable diagnosis in the evaluation of nutritional aspects when relating the body weight to abdominal circumference.

In this study, the body weight variant had a significant relation with abdominal circumference; also, with the body mass index in both genders.

Therefore, for the population studied, we can use the body weight resource and relate it to fat distribution located in the abdomen with a pattern to diagnose this syndrome.

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Modeling and Simulation of an Oxygen Delignification Industrial Process of Cellulosic Pulp using Kinetic Expressions and the software CADSIM Plus

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Abstract— The Brazilian productive sector of pulp and paper represents a relevant contribution for the development of Brazil. To increase the competitiveness of Brazilian companies to an international level, products must have high standards of quality and high added value. Thus, the mathematical modeling and simulation of industrial processes ensures the stability of production. This study presents the fit of mathematical models for the Oxygen Delignification process of eucalyptus pulp of the industry Klabin Monte Alegre. The mathematical model estimates the kappa number after the reactor, based on two kinetic models given by the literature, one of these models considers oxygen excess in the reaction medium. The models showed a mean relative error of 10 %. The adjustment of the kinetic parameters equations was done in Matlab software, using classical methods of optimization, such as BFGS, DFP, Steepest Descent, Gauss Newton, Simplex and Levenberg Marquardt. The models were incorporated in the commercial simulator CADSIM Plus to provide an optimization tool to the pulp industries. The simulator predicts the kappa number after the Oxygen Delignification reactor. The results of the phenomenological models indicate that possibly there is excess of oxygen in the reaction media. Only the model that considered the presence of the oxygen in the kinetic equation was able to be implemented in the simulator CADSIM Plus, generating consistent results, with an absolute error of ± 2 kappa number.

Application: The kinetic model applied to the CADSIM Plus software in this study may be used to optimize the Oxygen Delignification process either by reducing chemical consumptions or by testing different process conditions without changing production.

Keywords— Cellulosic Pulp, Kinetic Expressions, CADSIM Plus.

I. INTRODUCTION

Klabin Papéis Monte Alegre increased the paper production capacity of the mill to 1,1 million tons/y. This project gave the company an excellent position in the global market with highly competitive production costs. The incorporation of mathematical models and process simulators helps the mill to optimize the pulp production assuring quality specifications that fit the clients demand with a safety and environmentally friend process.

After the Kraft cooking in the continuous digester # 1, the pulp goes to the oxygen delignification process that occurs in a medium consistency media with sodium hydroxide as alkali source. The pulp is washed and discharged into a tank where alkali and oxygen with medium pressure steam are applied. There are two parallel lines with two post oxygen washers in each line. At one line, the pulp is washed in a pressurized diffuser washer followed by a post oxygen filter washer. In the other line the washing is done with two presses. The washed pulp goes to the ECF bleaching. **Figure 1** illustrates the mill process.

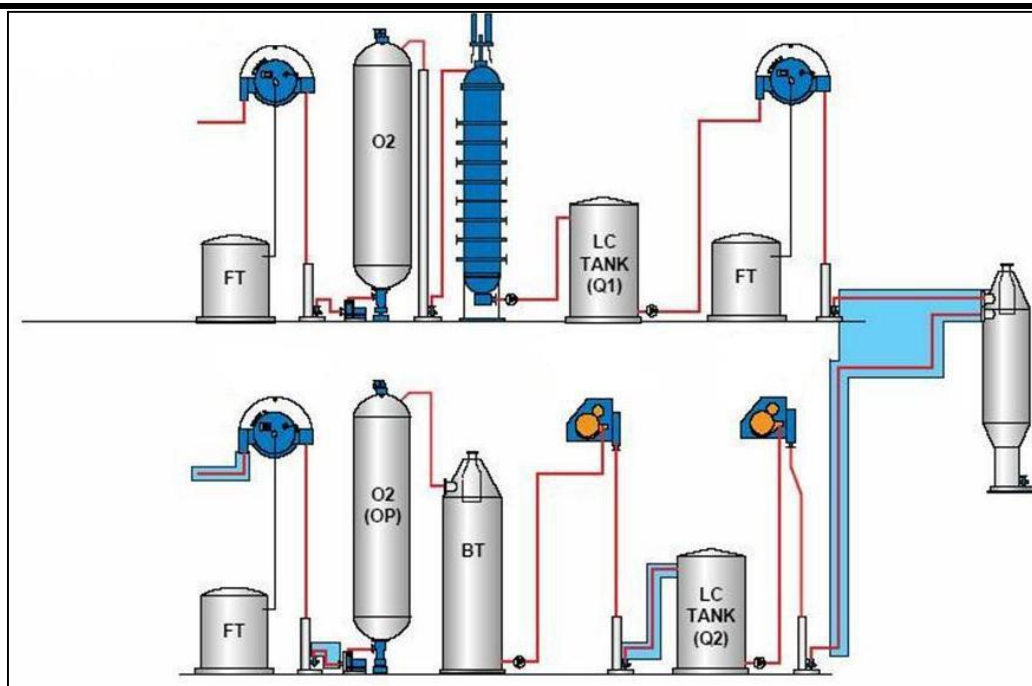


Fig.1: Oxygen delignification plant of Klabin Monte Alegre.

The oxygen delignification is the process which the pulp, suspended into an alkaline solution, is pressurized with oxygen which forms a stable dispersion in the pulp and is consumed in the lignin reactions. This stage removes 50% of the remnant lignin in the brown pulp, saving chemicals in the Bleach Plant and minimizing organic material in the effluents (COD and BOD). The process is controlled by a heterogeneous reaction that involves the solid fibers, liquid phase around and between the fibers and oxygen dispersed gas phase [1]. In general, delignification and the carbohydrates degradation reactions are mainly affected by temperature, sodium hydroxide concentration and dissolved oxygen concentration.

Rubini [2] developed mathematical models based on the phenomenological and neural network models to predict the kappa number after the oxygen delignification reactor. The results achieved were very satisfactory regarding industrial simulation having an average error of 8,5%. By those results and the similarity of the data used in this study, the same kinetic models used at Rubini's [2] work were used given by Agarwal et al [3] and Violette [1]. The model proposed by Violette [1] is a single stage model that does not consider the oxygen pressure influence. Agarwal et al [3] suggested a homogeneous kinetic model considering the presence of the oxygen in the reaction media.

The goal of this study was to obtain models adapted from previous published kinetics equations by using classical optimization methods (like: BFGS, DFP, Steepest Descent, Gauss Newton, Levenberg-Marquardt and Simplex) to represent the industrial process. After identifying the kinetic parameters as the Arrhenius

frequency factor, activation energy and the exponents of the chemicals concentrations involved in the reaction, the models were applied in the commercial simulator CADSIM Plus. The software represents the process with mass and energy balances being capable to predict the kappa number after the oxygen delignification reactor.

II. KINETIC MODELS

Several authors studied and proposed kinetic models to the oxygen delignification reaction rate considering the mass transfer phenomena. Usually the reaction is described into two phases, the initial is fast and the final is slow or nonexistent lignin reaction. The fast reaction represents the alkaline extraction of the soluble lignin instead of the oxygen reactions [1]. This can be represented by a mathematical model composed of two parallel first order ordinary differential equations related to the lignin [4]

The system can also be described by one equation representing the kappa number degradation in a potential form, usually having high reaction order related to the kappa number. By using a simple reaction rate, the slow lignin degradation course during the final stage of the delignification can be mathematically described by the high reaction order. More slow the reaction, higher the exponent will be [4].

Agarwal et al [3] suggest representing the kinetic behavior as a series of parallel first order reactions occurring simultaneously and also consider the possibility of the nonexistent lignin presence characterizing the final slow reaction. The model is given by a one stage equation with a high reaction order related to the kappa number:

$$-\frac{dK}{dt} = k \cdot K^{7.7} \cdot [OH^-]^{0.92} \cdot P_{O_2}^{0.53} \quad (1)$$

$$k = 2,368 \cdot 10^6 \exp\left(-\frac{107,2}{R \cdot T}\right) \quad (2)$$

The authors believe that there is some kind of delay in the process due to the series of parallel first order reactions that leads to a high order equation. The parameters identification based on industrial data is easy to be done using this model because it is represented by the global kappa number, not being necessary to characterize the fast and slow reaction lignin. This model is also efficient to apply into process simulators to evaluate the kappa number variations caused by the oxygen because the kinetic model considers the presence of this chemical in the reaction media.

The objective of Violette's [1] study was to improve the selectivity of the delignification reaction using polymeric additives. The author evaluated the effects of these additives in the selectivity and reaction kinetic rate. Violette [1] suggested that oxygen radicals may be trapped with relatively low amounts of additive radical scavengers if they are concentrated at the cellulosic surfaces. To confirm his hypotheses, the researcher determined the change in the kappa number given by the alkaline extraction by measuring the kappa variations in a reaction media without oxygen.

The author tested seven models to evaluate the alkali consumption and he observed that the decrease in the alkali consumption was proportional to the kappa number decrease and independent of the process operational conditions:

$$\Delta[NaOH] = 0,168g / L \cdot \Delta K + 0,2g / L \quad (3)$$

The model to predict the kappa number is represented by equation 4. As Violette [1] used nitrogen instead of oxygen in his work, the model is represented by a corrected kappa number. As this study is based on industrial data the correction is not applicable.

$$-\frac{dK}{dt} = k \cdot K^{3,12} \cdot [NaOH]^{0,588} \quad (4)$$

$$k = 4,4 \cdot 10^3 \cdot \exp\left(\frac{-7140}{R \cdot T}\right) \quad (5)$$

The parameter identification of Violette's model is also simple to apply regarding the use of the global kappa number and a linear model of alkali consumption. However, as the oxygen is not considered in the kinetic equation rate, this model cannot be represented in the

simulator as this does not show the kappa-oxygen interaction.

III. PULP AND PAPER SIMULATORS

The process simulation is a useful tool to reduce operational costs and improve the efficiency of existent mills, it is also essential to project new systems and make the start-ups faster and more rentable. Testing different solutions in the simulator helps to indentify the potential problems and change control strategy.

During the 80's, the computational system started to be trustable enough to simulate processes. The Fortran language gave the opportunity to realize complex calculations quickly. The solution was given in the stationary state, by mass and pressure flows, valve opening and tank levels. Then the process parameters were calculated, as concentration, reaction rate and temperature. In this same period, Honeywell acquired the software SCADA (*Supervisory Control and Data Acquisition*) which included solutions to differential algebraic equations and interaction with the control system. This resulted in engineer tools as the MASSBAL [5].

Since the early 90's, the necessity of dynamic simulations appeared. Nowadays the most used pulp and paper simulators are the WinGEMS from Mesto Automation, IDEAS from Andritz and CADSIM Plus from Aurel Systems.

CADSIM Plus allows a CAD draw to give the data source to the process simulation. It supports any drawing complexity, being especially adequate to P&ID diagrams. The dynamic simulation can be used to optimize process, to plan operations, to test DCS (Distributed Control System) control system and to develop control strategies. The software uses de 'C' code providing low execution time in commons computers. The user can also create particular modules of simulation called DLM (Dynamically Linked Modules). The streams of the process can indicate the fiber fraction and specific items as metallic ions, viscosity, brightness and kappa number [6].

The CADSIM Plus can use the function COM (Common Object Model) or DDE (Dynamic Data Change) to communicate with other applicative from Windows, as Microsoft Excel or Visual Basic. Once the communication is done, the software can send or receive data. The software can also Interact with distributes control systems (DCS) by the protocol OPC (OLE to process control) [6]. For example, in the Klabin Monte Alegre's case, the communication with the PI software is possible.

This simulator uses modules to represent the process. Each module is a mathematical representation of the process streams and equipment units. The software has a standard library that includes process equipments, control, integration, mathematical and logical modules.

There are optional libraries of fiber, utilities, hydrocarbons, data reconciliation and connection to other software and process controllers. The fiber library has modules for chip refinery, ion change, pressurized filters, pulp and reject refineries, washers and digesters washing zone.

IV. DATA ACQUISITION AND MODELING DEVELOPMENT

The data was collected from Klabin Papéis Monte Alegre industry. The period was sufficient to recreate the process dynamics and generate the necessary amount of data to do trustable analyses. Statistical treatments were done to eliminate errors caused by production stops and variations, online analyzers wrong registered values and instruments out of operation.

A total of 470 process variables patterns of pulp volumetric flow entering the stage, pressure and mass flow of the oxygen, reactor temperature, pulp consistency and kappa number from the Digester and inlet of the Bleach Plant were used to do the modeling and the process simulation.

The kinetic parameters were adjusted based on the models given by Agarwal et al [3] and Violette [2]. The model to represent the alkali consumption is a linear model proportional to the kappa number decrease similar to the one proposed by Violette [2] given by equation 6.

$$\frac{d[OH^-]}{dt} = \alpha \cdot \frac{dK}{dt} \quad (6)$$

The first order differential equation system composed by the kinetic equation rate (equation 7 or 8 referring to Violette and Agarwal's et al model respectively) and the alkali consumption model was solved with direct integration with the fourth order Runge-Kutta method with variable step on the average residence time of the reactor. The parameter fitting was done using the classical optimization routines: BFGS, DFP, Steepest Descent, Gauss Newton, Levenberg-Marquardt and Simplex

$$-\frac{dK}{dt} = k \cdot K^a \cdot [NaOH]^b \quad (7)$$

$$-\frac{dK}{dt} = k \cdot K^a \cdot [OH^-]^b \cdot P_{O_2}^c \quad (8)$$

To find the best equation to simulate the process the objective function was evaluated by the normalized quadratic error given by equation 9. A minimum value of the quadratic error implies that there is no need of a new adjusts of the parameters.

$$VV = \frac{\varepsilon^2}{N \cdot \bar{M}} \quad (9)$$

The criteria adopted in the optimization routines of Matlab were a normalized error related to the calculated variable of 10-3 or a maximum number of iterations of 750, what happened first. In all cases the test conjunct was 33% from the original data to validate the models.

The process simulation was created by drawing the industrial flowsheet with two main streams. One representing water, chemicals, organic and inorganic dissolved solids, fiber and lignin, the other is related to the steam line used in the process.

The pulp washing was characterized by the displacement ratio and dilution factors particularized to each type of washer. The reactor simulation mode was done by mass balance based on the kinetic equation rates obtained after the optimization step. The equation rate is an input to the software that considers perfect mixture in the reaction vase. The type of the reactor chosen to represent the industrial process was an upflow tubular reactor. The tanks were modeled to represent a perfect mixture behavior.

The software uses typical PID controllers to simulate the process control. The PID control varies the controlled variable until the measured variable reaches the set point which is a input to the simulation. CADSIM Plus tunes automatically the controllers but if the simulation shows oscillatory behavior or takes too long time to reach the set point it is possible to change the parameters values in order to avoid these disturbances.

First, equation 7 with the adjusted parameters was used as the kinetic equation rate, followed by equation 8 simulation. During the simulation, DDE communication protocols were created to make interactions between CADSIM Plus and Microsoft Excel. The simulator acts as data client or server, working as client the simulator imports the data to be utilized as inputs in the simulation. When working as server, the simulator exports the simulated data to the Microsoft Excel spreadsheets. Having the real process values and the simulated data, the relative error of the models was obtained.

V. RESULTS

To facilitate the comprehension of this work the models are nominated as Model 1, that is similar to Violette's model and represents the first delignification line. For this same process line, Model 2 represent the one based on Agawrall et al study. Regarding the second delignification line, Model 3 represents the one modeled based on Violette's proposition and Model 4 on

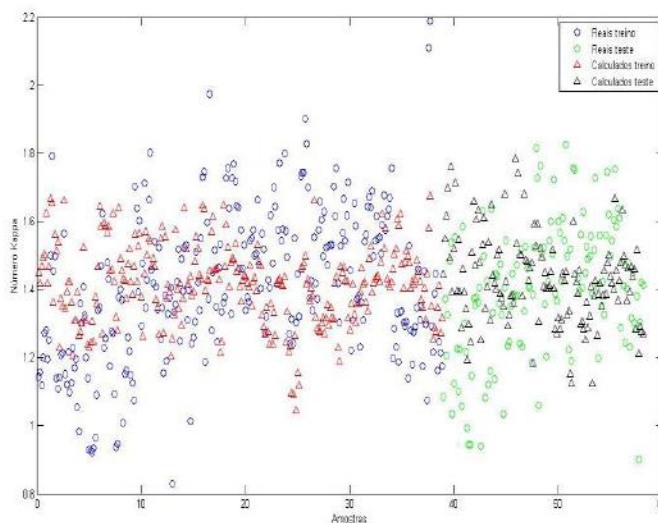
Agawrall's et al. The results shown in this section are normalized values to keep industrial confidential.

The results obtained from Model 1 are shown by equations 10 and 11. The adjusted parameters were given by the BFGS optimization method that presented the lowest error. The kinetic constant model is the same one obtained by Rubini but the exponents of the chemicals concentrations changed. The difference between this and Rubini's work is the raw material utilized in the delignification process.

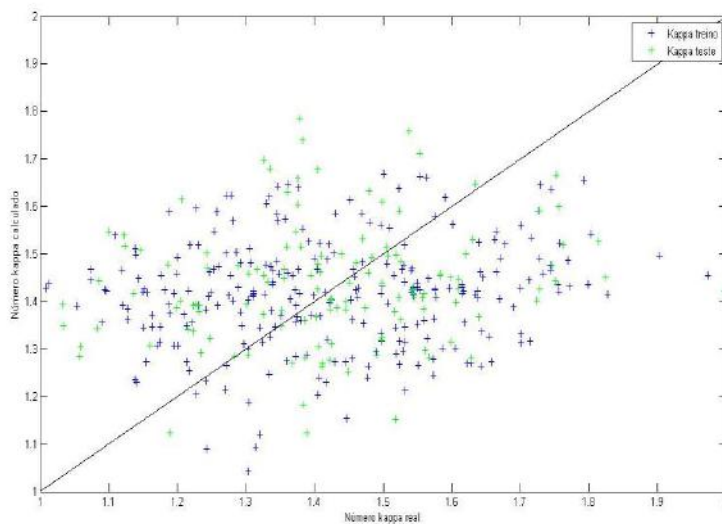
$$-\frac{dK}{dt} = k \cdot K^{4,620} \cdot [NaOH]^{-0,029} \quad (10)$$

$$k = 11610 \cdot \exp\left(\frac{-72,5 \cdot 10^3}{R \cdot T}\right) \quad (11)$$

Figure 2 (A) and (B) illustrate the simulated results and the real industrial values. The first figure shows the values across the data quantity. The second one is the plotting of the calculated data by the real values, more the curve is close to the 45 line better the modeling prediction is.



(A)



(B)

Fig.2: Kappa number comparison between simulated and real values for Model 1.

The simulated values follow the real values tendency even not considering the oxygen presence in the reaction media. Only for high kappa numbers the model was not accurate, however these are not usual operational

values as they seldom occurs in the process. It can be concluded also that there is oxygen in excess because Violette's model describes well the data pattern.

The absolute error (difference between real and calculated values) is $\pm 2,5$ kappa number and the relative error is 20%, the most part is due to process variations. The model is able to represent accurately normalized kappa numbers between 1,3 and 1,7.

The kappa number decrease and the alkali consumption trough the reactor are illustrated on Figure 4. All optimization routines resulted in values close to 6 to the proportional constant that describes these profile, as given by equation 12, same result obtained by Rubini [2].

$$\frac{d[OH^-]}{dt} = 6 \cdot \frac{dK}{dt} \quad (12)$$

With this information, it is possible to evaluate the alkali amount consumed in the reaction and the possibility to reduce its concentration or flow in the process. These results are also normalized values.

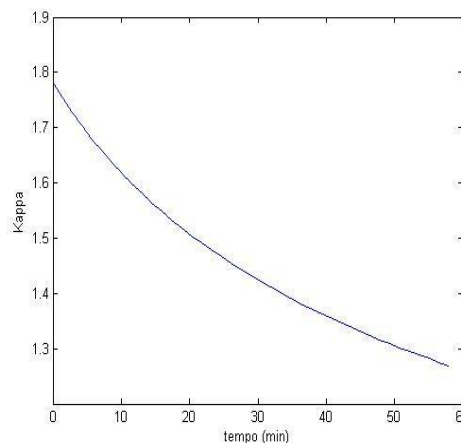
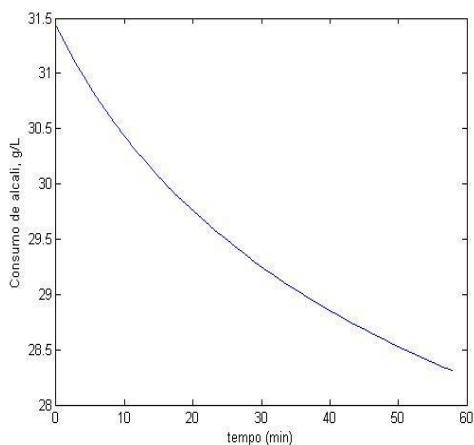


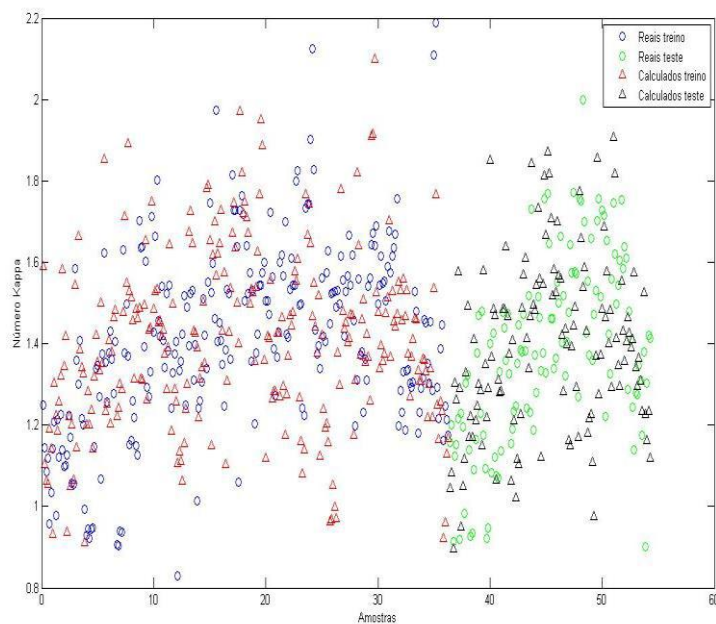
Fig.3: Alkali consumption and kappa number decrease profiles for Model 1.

These profiles allow establishing quality limits to the reaction, i.e., find the optimum sodium hydroxide concentration to get the desired kappa number within the specifications [2]. The results show that the alkali consumption profile has similar behavior to the one propose by Violette [1].

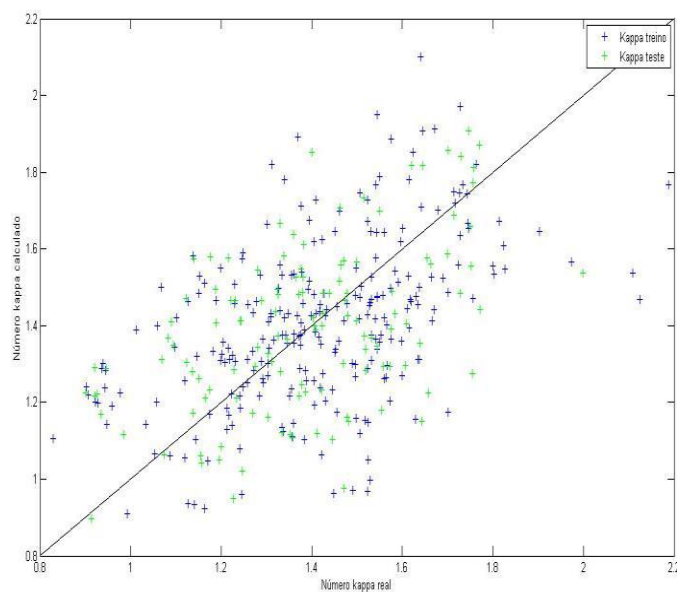
Regarding Model 2, the optimization routines that gave the best results were Gauss Newton and Levenberg Marquardt. By choice, the results below are given by the Gauss Newton method. Equation 13 is the kinetic equation for this model, the kinetic constant is also represented by equation 11 because the results are the same as Model 1. The alkali consumption is the same as Model 1.

$$-\frac{dK}{dt} = k \cdot K^{3,330} \cdot [NaOH]^{0,751} \quad (13)$$

The absolute error is into the interval of $\pm 2,5$ kappa number and the relative error is 15%, proving the model accuracy. **Figure 4 (A)** and **(B)** illustrate the simulated results and the real industrial values.



(A)



(B)

Fig.4: Kappa number comparison between simulated and real values for Model 2.

The simulated values follow the real process values mainly in the range between 1,2 and 1,6 normalized kappa numbers, even not considering the oxygen presence in the reaction media. Again, it can be seen that the model is capable of predicting the process values as shown by **Figure 4 (A)**.

Model 3 was obtained by the Steepest Descent optimization method, having an relative error of 20% and an absolute error of $\pm 2,0$ kappa number. Equation 14 represents the alkali consumption and equations 15 and 16 show the kinetic rate.

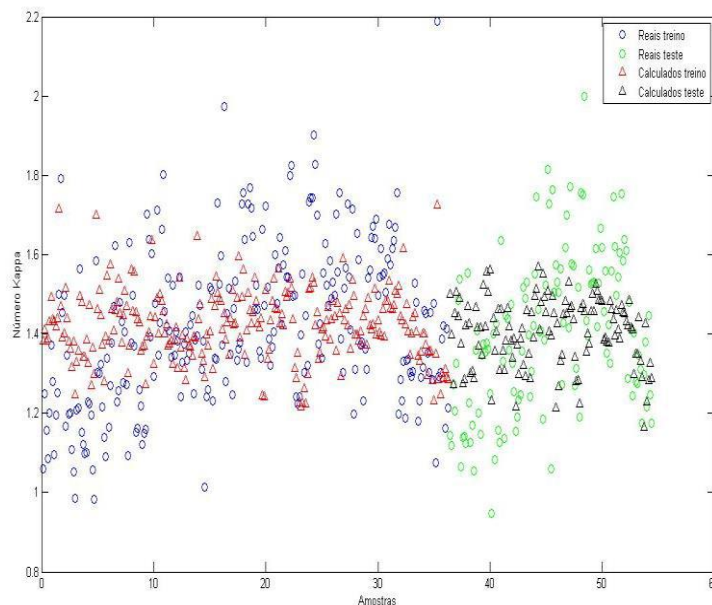
$$\frac{d[OH^-]}{dt} = 6,706 \cdot \frac{dK}{dt} \quad (14)$$

$$-\frac{dK}{dt} = k \cdot K^{9,231} \cdot [OH^-]^{5,839} \cdot P_{O_2}^{-11,986} \quad (15)$$

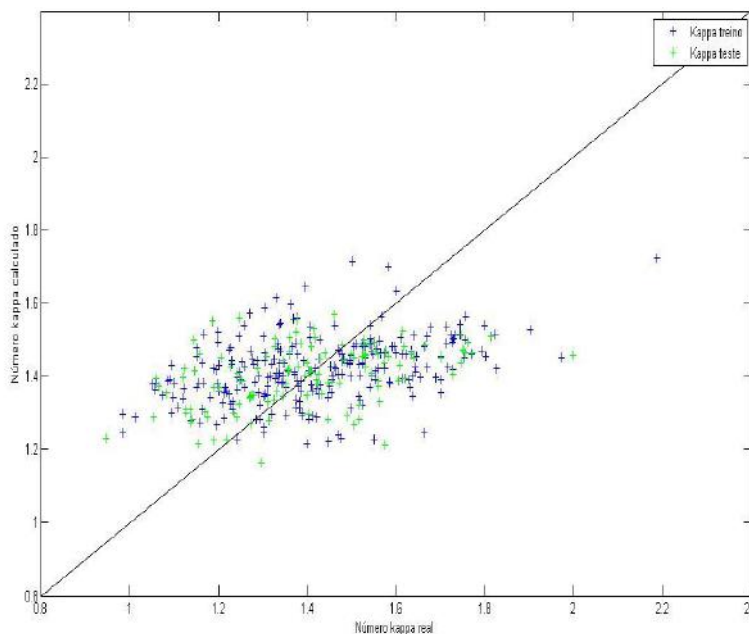
$$k = 2,3 \cdot 10^6 \cdot \exp\left(\frac{-107,20}{R \cdot T}\right) \quad (16)$$

Figure 5 (A) and (B) illustrate this model is able to predict normalized kappa number values in the range of

1,2 and 1,6, only high kappa numbers were not well represented but they are not usual in the process.



(A)



(B)

Fig.5: Kappa number comparison between simulated and real values for Model 3.

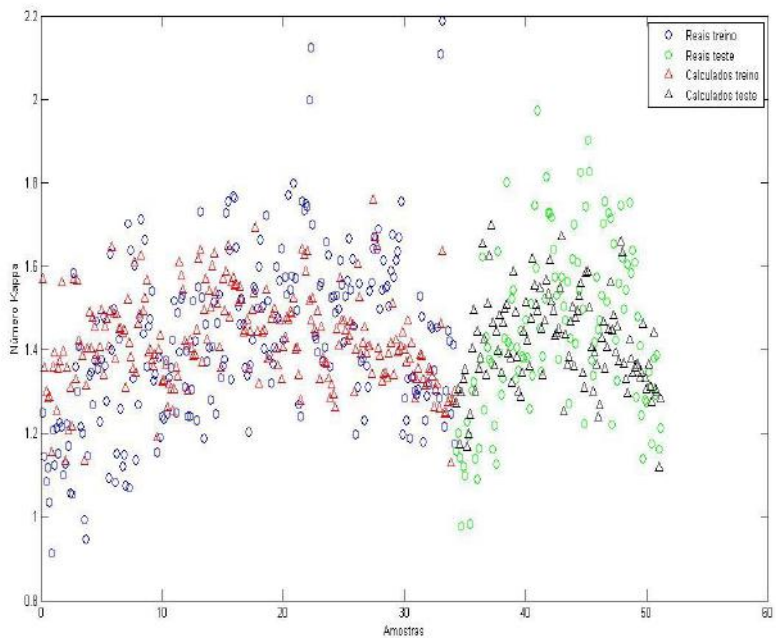
Model 4 was better represented by the BFGS method as this was the one with the lowest error conjunct data. Equations 17, 18 and 19 represent the kinetic rate and the alkali consumption model respectively with accuracy of $\pm 2,0$ kappa number and 15% of relative error.

$$-\frac{dK}{dt} = k \cdot K^{7,144} \cdot [OH^-]^{2,694} \cdot P_{O_2}^{-3,343} \quad (17)$$

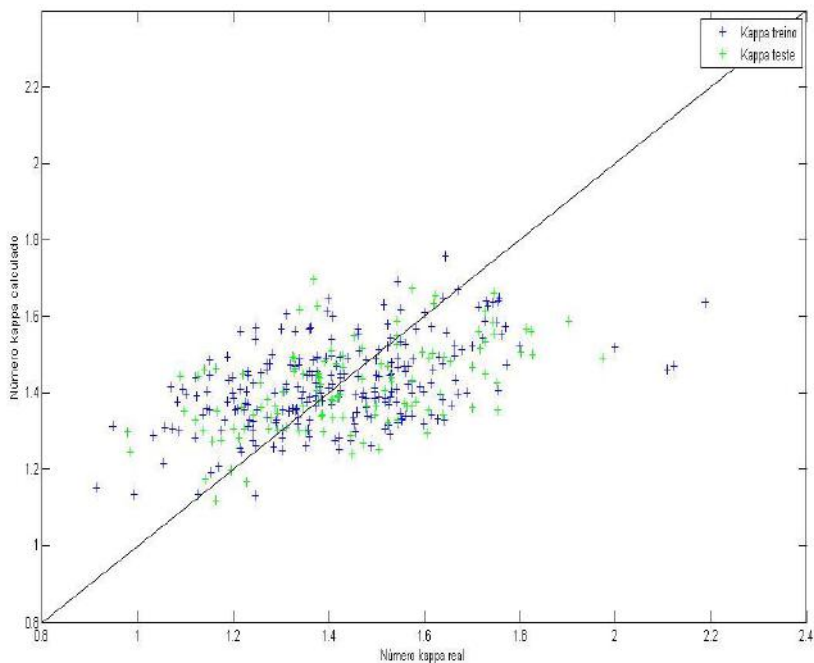
$$k = 11610 \cdot \exp\left(\frac{-72,5 \cdot 10^3}{R \cdot T}\right) \quad (18)$$

$$\frac{d[OH^-]}{dt} = 6,612 \cdot \frac{dK}{dt} \quad (19)$$

As shown by the figures below, this model has a good performance between the range of 1,2 and 1,6 normalized kappa number. The alkali consumption profile is similar to the one from Model 1.



(A)



(B)

Fig.6: Kappa number comparison between simulated and real values for Model 4.

Only Models 3 and 4 gave coherent result when applied to the CADSIM Plus simulator, also these models had short simulation time.

In the first simulation, the software acted as client receiving the inputs, as chemical flows and concentrations

from excel. It presented an average absolute error of 1,3 kappa number after the delignification reactor. **Figure 7** is a tendency chart of the real and simulated kappa number.

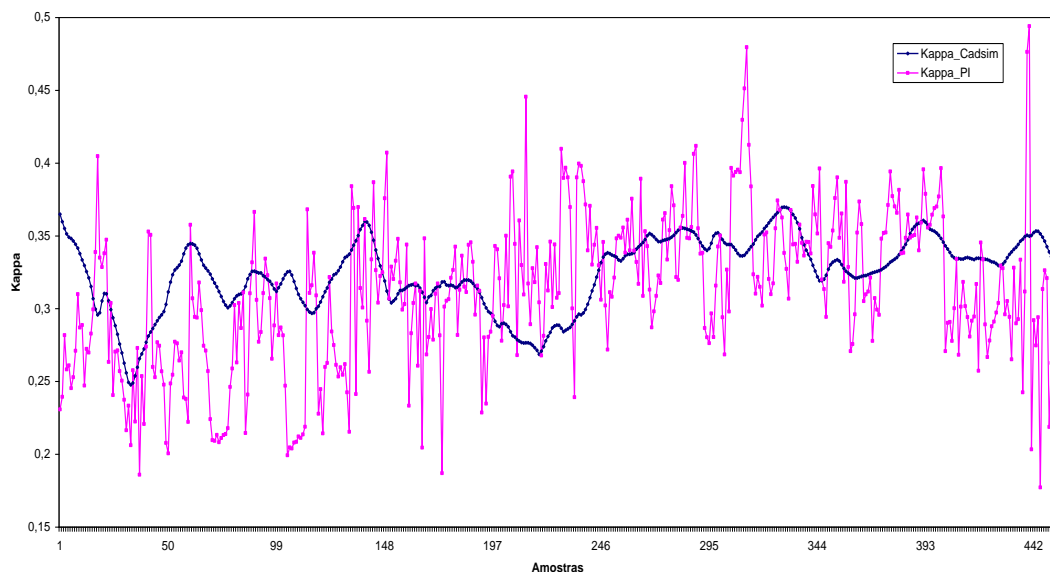


Fig.7: Comparison between real and simulated kappa number values simulated on CADSIM Plus with Model 3.

The figure above shows that this model is able to follow the process tendency, excepting for some points, probably from transient periods in the operation or conditions that were not used in the data fitting. Even with the data treatment to assure stationary simulation, some data should be characteristic of process variations. This is because this is a new operation in the mill, resulting in some instability

With CADSIM Plus it was possible to evaluate de chemical consumption inside the delignification reactor,

simulating the mass balance to the oxygen with mass flow into the process and the residual oxygen after the reaction, the same was done referring to alkali. The result showed oxygen in excess while the alkali was all consumed in the reaction corroborating with the results obtained from the alkali consumption modeling.

Model 4 simulation gave an average absolute error of 1,2 kappa number. **Figure 8** shows the tendency chart of the real and simulated kappa number.

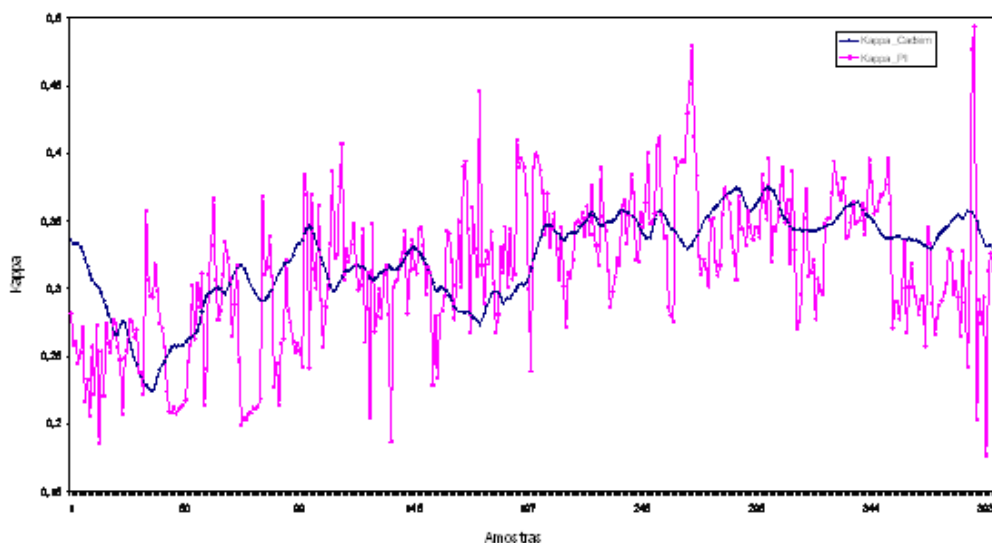


Fig.8: Comparison between real and simulated kappa number values simulated on CADSIM Plus with Model 4.

Again, this model is able to follow the behavior of the process excepting for unusual data. When analyzing the mass balance for oxygen and alkali, it can be seen that this line also operates with excess oxygen while practically all the alkali is consumed.

In the second type of simulation for both models, the software worked as server, with fixed usual process conditions as inputs, providing the analyses of the kappa number behavior when changing operational conditions.

VI. CONCLUSIONS

To represent the kinetic of the chemical reactions two adapted phenomenological models based on literature study were used. Both models were able to predict the kappa number after the delignification reactor and it was possible to obtain profiles for the kappa number decrease and the alkali consumption inside the reactor. However only the model that considered the oxygen presence in the reaction media was able to be implemented in the CADSIM Plus simulator generating reliable results.

The vantage of the phenomenological modeling is that, once the models are validated, they become a methodology potentially useful to investigate the behavior of the reaction in many operational conditions.

The models showed an average relative error of 13% to one delignification line and 10% to the other. The models are applicable to predict normalized kappa numbers in the range of 1,2 to 1,6 kappa number units. Rubini's model presented an average relative error of 8,5%, these values are in agreement with the errors given by the literature, about 8 to 20% [2].

This shows that the models obtained in this study have good accuracy to represent the real process as they are in the same level of the errors obtained by other authors in the literature. The deviations were slightly higher from another works because this is a new process in the mill operation what results in process variations and non stationary operation. Even with cautiously analyses to assure the stationary state, some data still can have errors from instrument calibration, data acquisition, or signal processing for PI software.

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Impact of the Caspian Sea Level Fluctuation on Ground Water Regime and Functioning of the Hydro-Reclamation Network on the Caspian Side Zones

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Abstract— An aim of the research is to investigate an impact of the Caspian Sea level fluctuations on the ground water regime and functioning of the hydro-meliorative network on the Caspian side zone, including Mugan-Salyan region. On the basis of the long-term data of Baku meteorological station during 1830-2014, the water level changes in the Caspian Sea was analyzed, calculations on ground water level fluctuations on the sea influence zone with the application of the selected calculation method were performed. It was determined that due to the changes in the Caspian Sea level between -28,9 m (minimum) and -26,13 m (maximum) interval, the ground water tables at the 25 km influence coastal zone, changes between 0,5- 1,93 m. These values are less than an accepted for the zone value of $h_{esk}=2,2$ m.

An analysis of the data shows that due to the fluctuations, especially rising of the Caspian sea water level, the normal working regime of the hydro-reclamation network (collector and drainage system, different type of the irrigation canals and rivers) under operation have been disturbed in the side zones, including in Mugan-Salyan massive. Consequently, this creates risks for formation of secondary salinization, water logging and desertification in the Caspian Sea influence zone.

Keywords— The Caspian Sea, ground water, the Kur river, Head (Bash) Mil-Mugan collector, secondary salinisation, water logging, desertification, depression curve.

I. INTRODUCTION

The Caspian Sea is a closed water basin, therefore a climate with the global character, tectonic, technogen modifications in the earth disturb its level stability. When the changeability amplitude of the level gets high values, this process forms large-scale, major problems for the

seaside zones and states. But a solution of these problems requires significant finance and cost expenditures $\square 10 \square$.

An influence of the Caspian Sea level fluctuations on the country's economic development in the republic shows itself vividly. Approximately, at a length of 750 km, from northern- east to southern- east the Caspian coast falls to a share of the Azerbaijan zone $\square 1 \square$. For a ratio coefficient of the coast linear length to the zone area is the first among the Caspian side countries. And it shows an effectiveness of the level modification problems for our republic. Ten administrative districts and approximately 13 % of the zone are situated on the Caspian coast. Lately, the farms in the seaside zones of the republic have been damaged in a great amount as a result of the Caspian level rising.

The sowing areas, living and industrial objects, transport and communication lines exposed to the destructive effects by the level rising in the seaside zones which are distinguished with the high development level of the high settlement density, industrial and agrarian area. The level rising shows itself not only in the seaside zone, but also in the depths of the region. So, the level rising affects the hydrological regime of the rivers and large collectors running into the sea, and changes the course processes dynamics at the large lengths. An influence of the level modification on the ground waters level and mineralizing rate shows itself in the depths of the zone. The regular observations on the sea level of Azerbaijan were begun in the first half of the XIX century (Baku point -1930), at present 13 hydro meteorological observation stations of the National Hydro meteorological Department at the Ministry of Ecology and Natural Resources in the Caspian Sea part belonging to the Azerbaijan Republic (on the coast, open sea, islands and piers), the observations are performed on the sea level in seven of them. The

information about the Caspian level ranges for 1830-2014 on table 1.

Table.1: Mean annual absolute value of the Caspian Sea level (by the negative sign), m
 Baku meteorological station 2

Decimal years	Odd years									
	0	1	2	3	4	5	6	7	8	9
1830	25,06	25,08	25,21	25,32	25,38	25,41	25,51	25,54	25,55	25,57
1840	25,75	25,95	26,11	26,23	26,16	26,18	25,77	25,63	25,73	25,92
1850	25,94	25,99	26,11	26,37	26,25	26,28	28,21	26,33	26,34	26,25
1860	26,28	26,29	26,21	26,16	26,17	26,21	26,25	26,04	25,66	25,61
1870	25,91	26,03	26,05	26,02	25,85	25,81	25,81	25,70	25,71	25,72
1890	25,81	25,96	26,01	26,03	26,06	25,96	25,74	25,78	25,87	25,89
1900	25,91	25,95	26,05	25,93	25,96	26,03	25,98	26,03	26,03	25,99
1910	26,17	26,40	26,39	26,44	26,36	26,15	26,05	26,08	26,18	26,02
1920	26,33	26,46	26,57	26,63	26,63	26,75	26,65	26,46	26,28	26,11
1930	26,22	26,36	26,27	26,38	26,52	26,71	26,92	27,14	27,45	27,75
1940	27,91	27,95	27,86	27,83	27,86	28,04	27,97	27,83	27,86	27,89
1950	28,07	28,19	28,24	28,28	28,29	28,35	28,39	28,31	28,17	28,13
1960	28,19	28,37	28,45	28,36	28,39	28,33	28,17	28,29	28,37	28,42
1970	28,27	28,32	28,41	28,47	28,48	28,58	28,83	28,92	28,87	28,57
1980	28,43	28,17	28,08	28,01	27,98	27,91	27,84	27,73	27,54	27,54
1990	27,44	27,10	26,91	26,82	26,65	26,54	26,55	26,25	26,18	26,13
2000	26,90	27,00	27,85	26,90	26,85	26,74	26,81	26,85	26,83	26,88
2010	27,00	27,20	27,25	27,30	27,43	-	-	-	-	-

The rising and falling state of the Caspian level was available in all the geological developed period 4, 9, 5. The sea level diminished till the least limit -28,92 m in 1977 of the XX century, then the water level in the sea reached -26,13 m for a short historical period (1977-1999). Since 1999 decrease of the sea level has been observed again. In 1999-2014 the Caspian level diminished 1,30 m and a mean annual value of the sea level was -27,43 ± 2,9 in 2014.

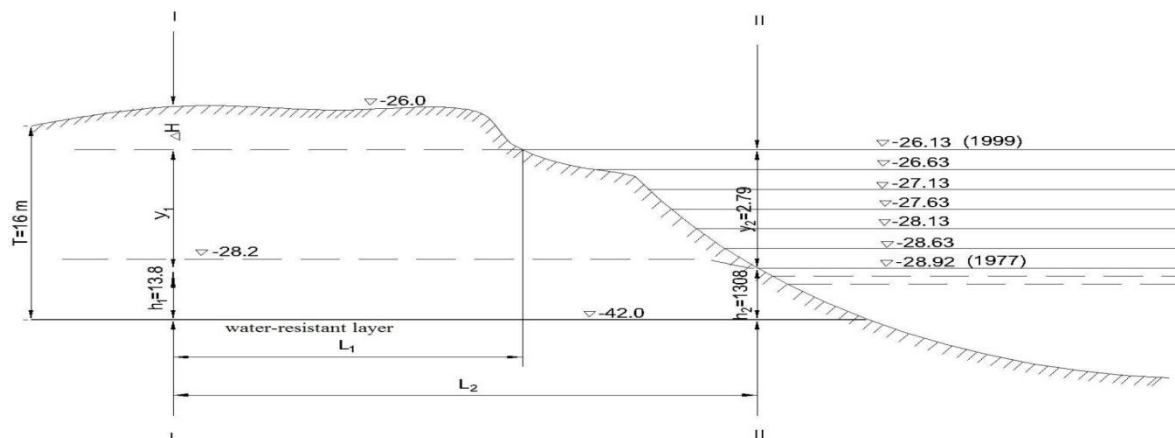
II. RESULTS AND DISCUSSION

An analysis of the different depression curves in the ground waters shows that the sea level rising, i.e. flood effect zone encircles 20-30 km of the distance.

The mineralization degree of the ground waters from the seaside areas changes to 13,5 g/l and its chemical composition is chloride-magnesium-sodium 1.

But a rate of the mineralization at 20-30 km from the sea is 78-113 g/l. The chlorine ion quantity rose till 683,0 mg.ekv., but sodium reached 816 mg.ekv. in the same zone in 2000 in comparison with 1980. This happened as a result of the sea water and ground waters mixing. A quantity of sulphate (232 mg.ekv.) and magnesium (79 mg.ekv.) ions rose in this zone. Here an amount of sulphate, chlorine, magnesium and sodium ions corresponds to the quantity before flood and chemical composition. Regarding it we can note that

$R=25 \text{ km} \left\{ \frac{20 + 30}{2} = 25 \right\}$ may be called an effect interval of the flood, an impact of the Caspian Sea level modification on ground waters regime in the seaside zone has been studied according to the situation in picture 1.



Picture.1: Study scheme of the sea water level modification effect on ground waters regime

The expenses equality equation will be as the following according to the current infertility law for the I and II sections □ 12 □.

$$K \frac{h_1^2 - h_2^2}{2l_1} = K \frac{(h_1 + y_1)^2 - (h_2 + y_2)^2}{2l_2} \quad (1)$$

here: K - is a filtering coefficient of the ground water layer; K=2 m/day was received;

h_1 and h_2 -intervals to the water-resistant layer under sea and in the effect distance of the ground water layer in the I and II section before flood creation, m;

y_1 and y_2 -an absolute height of the sea water stratum and in the effect distance after flood formation, m;

l_1 and l_2 -intervals to the I section before and after the flood creation, m.

We received $l_1 = l_2$ for the account scheme: Then

$$K \cdot (h_1^2 - h_2^2) = K \cdot [(h_1 + y_1)^2 - (h_2 + y_2)^2] \quad (2)$$

after the simple overturns performance

$$y_1 = \sqrt{(h_1^2 - h_2^2) + (h_2 + y_2)^2} - h_1 \quad (3)$$

The sea water level was in the lowest value.

In 1977, (V -28,92 m), the highest level in the sea was (V-26,13 m) observed in 1999.

An interval till the water-resistant layer with the water level in the influence radius distance (L=25 km) of

the ground water depression curves in the lowest value of the sea water level will be $h_1=13,8$ m. The same level is received as a level corresponding to crisis depth. A crisis depth of the ground waters for the Mugan-Salyan zone is received as $h_{cris}=2,2$ m.

We find $h_2=13,08$ m; $y_2=2,79$ m in the II cut a difference of the maximum and minimum water levels in the sea is equal to $|-26,13 - (-28,92)|=2,79$ m.

The levels due to II-3, II-4, II-5, II-6 and II-7 sections with the 0,5 m modification of the level determine y_2 heights corresponding to them in the II cut and y_1 heights are calculated by using of formula 3. The calculation consequences have been given on table 3.

We use from this formula

$$\Delta H = T - (h_1 + y_1) \quad (4)$$

To find distances (ΔH) of the ground waters from the surface (L=25 km) at the end of the effect zone.

If the known values are written:

$$\Delta H = 16 - 13,8 - y_1 = 2,2 - y_1$$

$$\Delta H = 2,2 - y_1$$

ΔH values are found for each section according to the known values of y_1 .

As it is shown on table 2 ΔH values change from -0,5 m to 1,93 m in the different levels between -28,9 m (minimum level) and -26,13 m (maximum level) of the sea water level. These values are less than $h_{cris}=2,2$ m received for the massive.

Table.2: Ground waters level modifications in the various values of the sea water level

Section s	Minimum level of the sea water, m	Various water levels, m	L, km	h ₂ , m	y ₂ , m	h ₁ , m	y ₁ , m	ΔH, m
II-1	- 28,92	- 26,13	25	13,08	2,79	13,8	2,72	- 0,5
II-3	- 28,92	- 26,63	25	13,08	2,29	13,8	2,28	- 0,08
II-4	- 28,92	- 27,13	25	13,08	1,79	13,8	1,75	0,45
II-5	- 28,92	- 27,63	25	13,08	1,29	13,8	1,22	0,98
II-6	- 28,92	- 28,13	25	13,08	0,79	13,8	0,75	1,45
II-7	- 28,92	- 28,63	25	13,08	0,29	13,8	0,27	1,93

If we take into account that an effect distance of the flood created as a result of the Caspian Sea level raising, it affects the ground waters level in the Mugan-Salyan massive. A change dynamics of the ground waters over a massive was reflected on table 3. During the table

composition H.Y.Israfilov's materials and information of the meliorative state cadastre of the irrigated waters about a date of January 1, 2015 in the Azerbaijan Republic [11, 8] have been used.

Table.3: Distribution dynamics of the ground water table in the Mugan-Salyan irrigation massive in 1930-2015

Name of the plains	1930					1962					2015				
	0-1	1-2	2-3	3-5	> 5	0-1	1-2	2-3	3-5	> 5	0-1	1-2	2-3	3-5	> 5
	m														
Mugan	56,2		13,1	30,1	0,6	16,6	62,4	20,4	0,6	-	0,69	43,42	49,2	6,69	-
Salyan	4,8	39,3	24,8	22,6	8,5	56,4	14,5	16,6	12,5	-					

The Caspian Sea water level was -26,22 m in 1930; -28,45 m in 1962; -27,43 m in 2015.

As it is seen from the table a slope depth of the ground waters which is more than 5 m in the research zone were observed in 1930. In the following years a mitigation in the slope depth of the ground waters was observed and the areas where the ground waters spread at the slope depth more than 5 m did not participate. The zones where a slope depth of the ground waters is 1-3 m prevail. If we analyze a modification dynamics of the ground waters slope depth depending on time, we can see that on the one hand process approaching of the ground waters the land surface happened, on the other hand an amount of the areas where the ground waters with the different depth spread increased-decreased in different years.

The reason is connected with the collector-drainage and irrigation systems work on the one hand, on the other hand it is related to rising or falling of the Caspian Sea level.

The analyses show that the hesitations occurring in the Caspian Sea level disturbed a normal work regime of the hydromeliorative net which is in action in the Mugan-Salyan massive (collector-drainage systems, different fixing canals, rivers).

An analysis of the available materials shows that a flow rate of the ground waters into the sea diminishes as a result of the sea water level rising. This was a reason for decrease of the affective impression in the inter drains distance and decline of the flow rate in the collector-drainage net.

The largest collector operated in the research object is a Head Mil-Mugan collector. Building of the Head Mil-Mugan collector was started in 1984. In the same year the Caspian Sea level was -27,98 m. The Caspian Sea level vibrated in different values in 1984-2014.

The observations show that the 40-50 km of the mouth part in the collector works in a flood regime as a result of the sea water level rising. The water level of the

collector is at 1,5-2,0 m distance from the surface. That affects the water rate and expense in the collector. A comparison of the project and factual values of the water rate and expense in the collector at 110 km distance between the Araz river and Caspian Sea shows that there is an enough difference between these values. If an object expense of the water flowing into the Caspian Sea should be 107 m³/sec., this value is 30 % less than a project value by being equal to 74,0 m³/sec.

The project rate of the water in collector is 0,52 m³/sec. in the same part, but a factual value is 0,41 m³/sec.

The factual rate is 21,0 % less than the project rate. Six collectors join the Head Mil-Mugan collector at 110 km interval.

The right coast collector, K-1-1 collector, Mugan-Salyan water-throwing, North Akusha collector, the Kurside collector, South-Eastern collector.

This situation in BMMK affects the same collectors and initial drains. The normal work regimes of the collector-drainage net which is consequently in action in the massive disturbed, the nearness of the ground waters level to the surface in the effect zone of the net creates a condition for the secondary salinization in the same soils.

If we take into account that the soils possessing a different salinization degree in the soils from Salyan and Neftchala occupy large zones, then we can come to such a conclusion that the situation is rather serious □ 6, 7□.

The second larger collector in the irrigation massive is Mugan-Salyan water-thrower. A length of this collector in the available state is 87,5 km (from the Caspian Sea to the pump station). It was put into operation in 1953. The collector water transmissivity ability of the collector on the project is before 21 m³/sec. and 36 m³/sec. at the mouth. A reason of the work regime disorder in this collector is stable and regular uselessness of the pump-station serving the same collector.

The fundamental factor affecting the regular uselessness in the pump station is water level raising in the water-thrower as a result of the Caspian water level raising. It is such a situation that the collector parameters don't answer the power, of the pump station.

Majority of the rivers including the largest river Kur flows into the Caspian Sea. Rising of the Caspian Sea level has affected and is affecting the dynamic processes in the rivers' mouth coasts and a hydrological regime of the rivers □ 3 □.

III. CONCLUSIONS

Summarizing of the research materials allows to come such a conclusion that it is important to solve the problems created by the Caspian Sea level rising, to provide the future development of the coastal farming; including an abolishment of the flood by the mechanical

means, building of the drainage systems which are basically managed on all the zones; establishment of the stable observation nets; consolidating of the coastal zone; the appropriate measures fulfilment for an improvement of the ecological-ameliorative situation; regarding of the level fluctuations in the Caspian Sea as an important factor while accommodating the new dwelling settlements and objects.

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Adsorption and incorporation of the zinc oxide nanoparticles in seeds of corn: germination performance and antimicrobial protection

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Abstract—The treatments of the seeds are important procedures applied by the agronomical area to improve the culture yield. From these procedures the micronutrients are available for the seeds before and during the germination stages. One high challenge is make efficient these treatment processes and to ensure the adsorption and the incorporation of these micronutrients in the seeds and to improve its performance in the germination phase. In this work studies explored the optimization of the incorporation process and the characteristics of the zinc oxide clusters adsorbed on the surface of the seed. The results were associated with the agronomic responses during the germinations stages of the seeds of corn. The seeds were treated in suspensions containing different concentrations of nanoparticles of zinc oxide and during different treatment times. The adsorptions in the corn surface and the absorption of the nanoparticles for the inner of the seeds were studied together with its antibacterial characteristics and correlated with the germinations indicators. The results showed that is possible to incorporate nanoparticles of zinc oxide in inner of the seeds of corn and improve the germinations indicators. Antibacterial protection was aggregated on the seeds of corn. It's possible to incorporate 0.280 mg of zinc oxide nanoparticle per seed mass in inner of seeds with the optimal treatment conditions with nanoparticle concentration of 50 mg/L in the suspension and with treatment time of 180 minutes. With the optimal treatment concentration the normal plant percentage increase of 2.70% in relationship to the seeds not treated.

Keyword—Zinc oxide nanoparticles, treatment of seeds of corn, treatment with nanoparticles, improve of germinations indicators.

I. INTRODUCTION

Technological innovations for corn culture in the last years are largely associated with the decrease of the cost production and for the increase of the culture yields. Despite the accumulated technological information by the agronomic sector the nanotechnology is a new science that can bring excellent opportunities for this field, specifically for the treatment of seeds and for the foliar treatments.

The nanotechnology is very applied by many segments for the development of drugs [1-4], biosensors [5-9], electronic devices [10-14] and others. But, in the agronomic experiments this science is few applied for improve the yield of corn culture, for example.

Some agronomic practices need to be further studied and refined and can be improved with the use of nanotechnology. As a factor of great importance associated with the production, fertilization methods need to be balanced, not only macronutrients, but also with micronutrients, and these may be in the form of nanoparticles [15,16]. In particular, nanoparticles of manganese (Mn) [17], molybdenum (Mo) [18] and zinc (Zn) [19] may be employed as micronutrients for corn seeds.

The zinc element, for example, has great importance in all stages of the development of the corn plant. According to Barbosa Filho et al. (1990), one of the consequences of zinc deficiency in the plants is the shortening of its internodes, which results in the reduction of the plant growth rate and in the lower production of new leaves and of the yield of the grains. These effects are due to the fact that zinc is required for the tryptophan production, which is a precursor of the indole acetic acid, a growth hormone promoter of the plant [20].

In the traditional processes of corn seed treatment are employed zinc salts such as zinc hydroxide and zinc

nitrate. When the seed is placed in the soil, which contains water, the salts are dissociated and the zinc ions are leached into the soil. These conditions do not favor the supply of zinc species for the seed and reduces the efficiency of the treatment process.

The addition of zinc oxide nanoparticles may be an interesting alternative to improve the treatment process yield of the seeds. The zinc oxide nanoparticles not are dissociated in water and have a very small dimension. When added to the seed the zinc oxide nanoparticles remains stable and may migrate to the inner of seed and to participate of the metabolic processes. Seed treatment with zinc oxide nanoparticles can be more efficient and to lead to significant improvements of the indicators of plant development.

Recently studies applied metallic nanoparticles in agronomic experiments and obtained promising results, but also negative responses were obtained for the same conditions of applications and for the same type of nanoparticle. For example, studies showed that after long exposition time in suspensions containing 500 mg/L of cerium oxide nanoparticle, in hydroponic systems, the defense mechanisms of the plant is prejudiced [21]. But, others works made the proteomics analysis of roots of soy treated with aluminum oxide nanoparticles and obtained positive responses for the growth performance of the soy in inundation stress conditions [22].

The zinc oxide nanoparticle has been an interesting theme and has been studied for the treatment of seeds, in special for the treatment of seeds of corn. Boonyanitiponget al., (2011) and Lin and Xing (2007) studied the impact of the application of zinc oxide nanoparticles on some plants and reported that the nanoparticles can be affect their developments when applied with higher concentrations than the critical concentrations, but not affect their performance during the germination processes [23,24]. For example, when applied in the treatment of pea (*Pisum sativum*) the zinc oxide nanoparticles not promote negative effects for the germinations indicators, but the treatment promote a decrease of the length of the roots [25].

Pokhrel, L.R. et al. (2013) evaluated the phytotoxic potential of the zinc oxide nanoparticle in the corn culture (*Zea mays L*) and in the cabbage plants (*Brassica oleracea var. Capitata L.*). In the germination indicators and in the length of the roots the nanoparticles presented small toxicity in comparison with the compounds containing free ions of zinc [26]. The authors not founded significant signal of lipid peroxidation processes or the leakage of the ions and verified that the physiologic measures (transpiration, photosynthesis and stomatal conductance) not were affected. In the same studies the authors identified the increase of the activity of the catalase enzyme and of the

ascorbate enzyme and a positive regulation of the thermal shock.

The zinc oxides nanoparticles can contribute with an antimicrobial protection of the seeds beyond of the benefits in the supplying micronutrient mechanisms for the plants due increase the mobility in the transport mechanisms of the micronutrients. Recently studies showed that the nanoparticles of zinc oxide have antibacterial effect [27-31]. Therefore, the zinc oxide nanoparticles can inhibit or death the microorganism undesirable during the germination of the plants, with an antibacterial protection of the seeds.

Many studies have been realized about agronomical and physiological aspects involving the treatment of the seeds by nanoparticles [32-33]. But, there is not evaluation about of the nanoparticle storage in corn seeds after their treatment with different nanoparticle concentration in the ZnO nanoparticles suspension and different treatment times. Similarly, there are not correlations between the treatment conditions of the seeds with the real protection capacity of microbial agents. This information is important and interesting for the agronomical area, considering that these treatments can promote a positive effect or a negative effect, depending of the nanoparticles concentrations in suspension or of the treatment time.

In this work was studied the simultaneous treatment of the seeds of corn with different concentration of zinc oxide nanoparticle and different treatment times. The studies explored the optimization of the incorporation process and the characteristics of the zinc oxide clusters adsorbed on the surface of the seed. The results were associated with the agronomic responses during the germinations stages of the seeds of corn. The adsorption characteristics of the nanoparticles on the seed surface (pericarp) were evaluated and the amount of zinc oxide nanoparticles incorporated in the inner of the seed of corn was determined. These information were correlated with the germination indicators of the seeds. The antibacterial properties aggregated on the seeds due the adsorption of the zinc oxide nanoparticle were studied too.

II. EXPERIMENTAL PROCEDURES

2.1 Seeds of corn and nanoparticles

In this work were utilized seeds of a hybrid corn of the type ADV 9275 PRO® courtesy by AdvantaSementes® of the group UPL (United Phosphorus Limited). The seeds were classified as the simple hybrid, with grain semi-hard and with yellow-orange coloration, of precocious cycle and of high technology and with a plant population of 6000/ha. The seeds of corn were treated according the commercial procedures adopted by the company and with the chemical solution formulated according the Table 1.

Table 1: Suspension adopted for the industrial treatment of the seeds of corn by the companies for the hybridic corn type ADV 9275 PRO®

Chemical compound	Active compound	Dose for the treatment of 100kg of seeds
Maxim XL	Fludioxonil 2,5% + Metalacyl – M 1,0%	150 mL
K-Obial 25CE	Deltametrine 2,5%	6 mL
Actellic 500 EC	Pirimifois - Methyl 50%	3 mL
Agrawal Dye	Sulfate of dodecylbenzenesulfonic Not applicable	1 mL 27 mL

Source: Advanta Sementes® (2014).

The zinc oxide nanoparticles utilized in this work were courtesy by Kher Chemical Research and have a cylindrical stick format with average length of 100 nm and average diameter of 20 nm. The purity grade is 99.5%.

2.2 Treatment of the seeds of corn with different concentration of zinc oxide nanoparticles in the ZnO nanoparticles suspensions and different treatment time

The treatments of the seeds of corn were realized in an open glass reactor containing an aqueous suspension at room temperature. The suspensions with different concentrations of zinc oxide nanoparticles were prepared in 2000 ml of ultrapure water and containing 100 g of seeds immersed in this medium. The agitations were realized by a magnetic system and with different treatment times. All experimental conditions for the seeds treatment are presented in the Table 2.

Table.2: Experimental planning matrix showing the experimental conditions for the treatment of 100g of seeds of corn with different concentrations of zinc oxide nanoparticles and different treatment times

Treatment time (minute)	69	180	450	720	830
Concentration of zinc oxide nanoparticles (mg/L)	6.95	50.00	155.00	260.00	303.05

The experimental conditions were defined utilizing a factorial experimental planning with the concentrations of zinc oxide nanoparticle (C) and with the treatment time (t) being the experimental planning factors (variables). The range adopted for the treatment times was 69 min to 830 min and the range for the concentrations of the zinc oxide nanoparticle was 6.95 mg/L to 303.05 mg/L, respectively. As experimental responses were evaluated the concentration of zinc oxide nanoparticles incorporated in the inner of the seeds of corn.

After each treatment the seeds of corn were extracted of the glass reactor and dried at room temperature and

accommodated in paper bags and identified according with the respectively treatments. The paper bags containing the seeds of corn were stored in a dry chamber with controlled temperature of 20°C and humidity of 40%.

According the methodology of experimental planning were realized 11 experimental treatments and with triplicate. Table 3 presents the experimental matrix with all treatment conditions applied for the seeds of corn.

Table.3: Experiments adopted according experimental planning for the treatment of the seeds of corn

Experiments	Concentration of zinc oxide nanoparticles -----mg/L-----	Treatment time -----minute-----
1	260.00 (+1)	180 (-1)
2	50.00 (-1)	180 (-1)
3	260.00 (+1)	720 (+1)
4	50.00 (-1)	720 (+1)
5	155.00 (0)	450 (0)
6	155.00 (0)	450 (0)
7	155.00 (0)	450 (0)
8	155.00 (0)	69 (-2 ¹) ²
9	155.00 (0)	830 (+2 ¹) ²
10	6.95 (-2 ¹) ²	450 (0)
11	303.05 (+2 ¹) ²	450 (0)

The seeds of corn also were treated with concentration of 1000 mg/L of zinc oxide nanoparticles. The objective was to evidence the adsorption effects of the zinc oxide nanoparticles on the surface of the seeds.

To statistical analysis of the effect of the factors (variables) in the incorporation of the nanoparticle in the inner of seeds and in the adsorption characteristics on the surface of the seed were applied statistical tests type t, F and P, together with variance analysis and of estimated effects.

2.3 Quantification of the concentration of zinc oxide nanoparticle in the inner of seeds of corn

For all experimental treatment conditions was determined the concentration of zinc oxide nanoparticle incorporated in the inner of the seeds of corn and on the surface of the seed by atomic absorption spectrometric technique (AAS).

For AAS analysis 2g of seeds of corn treated and shelled was diluted by acid digestion procedures in a solution of 5ml of concentrated nitric acid (Merck - 65%) on the digester block (Model TE-040/25 Tecnal) during one hour at 90°C and by 2 hours at 180°C.

The digestion solutions were diluted with 10ml of deionized water (18.2 MOhm.cm – Milli-Q) before all AAS analysis for the determination of the total concentration of zinc oxide nanoparticles in the inner of the seeds or on the inner surface. Thus, was possible to correlate the amount of the zinc oxide nanoparticle incorporated in the inner of seed with the different concentration of zinc oxide nanoparticle in the suspension and with different treatment times applied in the treatments. Similar experiments were realized with the seeds in shell and shelled seeds.

2.4 Chemical and physical characterization of the seeds of corn

After the treatments, according Table 2, the seeds of corn were submitted to analysis by the absorption atomic spectrometry (AAS) to determine the percentage of the zinc oxide nanoparticle adsorbed on its surface and the percentage incorporated in the inner of the seed. In these experiments the seeds with its shell were analyzed and the total of the zinc specimens was determined by the AAS experiments with a system Model 800 Analyst AAS - Perkin Elmer®, with wavelength 213.9 specifically for detection of zinc component, and realized in quadruplicate for each treatment condition.

The scanning electron microscopy (SEM) was applied to evaluate the characteristics of the morphology and of the distribution of the nanoparticles adsorbed on the surface of the seeds. The SEM also was applied to evaluate the integrity of the cellules of the seeds of corn. The energy

dispersive spectrometry (EDS) was simultaneously applied for the chemical identification of the zinc oxide nanoparticles and to obtain the chemical distribution of the nanoparticles on the cellular structures. The system FEG Model Tescan Mira3 and EDS Model Oxford X-Max 50 were applied for these analyses. All samples were coated with a thin film of gold to analysis.

2.5 Germination tests and evaluation of the vigor of the seeds of corn treated with zinc oxide nanoparticles

The germination tests and the vigor information's of the seeds of corn treated with different concentration of the zinc oxide nanoparticles in suspension and with different treatment times were realized during April and May of 2015.

Amounts of the seed of corn were treated only with water, without zinc oxide nanoparticles, but with equal times utilized for the treatments in suspensions containing nanoparticles. These seed of corn were considered as the standard seed of corn.

Thirty experiments were established as a results of the combinations between the treatments times and concentrations of zinc oxide nanoparticle employed in the treatments. The experimental planning utilized was the completely randomized (D.I.C.), organized with the factorial scheme 5x6 (time x concentration) and with four repetitions for each experimental condition. The respective values for the factors were: t1: 69 minutes; t2: 180 minutes; t3: 450 minutes; t4: 720 minutes e t5: 830 minutes e C1: 0 mg/L (standard seed of corn); C2: 6.95 mg/L; C3: 50.00 mg/L; C4: 155.00 mg/L; C5: 626.00 mg/L e C6: 303.05 mg/L.

The germination tests were realized in substrates of paper towel (Germitest) hydrated with a volume of distilled water equivalent to the three times of the seed mass. The vigor of the seeds was evaluated with first germination counting and with the determination of the germination velocity.

The germination tests were realized with four sub-samples of 50 seeds for each treatment, according the criteria established by the Rules for Seed Analysis in Brazil [31]. The rules containing the seeds were put up in a germination camera type B.O.D. (Model MA 415) and maintained at 25±2 °C.

The evaluation of the first germination counting was realized on the fourth day after the installation of the tests. The final germination counting (second counting), obtained by the sum with first germination counting, was realized on the seventh day after the installation of the tests. The dates were converted for percentage values of normal plants and for the not normal plants [34].

The germination velocities were determined employing the equation of Edmond e Drapala (1958), equation (1):

$$V.G.= [(D_1 \times P_1) + (D_2 \times P_2)] / (P_1 + P_2) \quad (1)$$

where: V.G. is the germination velocity expressed as the medium number of days for the germination; D1 and D2 a number of days between the sowing and the first and the second germination counting; P1 and P2 is the number of normal plants or abnormal plants in the first and in the second germination counting.

The collected dates from the germination tests were analyzed with the variance analysis methods applying the F test and the regression analysis ($p \leq 0.05$) and utilizing the computational applicative SISVAR, a variance analysis systems for the balanced dates.

2.6 Microbiological characterization of the seeds of corn
The antimicrobial activity tests of the seeds of corn treated with zinc oxide nanoparticles were realized according the Japanese Industrial Standards Methods (JIS Z2801:2010) with some modifications. The tests were realized with triplicate with the *Staphylococcus aureus* (ATCC 25923) and with the bacteria *Escherichia coli* (ATCC 11229). The microbiological tests were realized with the seeds of corn treated by 180 minutes with the suspensions containing 6.95, 50.00 and 303.05 mg/L of zinc oxide nanoparticle and with seeds of corn treated only ultrapure water (considered the standard samples). The microbiological tests were realized with the objective to analyses the presence of the antibacterial activity and if is dependent of the concentration of zinc oxide nanoparticles in the treatment suspensions. The microbiological tests were realized with three suspensions of treatment containing a low concentration, a medium concentration and a high concentration of the zinc oxide nanoparticles.

The bacteria were reconstituted in sterile distilled water and seeded in brain-heart infusion broth (MERCK) and incubated in a microbiological oven at 35°C by 24 hours. The inoculum was peaked in a nutrient agar (MERCK) and incubated during 24 hours in a microbiological oven at 35°C. After these procedures the bacteria were removed

and diluted in test tube containing 4.0 ml of saline solution of 0.8% (MERCK). The suspension was adjusted to McFarland standard solution. These procedures were realized for all microorganisms.

Aliquots of 0.2 ml of the bacteria suspensions' were distributed (spreader) on the surface of the seeds of corn ($\sim 0.43 \text{ cm}^2$) and deposited on the Petri dishes. The dishes were placed in the microbiological oven at 35°C to incubate the bacteria during different times, 0, 2, 4, 6, 10 and 24 hours.

For each incubation time were quantified the viable bacteria utilizing the Pour Plate Technical, with the homogenation of the seeds of corn in 10 mL of Luria Bertani broth. The volume 0.1 ml each dilution was placed on the Petri dishes and placed 7.0 mL of standard agar for the growth and count of the microorganisms (PCA). The samples were incubated in a bacteriological oven at 35°C by 48 hours.

The dilution that presented an amount of bacterial colonies between 30 and 300 was submitted to the counts and the number of viable bacteria per square centimeters was determined according equation (2):

$$n = (c.d.v)/A \quad (2)$$

where nis the number of viable bacteria per cm^2 , c is the colonies counted, d is volume (ml) of the broth for washing and A is the surface area (cm^2).

III. RESULTS AND DISCUSSIONS

3.1 Treatment of the seeds of corn with zinc oxide nanoparticles

Adsorption of the zinc oxide nanoparticles on the surface of the seed of corn

The seeds of corn were treated in suspension containing different percentage of zinc oxide nanoparticle. Fig. 1 show images obtained by the SEM of the surface of the seeds of corn treated with zinc oxide nanoparticle during 180 minutes in suspensions containing 50 mg/L, treated in suspension containing 1000 mg/L and for seeds treated with water without nanoparticles (standard seeds).

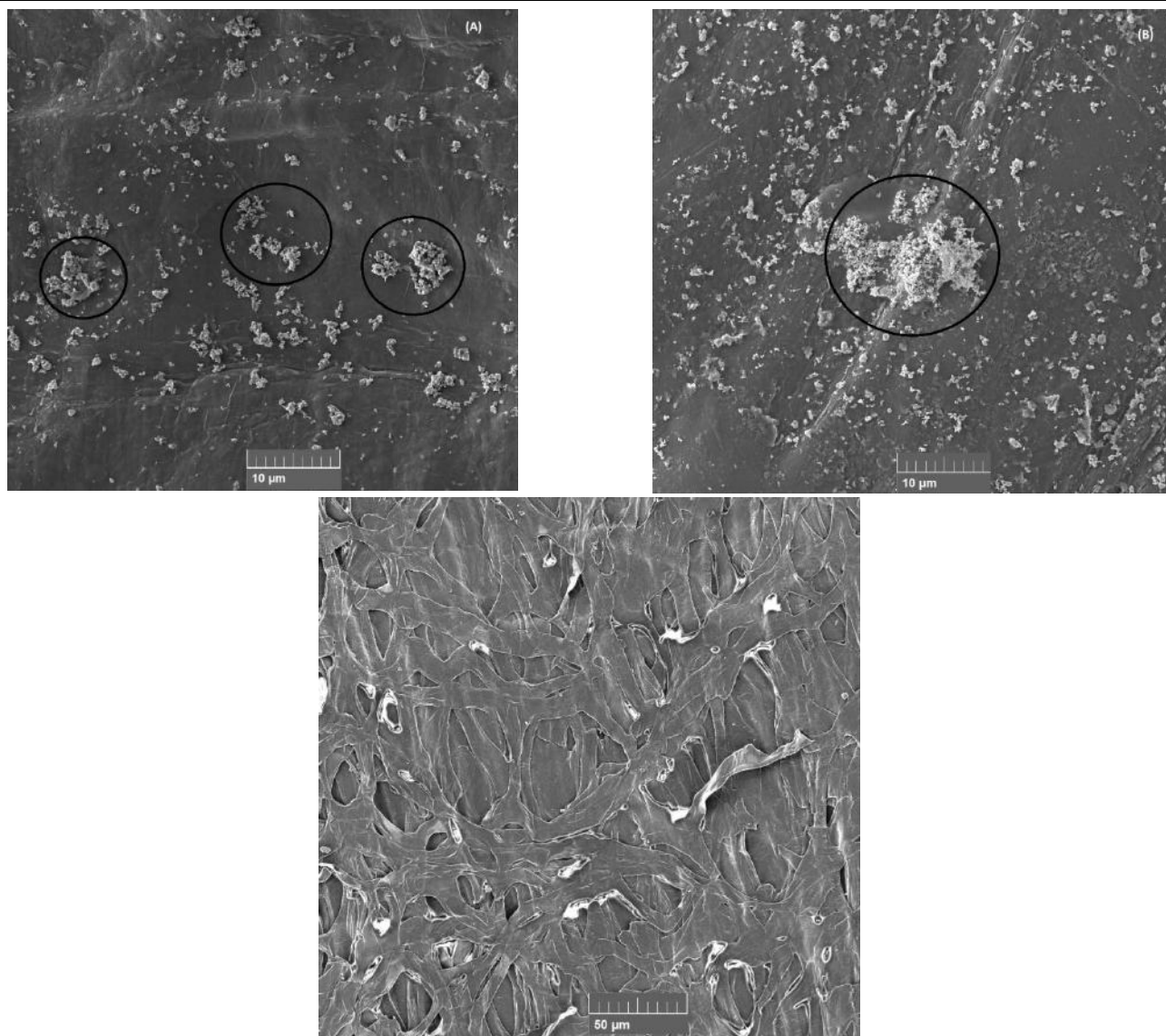


Fig. 1: Images obtained with electron microscopy of the surface of seeds of corn treated by 180 minutes with suspension containing different concentrations of zinc oxide nanoparticles: (a) 1000 mg/L, (b) 50 mg/L and (c) standard (without zinc oxide nanoparticles in suspension).

The images reveal that the surface of the seeds of corn treated only with water does not present nanoparticles adsorbed on the surface, Fig. 1(c). However, other images show clusters formed by zinc oxide nanoparticles distributed on the surface of the seeds of corn treated in the suspensions containing the nanoparticles. With the treatment in the suspension containing 50 mg/L, reformed clusters on the surface of the seeds with sizes between 1 and 2 micrometers and casually the formation of the higher clusters. With the treatment in the suspension containing 1000 mg/L, a larger amount of higher clusters are formed on the surface of the seeds and with sizes between 5 and 10 micrometers. The growth and shape of the clusters on the surfaces are typical

of agglomerates formed during a physical adsorption phenomenon. There are the adsorptions of the first zinc oxide nanoparticles in specific regions of the seed and after this time there are the growths of the clusters to long time. The surfaces of the seeds of corn are formed by fibrous cells (pericarp) that are interlaced. These structures generate cavities (micro-cavities) that are preferential paths for the migration of the mineral compounds that are adsorbed on the surface of the seeds for the inner of seeds. The Fig. 2(a) shows details of the pericarp morphology and its interlaced structure.

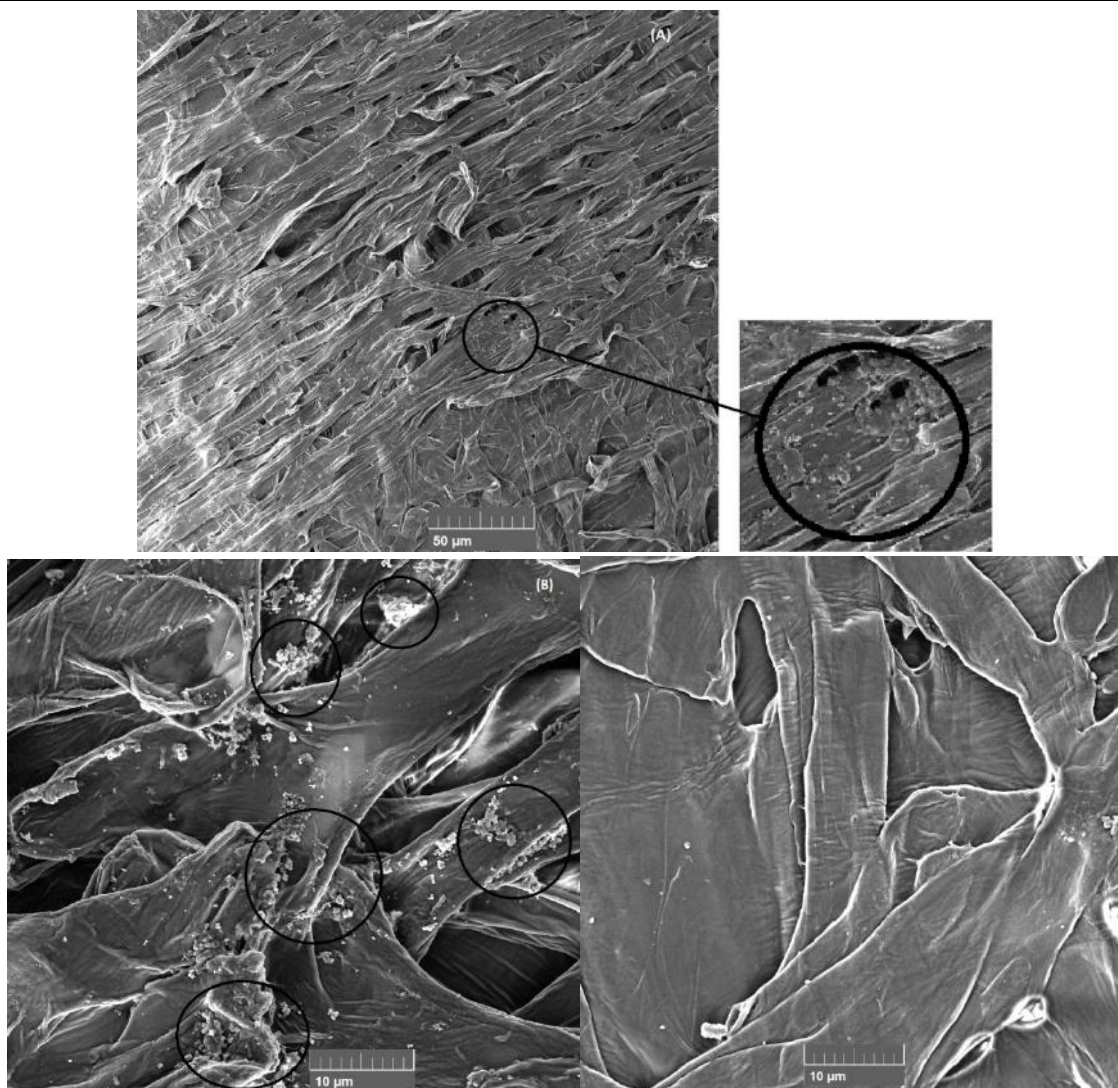


Fig. 2: Images obtained by electron microscopy showing details of the cell fibrous distribution (pericarp cells) on the surface of the seed of corn (a) and the formation and distribution of the clusters constituted by zinc oxide nanoparticles (b) Seeds treated with 180 minutes and in suspension containing 1000 mg/L and (c) standard (without zinc oxide nanoparticles in suspension).

Fig. 2(b) shows the clusters of zinc oxide nanoparticles adsorbed preferentially on the edges of the pericarp cells. The higher clusters are adsorbed on the edge of the pericarp while few small clusters are adsorbed on the surface of the pericarp cell. This is a strong indicative that the adsorption processes of the zinc oxide nanoparticle on the surface of the seeds of corn occurs preferentially on the edge of the pericarp cells and around of the micro-cavities which favor the migration of micronutrient for the inner of seeds. Fig. 2(b) show details for the pericarp cells of the seed of corn treated only water, suspension without nanoparticles. The images reveals the absence of the nanoparticles and cluster on the surface or on the edges of the cells.

Fig. 3(a) shows details of the clusters adsorbed on the edge of the pericarp cells for the seeds treated in

suspension containing 1000 mg/L and during 180 minutes. The results prove that the clusters are preferentially formed on the edge of the pericarp cells. The clusters are constituted by nanostructures with dimension between 50 and 250 nanometers of zinc oxide. These nanostructures are very lower than the dimensions of the micro-cavities formed by the interlacing of the pericarp cells, which have dimensions of micrometers. These characteristics suggests that the clusters of the zinc oxide nanoparticles can be considered a zinc micronutrient reserves and are easily transported from the surface of the corn seed for its inner. Fig. 3(c) reveal the absence of nanostructures or of clusters on the edge of pericarp cells of the seed treated only water (standard seed).

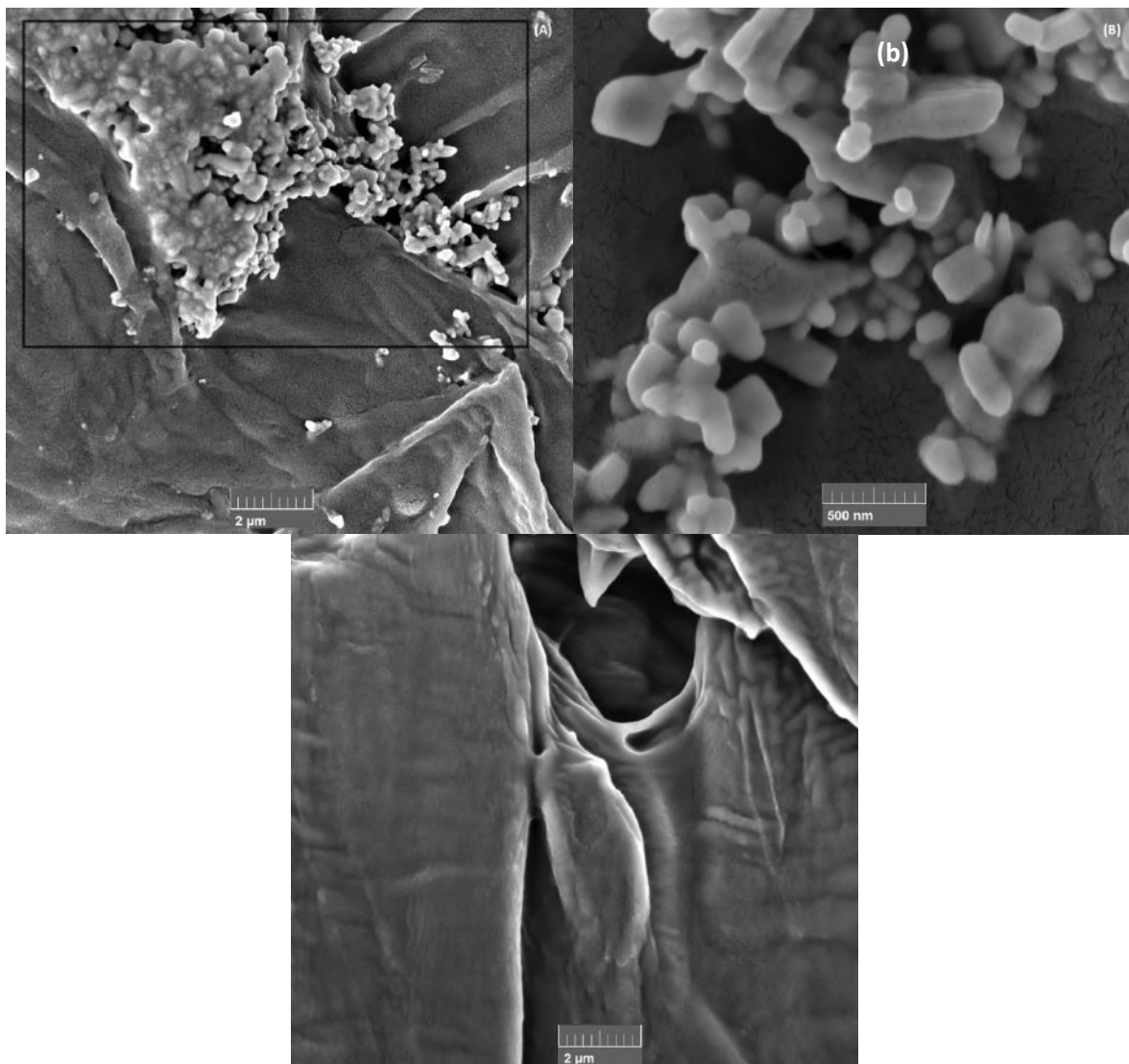


Fig. 3: Images obtained with electron microscopy showing details of the clusters constituted by zinc oxide nanoparticles and adsorbed on the edge of the pericarp cells (a) and the details of the nanoparticles (b). Seeds of corn treated with 1000 mg/L and time 180 minutes and (c) standard (without zinc oxide nanoparticles in suspension).

Details of the surface of a seed treated with 1000 mg/L are showed in Fig. 4(a). The images evidence the formation of clusters on the edge of the pericarp cell. Some regions were highlighted and studied by EDS and named by the Spectrum2 and Spectrum3. Fig. 4(b) shows the EDS results obtained from the region Spectrum2 and

proves the presence of zinc oxide. The EDS result presented in Fig. 3(c) proved the absence of the zinc oxide nanoparticle in the region Spetrum3, which is a region on surface of the seed of corn. These results demonstrate that the clusters formed or the nanostructures observed on the surface of the seed of corn are constituted by zinc oxide.

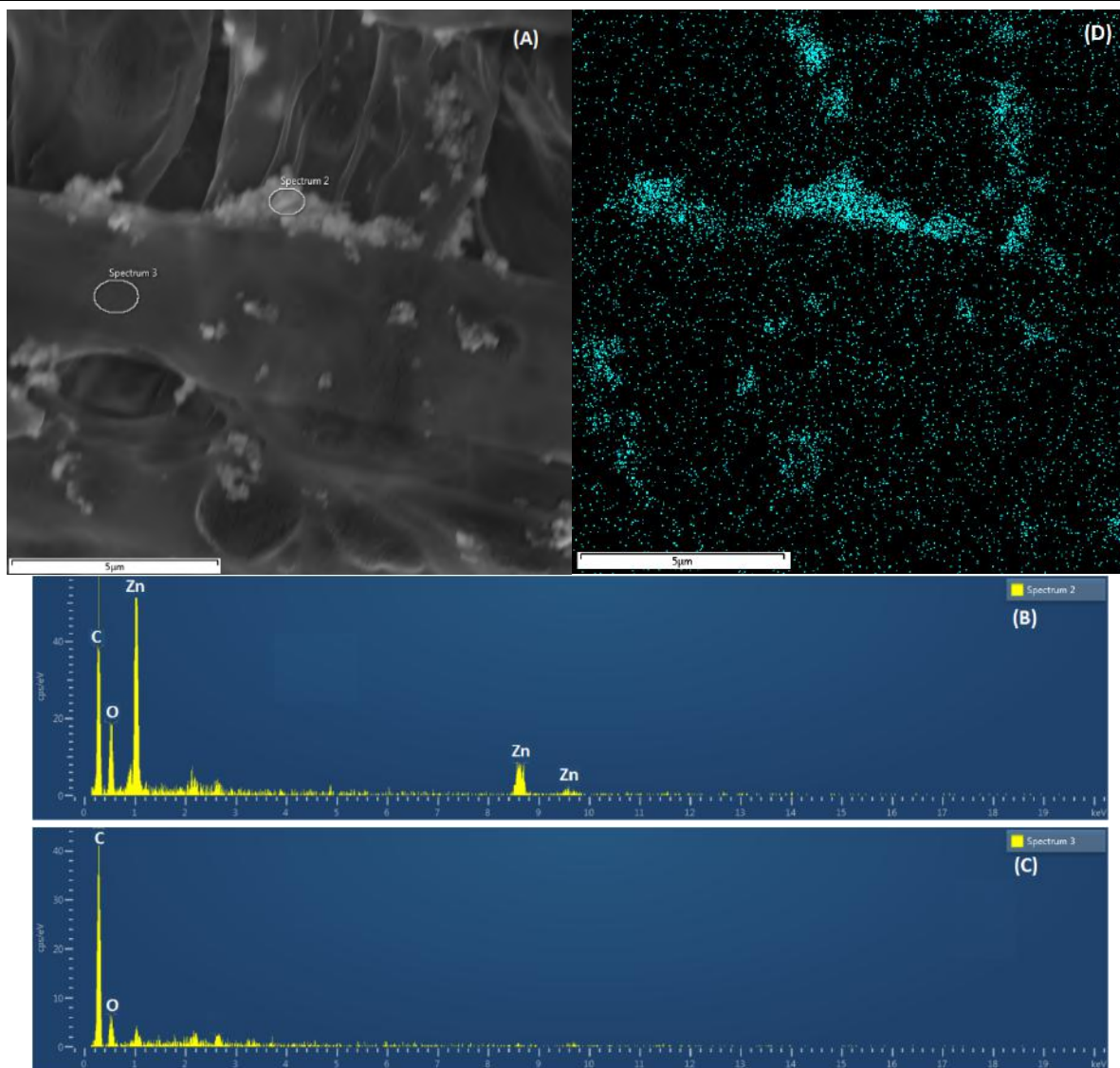


Fig. 4: (a) Images obtained by electron microscopy with details of the fixed nanoparticle cluster on the interfaces of the fiber cells on the surface of the seed of corn, (b) chemical distribution of the zinc oxide nanoparticles obtained by EDS, (c) chemical analysis by EDS in region defined as "Spectrum 2" proving the presence of zinc oxide in a cluster and (d) chemical analysis by EDS in the region defined as "Spectrum 3" proving the absence of zinc in the fiber cell of the pericarp of the seed of corn.

Fig. 4(d) shows the correspondent chemical distribution of oxide zinc compound on the complete surface analyzed by EDS and proves that the nanoparticles and clusters observed are constituted by zinc oxide and are fixed majority on the edge of the pericarp cells.

The characteristics of the clusters on the pericarp cells of the seeds of corn are important aspects for understand the transport mechanisms of the zinc elements for the inner of the seed of corn, which associated with the development of the seeds during its germination stages, for example. The preliminary results of this work show that the zinc oxide nanoparticles tend to form clusters after the treatment of the seeds of corn, which grows and fixated mostly in the interface regions between pericarp cells. In these interfaces are formed interlaced structures constituted by pericarp

cells and formed an inter-diffusion path (micro-channels into the interior) that favor the transport of the minerals components from the clusters fixed on the surface of the seed for its inner. In this case the transport of the zinc oxide nanoparticles for the inner of the seeds of corn.

The clusters are formed preferentially on the interface regions and can be considered as minerals reservoirs of the zinc oxide nanoparticles for the seed. The clusters are constituted by nanoparticles with lower dimensions than these micro-channels and the nanoparticles released can be easily transported for the inner of the seed along of the times and to participate of the important metabolic germination mechanisms of the seeds of the corn.

The clusters are formed by the adsorptions of the zinc oxide nanoparticles in specifically sites on the surface of the seeds of corn. In the physical adsorption phenomenon

the characteristics of the cluster depends of the specimen concentration in the suspension medium. The increase of the specimen concentration in the suspension medium promotes the increase of the amount of clusters and the increase of its sizes. But the growth rate of the cluster decreases with the increase of the time because the saturation of the adsorption area is expected [35].

Fig. 5(a) shows the relationship between the mass of zinc oxide nanoparticles per seed adsorbed on the surface of the seed of corn and the concentration of zinc oxide nanoparticles in the treatment suspensions, obtained by atomic absorption techniques. The results confirm that the mass of zinc oxide nanoparticles on the surface increase with the increase of the concentration in the suspensions. Utilizing the suspensions more concentrated is possible to obtain higher mass of the oxide zinc per seed adsorbed on the surface. The amount of zinc oxide mass is directly

associated with the concentration of nanoparticle in the ZnO nanoparticles suspensions. With higher concentration is possible to obtain higher mass of zinc oxide nanoparticles on the surface of seed, but with lower mass increase the adsorption rate. The amount of adsorbed mass of zinc oxide nanoparticles on the seed surface can be related with nanoparticle mass in the ZnO nanoparticles suspension utilizing the equations 3 obtained from the mathematical adjusting of the diagram presented in the Fig. 5:

$$M (\text{mg}_{\text{nano}}/\text{g}_{\text{seed}}) = A \cdot c^n, \quad n = 0.44 \text{ and } A = 4.37 \quad (3)$$

where M is the zinc oxide mass adsorbed on the seed surface per seed mass, c is the zinc oxide mass in the suspension medium and A is an adjust constant.

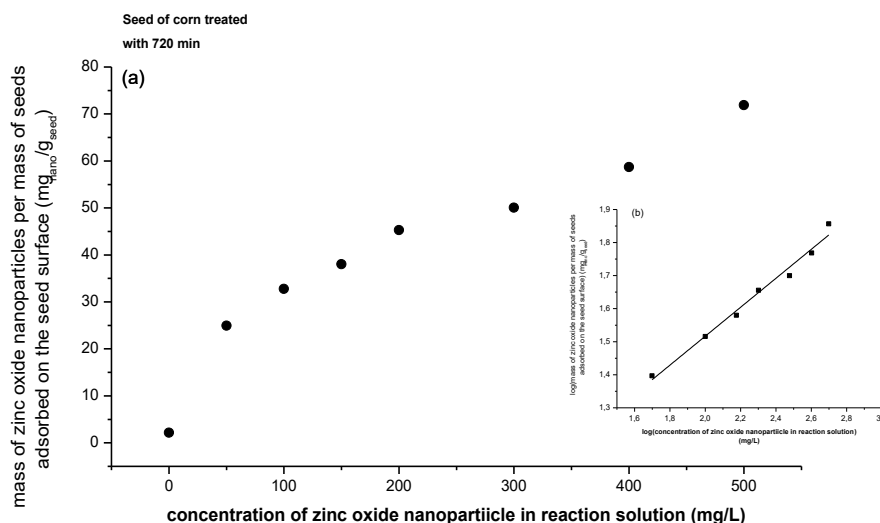


Fig. 5: (a) Relationship between the mass of zinc oxide nanoparticle per seed mass adsorbed on the surface of the seed of corn and the concentration of nanoparticles in ZnO nanoparticles suspensions and (b) linear relationship between the mass of zinc oxide per seed mass and the concentration of the nanoparticles in suspension. All treatments realized with 720 minute

Fig. 5(b) confirm that the relationship ($R^2 = 0.98$) between the mass of zinc oxide nanoparticle adsorbed on the seed and the concentration of zinc oxide nanoparticles in suspension medium is typical of a physical adsorption process.

The results suggest that the conditions of the treatment processes influence the adsorption of zinc oxide nanoparticles on the seeds of corn. So, the conditions of the treatment processes can be influences the amount of the zinc oxide nanoparticle incorporated in inner of the seeds, being that the clusters on the surface can be considered the reservoirs of the nanoparticles.

Incorporation of the zinc oxide nanoparticles to inner of the seed of corn

The atomic absorption technique was utilized to available the incorporation capacity of the zinc oxide nanoparticles to inner of the seeds of corn when treated with suspensions containing different concentrations of nanoparticles and with different times. Table 4 shows the values for the mass of zinc oxide nanoparticle per seed mass determined for the seeds of corn after the treatment with different ZnO nanoparticles suspensions.

Table 4: Values for the mass of zinc oxide nanoparticle incorporated in the inner of the seed of corn per seed mass. Experiments realized with different concentrations of nanoparticle in suspension and different treatments times. Mass determined by atomic absorption technique

Experiment	Concentration of nanoparticles in the reaction suspension (mg _{nano} /L)	Treatment time (min)	Mass of zinc oxide nanoparticle incorporated in inner of seeds of corn per seed mass (mg _{nano} /g _{seed})
1	260.00	180.0	0.200
2	50.00	180.0	0.100
3	260.00	720.0	0.200
4	50.00	720.0	0.100
5	155.00	450.0	0.200
6	155.00	450.0	0.200
7	155.00	93.0	0.100
8	155.00	831.0	0.300
9	6.95	450.0	0.000
10	303.5	450.0	0.200
No treated (standard)	-	-	0.000

The seeds treated only water solution not presented significant values for the zinc oxide nanoparticle mass incorporated. The atomic absorption technique utilized has a detection limit of one part per million (ppm), so for these studies, the values for the mass of zinc specimens in the inner of the standard seeds were considered null. The results show that the treatment processes employed is efficient to incorporate the zinc oxide nanoparticles to inner of the seeds of corn. Utilizing the treatment process with the suspension containing higher concentrations of nanoparticles is observed a tendency of increase of the

amount of the mass of zinc oxide nanoparticles in inner of seeds. But, the effect of the treatment time not is evident in these processes.

The statistical analysis (Variance Analysis) of the results presented in the Table 5 showed with the certainty of 86 % ($p < 0.14$) that the treatment time and the concentration of the zinc oxide nanoparticles in the suspensions are significant factors to define the amount of the mass of nanoparticles incorporated in inner of the seeds of corn.

Table 5 : Variance analysis ($p < 0.14$) for the results of amount of mass of zinc oxide nanoparticles incorporated in inner of the seed of corn per seed mass. Dates presented in the Table

	SS	dF	MS	F	P
[ZnO] _n (L)*	0.029235	1	0.029235	10.43938	0.031945
[ZnO] _n (Q)*	0.010973	1	0.010973	3.91825	0.118875
Time (L)*	0.009536	1	0.009536	3.40517	0.138741
Time (Q)	0.000026	1	0.000026	0.00936	0.927579
Interaction [ZnO] _n and Time	0.000000	1	0.000000	0.00000	1.000000
Erro	0.011202	4	0.002800		
Total SS	0.064000	9			

*significant variables - [ZnO]_n: concentration of zinc oxide nanoparticles in the suspension - Time: treatment time of seeds of corn in ZnO nanoparticles suspension.

A quadratic model ($R^2 = 0.82$) was adopted to relationship the mass of zinc oxide nanoparticles incorporated in the seeds with the variables of concentration of nanoparticle in suspensions and with treatment times, Fig. 6(a). The model shows a linear dependence between the values of mass

incorporated in inner of the seeds with the treatment time variable, indicating that higher treatment times promote higher amounts of the nanoparticles in inner of the seeds of corn.

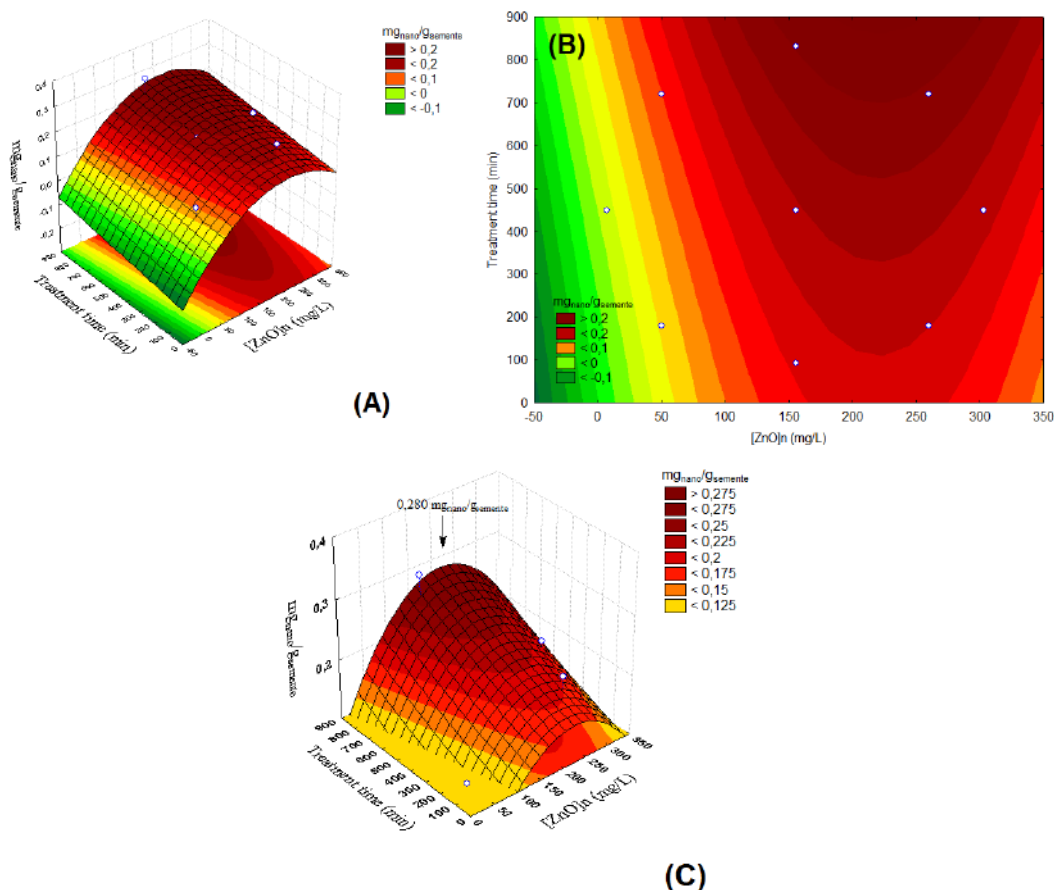


Fig. 6: Relationship between the mass of zinc oxide nanoparticles incorporated in seeds of corn per seed mass (mg_{nano}/g_{seed}) with the concentration of nanoparticles in the suspension ($[ZnO]n - mg/L$) and different treatment times (Time-min). Results obtained from a quadratic model ($R^2 = 0.82$) obtained with a experimental design with confiability of 86 %. (a) Response surface from quadratic model, (b) level curve from quadratic model and (c) response surface with highlight for optimal condition for incorporate the maximum amount of nanoparticles in inner of seeds of corn.

The concentration variable is a positive factor too, but influence with a quadratic factor. With higher concentrations of the zinc oxide nanoparticles in suspension medium is possible to incorporate higher amount of the mass of nanoparticles in inner of the seeds of corn. The increase of the mass in inner of the seeds not is linear but increase until a maximum value, which occur proximally to the concentration of the zinc oxide nanoparticles of 225 mg/L in the suspension medium, Fig. 6(b). Fig. 6(c) evidences the maximum conditions to incorporate the maximum amount of mass of zinc oxide nanoparticle in inner of the seeds of corn. So, is possible to establishes that the best condition for the treatment processes to incorporate the maximum amount of mass of zinc oxide nanoparticle in inner of seed of corn is with the maximum values for the treatment time and with the concentration of 225 mg/L in suspension medium. With this condition is possible to incorporate 0.280 mg_{nano}/g_{seed} in inner of the seed of corn.

From the EDS analysis not was possible to detect zinc oxide nanoparticles in inner of the seeds of corn. But the atomic absorption technique showed that is possible to incorporate the nanoparticles with low amounts in inner of the seeds. The amount of the mass of the nanoparticles incorporated in inner of seeds is very low and should not have toxically character.

Fig. 7 show the images obtained with electronic microscopy detailing the inner cells of the seeds of corn treated by 180 minutes with the ZnO nanoparticles suspension containing low concentration of the nanoparticles (50 mg/L) and with the suspension containing high concentration of nanoparticles (1000 mg/L). The results reveal cells with absolutely integrity. The inner cells not were affected by the zinc oxide nanoparticle incorporated in seed.

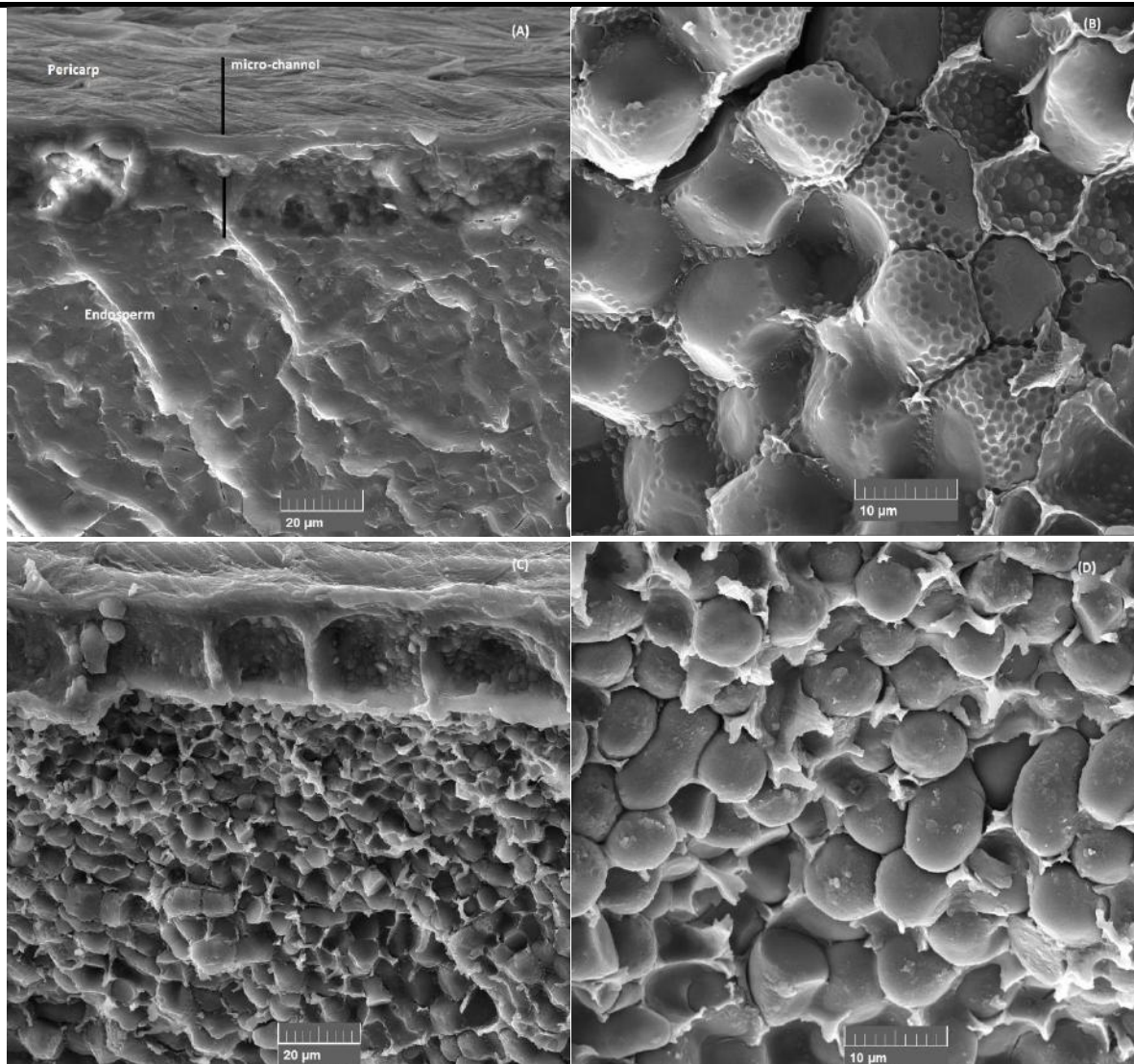


Fig. 7: Images obtained with electronic microscopy for the seeds of corn treated by 180 minutes in a suspension with different concentrations of zinc oxide nanoparticles. (a) and (b) seeds treated with 50 mg/L and (c) and (d) seeds treated with 1000 mg/L.

These results generate the expectancy that the treatment conditions studied do not cause a negative effect on the integrity of the seeds of corn and that they will not promote a negative effect on the germination of these seeds.

The atomic absorption and electronic micrographs proved that it is possible to incorporate the zinc oxide nanoparticles without compromising the structural integrity of the seed cells, i.e., not having significant structural cell damages due to the presence of the nanoparticles.

The zinc oxide nanoparticles are adsorbed by fibrous cells constituents of the pericarp structure on the surface of the seeds of corn. The nanoparticles form clusters that are fixed in the interface formed by these cells. These interfaces form micro-channels that communicate the inner regions with the surface of the seeds and can favor the transport of the nanoparticles from cluster to the inner of the seeds. So, the clusters formed on the surface can be

considered as a zinc mineral reservoir for the seed. By diffusion mechanisms through micro-channels the nanoparticle can be incorporated to the inner of the seed and the zinc mineral be provided to the germination mechanisms.

The formation of the zinc oxide nanoparticle cluster is very fast but on the surface and the interdiffusion processes of the nanoparticles to the inner of the seed should be very slow, so that the nanoparticle cluster should serve as a zinc reservoir during long time and during the development of the corn plant. It is possible to predict that during the germination phase zinc oxide nanoparticles will migrate to the inner of the seeds considering that the nanoparticles have a dimension approximately of 100 nm and the micro-channels have dimensions approximately of some micrometers.

3.2 Germination Tests

Normal plants and abnormal plants

The germination tests were realized with seeds of corn treated with the experimental conditions showed in the Table 4. The amount of the normal plants and abnormal plants were determined applying the agronomical procedures.

The following results show the percentage values for the normal plants after the germination period of the seeds of corn in function of the different treatment conditions. The results were available by the variance analysis ($p \leq 0.05$) and showed that the both factors are statistically significant to increase the values of the percentage of the normal plants.

Fig. 8 shows a quadratic dependence for the normal plant percentages and the time treatment. The values of the normal plants percentage increases with the increase of the time treatment until optimal value of 180 minutes. With the optimal treatment time the normal plant percentage increase of 2.70% in relationship to the seeds not treated (standard). But, for treatments realized with times higher than 600 minutes the effect is negative for the germination process and the values of the percentage normal plants are lower than the values for the standard seeds.

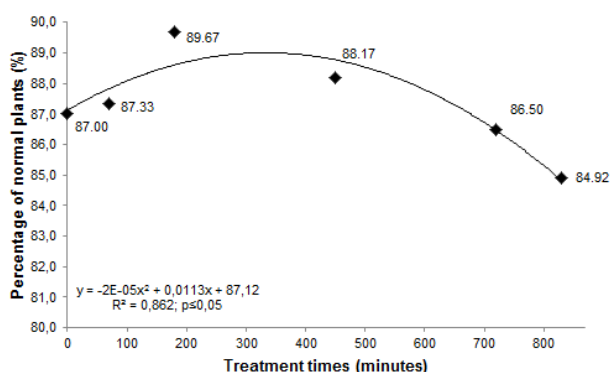


Fig. 8: Relationship between normal plants percentage and the treatment time for the seeds of corn treated in the suspensions containing zinc oxide nanoparticles.

Likewise, Fig. 9 shows a quadratic dependence for the normal plant percentages and the zinc oxide nanoparticles concentrations in the suspensions medium. The values of the normal plants percentage increase with the increase of the concentration of zinc oxide nanoparticles in the suspension medium until optimal value of 50 mg/L. With the optimal treatment concentration the normal plant percentage increase of 2.70% in relationship to the seeds not treated (standard). But, for treatments realized with concentration of zinc oxide nanoparticle higher than 240 mg/L the effect is negative for the germination process

and the values of the percentage normal plants are lower than the values for the standard seeds.

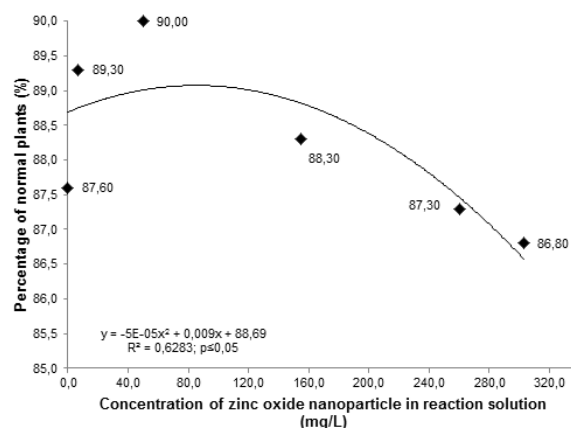


Fig. 9: Relationship between normal plants percentage and the zinc oxide nanoparticles for the seeds of corn treated in the suspensions containing zinc oxide nanoparticles

The increase of the normal seeds percentage is a benefit aggregated by the treatment processes of the seed of corn with the zinc oxide nanoparticles. The results obtained with the atomic absorption technical demonstrated that is possible to incorporate the nanoparticles to the inner of the seeds. The amounts of the nanoparticles in inner of the seeds increase with the treatment time but are limited by the zinc oxide concentration in the suspension medium. To incorporate the maximum amount of the nanoparticles in the seeds the best zinc oxide concentration in the suspension is 225 mg/L, but for the best germination results for the seeds of corn occur with the treatment containing 50 mg/L. So, is possible to conclude that the best germination performance for the seeds of corn is associated with the presence of the zinc oxide nanoparticle in the inner structure, because the seeds not treated presented a worse performance.

With treatment conditions with times higher than 600 minutes and with concentrations higher than 240 mg/L the negative effect is highlighted and promotes the lower values for the normal plants percentage than the values obtained for the standard seeds (no treated). It's quite possible that the negatives effects are associated with the small dangers caused in the cellular compounds, but that not were detected by de electronic microscopy. Taiz and Zeiger (2013) related that high concentrations of the zinc oxide nanoparticles generally promotes oxidative dangers in the vegetable cellular structures by peroxidation of the lipids and promotes the degradation of the some cellular compounds [36].

Fig. 10 and 11 show the values obtained for the abnormal plant percentage and confirm the presence of positive and negative effects of the treatments in function of the

treatment time and of the zinc oxide nanoparticles, respectively. The results confirm that the best treatment time is the 180 minutes and the best zinc oxide concentrations is the 50 mg/L.

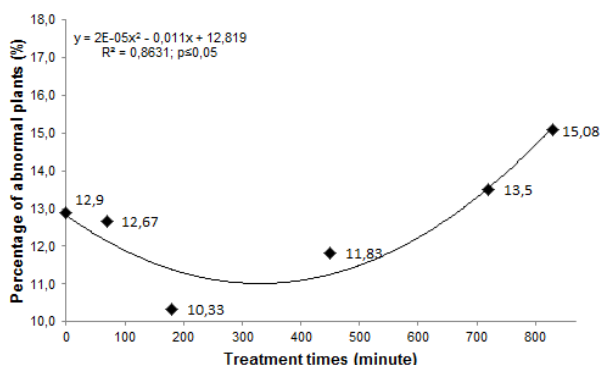


Fig. 10: Relationship between abnormal plants percentage and the treatment time for the seeds of corn treated in the suspensions containing zinc oxide nanoparticles.

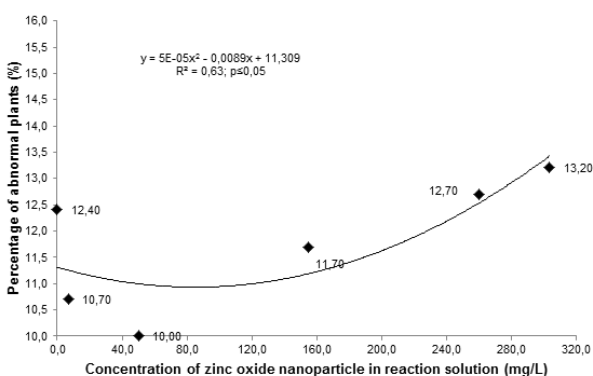


Fig.11: Relationship between abnormal plants percentage and the zinc oxide nanoparticles for the seeds of corn treated in the suspensions containing zinc oxide nanoparticles

Dead seeds and germination rate

The variance analysis with the germinations results not showed statically significance ($p > 0.05$) of the treatment

time and of the zinc oxide concentration in the suspension medium in the amount of the dead seeds and in the germination rate.

These results are strong indicators that the zinc oxide nanoparticles in inner of the seeds of corn not promote high toxic effects to the seeds. Though there are negative effects to the normal plants percentage the toxic effect of the nanoparticles shall be small enough to prejudice only the cellular physiology and to affect only the normality of the plants, but not to lead to death of the plants.

The presence of the zinc oxide nanoparticles in the seeds of corn not affected the germination rate. This indicator shows that the nanoparticles not prejudice the metabolic mechanisms of the seeds of corn during its germination phase. These results are expected, since that if the toxic effect exists shall be small and not shall compromise the seeds metabolism of significant forms. Likewise, the zinc oxide nanoparticles availability to the corn plant shall occur in future phases and during the growth of the plant, that is, in the vegetative and reproductive phases of corn plants.

3.3 Microbiological analysis of the seeds of corn

The clusters formed by zinc oxide nanoparticles on the surface of the seeds of corn, besides serving as micronutrient reservations, can be to contribute for the antimicrobial protection of the seeds, in special with the antibacterial protections. The ionic metals and metallic nanoparticles have excellent antimicrobial properties [37-38]. These characteristics can to aggregate the antibacterial property on the surface of the seeds of corn and protect them the harmful microorganisms and prevent the seeds of future disease produced by some bacteria during the germination phase.

Fig. 12 and 13 show the microbiological results, with death curves, obtained with seeds treated in ZnO nanoparticles suspensions containing different zinc oxide nanoparticles in the suspension during 180 minutes. The bacteria utilized were the *Escherichia coli* and *Staphylococcus aureus*.

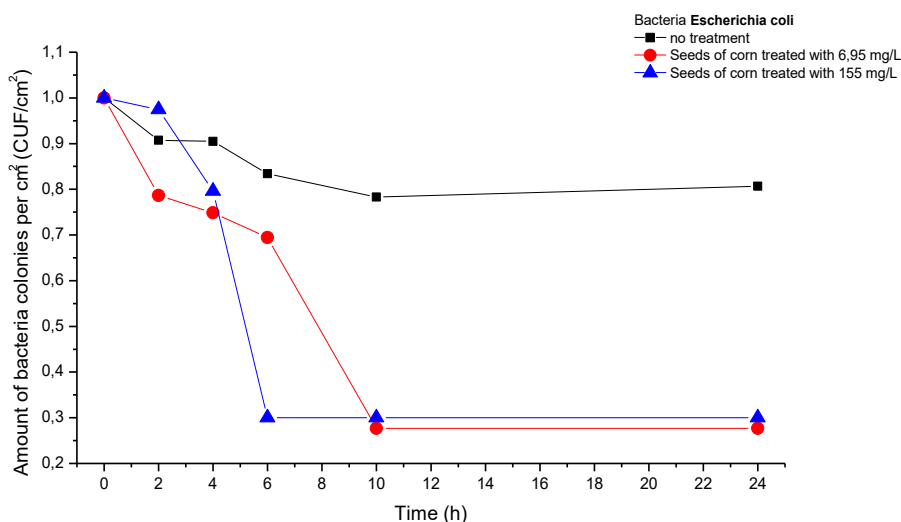


Fig. 12: Microbiological results with death curves test with bacteria *Escherichia coli* for seeds of corn treated with 6.95 mg/L and 155.00 mg/L of zinc oxide nanoparticles in the suspension.

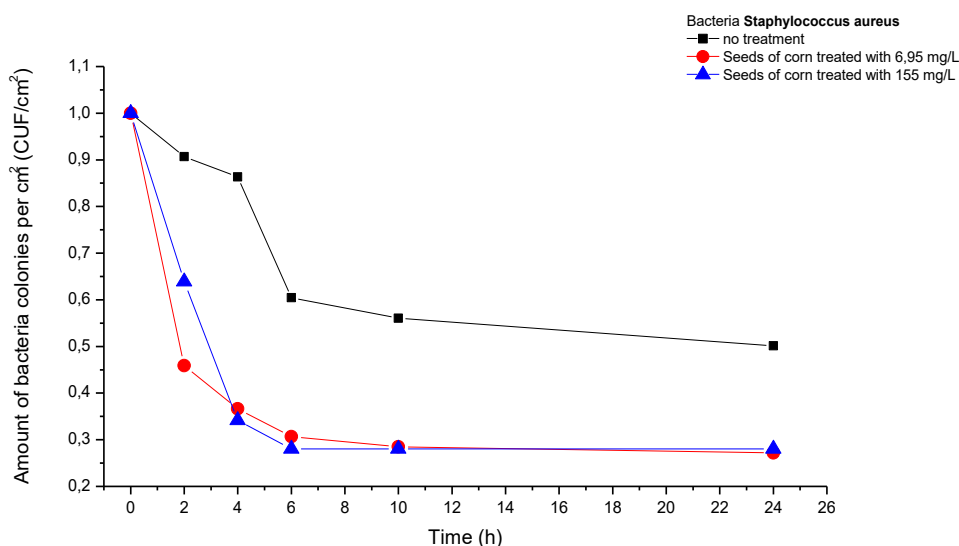


Fig. 13: Microbiological results with death curves test with bacteria *Staphylococcus aureus* for seeds of corn treated with 6.95 mg/L and 155.00 mg/L of zinc oxide nanoparticles in the suspension.

The microbiological results indicate the reducing of 73.0% of the bacterial colonies for both type of bacteria, while for the standard seeds (no treated) reduced for lower values to 20%. These results are antibacterial protection indicatives and prove that the zinc oxide nanoparticles aggregates the antibacterial properties on the seeds of corn

With the bacteria *Escherichia coli* the microbiological results showed that the seeds treated with 6.95 mg/L eliminate 73.0% of the bacterial colonies in 10 hours, while the seed treated with 155 mg/L eliminates 73.0% in 6 hours. This different between the elimination time is associated with the amount of the nanoparticles adsorbed on the surface of the seeds of corn during its treatment processes.

For the bacteria *Staphylococcus aureus* the microbiological results showed that the seeds treated with suspension containing 6.95 mg/L and containing 155 mg/L eliminates 73.0% of the bacterial colonies in 6 hours. The same values for the elimination time is expected considering that the gram positive bacteria is more susceptible to antimicrobial agents than the gram negative microorganisms and the antibacterial actions of the zinc oxide nanoparticle are more fast, even with lower concentrations (FIORI, 2009).

IV. CONCLUSIONS

The results proved that is possible to incorporate and to adsorb zinc oxide nanoparticles in inner of seeds of corn and to improve the germinations indicators. The optimal treatment conditions to incorporate the nanoparticles occur with nanoparticle concentration of 50 mg/L in the suspension and with treatment time of 180 minutes. With these conditions is possible to incorporate 0.280 mg of zinc oxide nanoparticle per seed mass in inner of seeds.

The germinations indicators are influenced by the treatment conditions. The values of the normal plants percentage increase with the increase of the zinc oxide nanoparticles in the suspension until optimal value of 50 mg/L. With the optimal treatment concentration the normal plant percentage increase of 2.70% in relationship to the seeds not treated (standard). But, for treatments realized with concentration of zinc oxide nanoparticle higher than 240 mg/L the effect is negative for the germination process and the values of the percentage normal plants are lower than the values for the standard seeds.

The treatment with zinc oxide nanoparticles aggregated the antibacterial characteristics on the seeds of corn. This new property can be interpreted with a antimicrobial protection of the seeds of gram-negative and gram-positive bacteria and promote the prevention of the seeds of corn of possible diseases generated by these microorganism.

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Fault Location in Power Transmission Lines using Autocorrelation Function

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Abstract—An electrical power system is subject to constant adversities due to its complexity, sensitivity and physical dimensions. Special emphasis is given to transmission lines (TL) that are the most vulnerable elements of an electrical system. Although most of the occurrences of distortions in the voltage signals from atmospheric discharges and overload are not detrimental to the energy supply, it is important to have control of these currents, since this allows the classification of the fault type and its geometric location on the transmission line. This study aims to compare different fault situations in a transmission line and to verify changes in time series models (TS). This study was carried out through computational tests performed with MatLAB® and RStudio® software. A total of 272 faults were simulated in different situations. The obtained results were compared with the Traveling Wave Theory (TWT), another quite widespread fault localization technique. The above study revealed the applicability of time series in oscillographic data of fault situations in transmission lines with errors lower than 1.25%.

Keywords—time series, line transmission, fault location, autocorrelation function (acf).

I. INTRODUCTION

With the importance of having an electrical system where continuity, compliance, flexibility and ease of maintenance are observed and guaranteed, the improvement and innovation of the techniques used in equipment for the protection and supervision of the system, as well as the expansion of the electric sector [1].

The precise location of faults assists the operating sector of the electrical system, reducing the time of occurrence of the disturbance, locating areas where faults occur regularly, reducing the occurrence of faults and minimizing the time of power failure. With this,

contributing to the continuity of the electric power supply [2][3][4][5].

There are many existing techniques to deal with the fault localization problem in transmission lines (TL). The classification of these techniques can be enhanced according to the number of terminals monitored in the TL. The use of data from more than one monitoring terminal involves online communication between them and use global positioning system (GPS), which increases the financial cost in the monitoring system. In [6], for example, it is monitor the fault current in three terminals of continuous transmission of high-voltage line. The use of single-terminal data eliminates the need for such investments.

Another way of classifying fault localization techniques is the way of analyzing the data. Most methods are based on the fundamental components of voltage and current sine [3]. In [7], for example, it provides an efficient algorithm with detection and fault isolation functions through a differential phase hopping pilot scheme to detect faulted branches in distribution networks. The method uses fundamental frequency components. In [8] is also used in fundamental frequency analysis in unbalanced three-phase faults observing the presence of negative sequence currents. Another example of fundamental frequency voltage signal analysis is presented in [9], which shows the behavior of the voltage drops for different fault situations in several scenarios of simulated sub transmission lines.

Another form of data processing is considering the high frequency components from the occurrence of the fault. However, in reality, immediately after the occurrence of a fault, transient displacement phenomena distort the steady state current and voltage waveforms. Consequently, these unwanted transient signal components must be eliminated before evaluating the voltage and current waveforms [10].

There are also methods that use computational intelligence through artificial neural networks (ANNs). An example of this application is shown in [11], which presents a new and accurate fault finding algorithm in a combined transmission line with underground power cable using the Adaptive Network Based Fuzzy Inference System (ANFIS).

The objective of this work is to present a fault localization technique in aerial transmission lines. The proposed method is based on the analysis of time series with autocorrelation functions, being the seasonality obtained for a failure situation, related to the location of this fault in the transmission line. The analysis of autocorrelation functions is used, for example, in cite parent, which addresses the uniformity property of the autocorrelation used to determine the delay time. This time

is a function of the position of the fault, employing numerical integration.

II. THEORY OF TRANSMISSION LINES DISTURBANCE

The transient voltage signals in a transmission line are oriented according to the Traveler Wave Theory (TWT) [12][13]. In this theory, the abrupt change of the voltage level in a transmission line propagates through this line from the point of origin of the perturbation to the ends of the line, in both directions. When finding a discontinuity in the "route" these waves are divided in reflected waves, and refracted waves. This process of reflection and refraction occurs several times, until the total absorption of the wave energy by the components of the line, reaching the steady state again [14]. Fig.1 shows the situation mentioned.

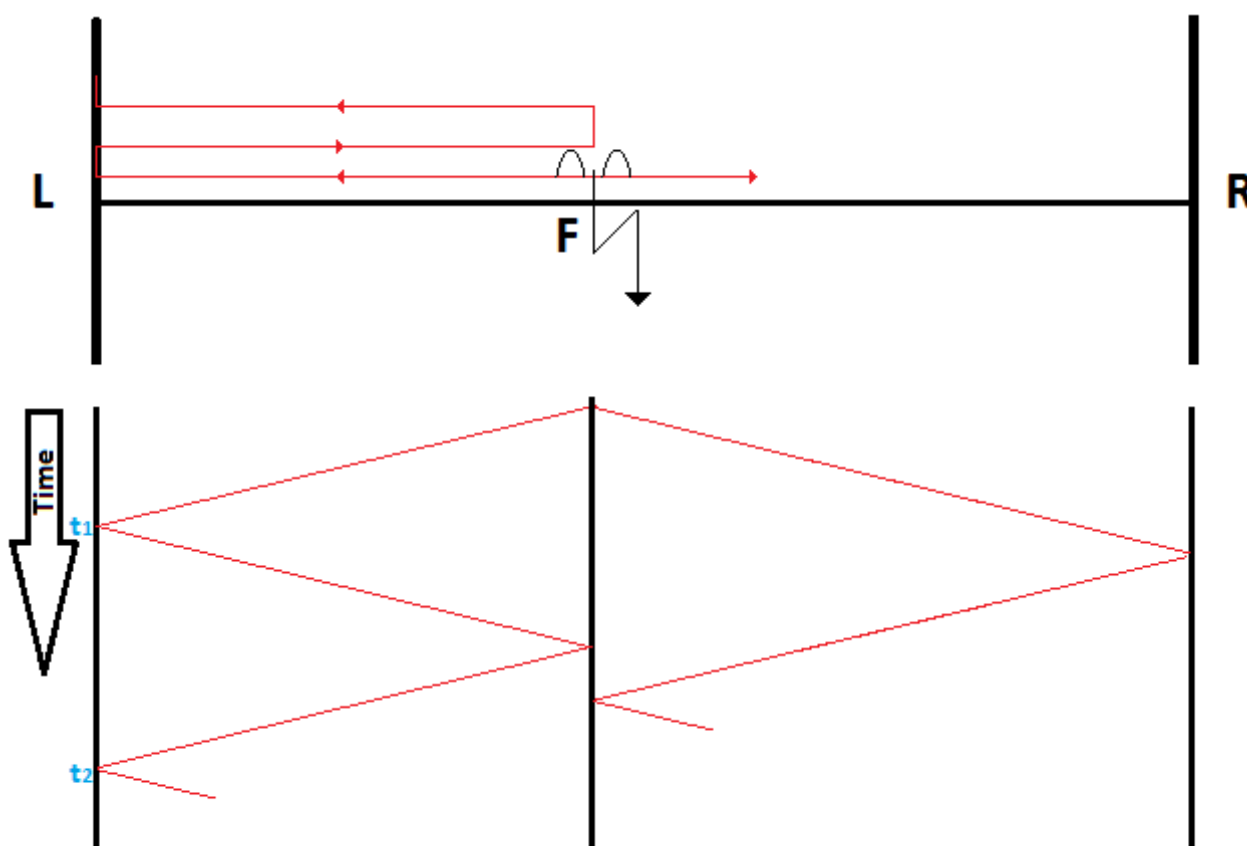


Fig. 1: Disturbance in the sinusoidal signals of phases A and B of TL. Beside, zoom in on the interest part in the analysis.

The behavior of the waves in the line depends on the intensity of the wave, the coefficients of refraction, reflection and damping and the speed of propagation. These in turn depend on the configuration of the transmission line, the fault resistance and, consequently, the type of fault. The angle of incidence of the disturbance in sinusoidal signals of the transmission line also influences the attenuation or expansion of the voltage peaks of the fault signals. In order for the TWT to be applicable and the results of the electromagnetic behavior

to be consistent with reality, it is necessary that the line model considered has its parameters distributed, for example the model JMARTI [15].

To determine the geographic location of the disturbance occurring at the point of transmission line are timed maximum points of the occurrences of times the monitored voltage (wave crests) at a terminal TL microarray [16]. These local maximum points on the voltage signals can be seen in Fig.2.

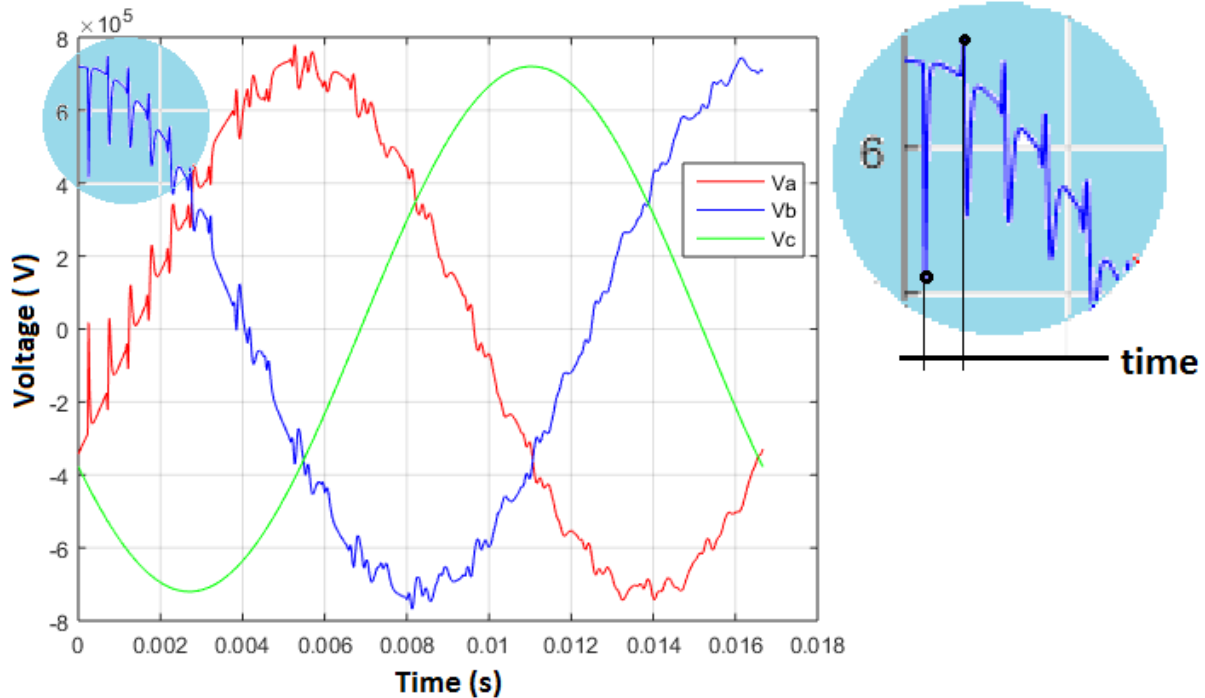


Fig. 2: Wave propagation in line transmission.

Once the times have been determined, the equation (1) is used to determine the fault distance.

$$d_{LF} = \frac{t_2 - t_1}{2} v \quad (1)$$

Where: d_{LF} is the distance between the monitoring terminal L and the point of occurrence of the fault F, t_1 is the time elapsing between the start of the timing and the arrival of the first wave front to the monitoring terminal, t_2 is the elapsed time between the start of the timing and the arrival of the second wavefront to the monitoring terminal, $v = \frac{1}{\sqrt{LC}}$ is the velocity of propagation of the wave in the line (approximated by the velocity of waves in a vacuum; L is the characteristic inductance of the circuit; C is the characteristic capacitance of the circuit). To compare the results obtained through the method proposed in this work, equation (1) is used.

III. THE PROPOSED METHOD

In order to extract distance from only one monitor terminal, it is necessary to observe the pattern generated by the wave propagating between the fault point and the monitoring point. The periodicity of the analyzed signal is due to its constant rate of propagation. Also, the instants referring to the points of maximum locations characterize the moments at which the wave front reaches the

monitoring terminal. Thus, calculating the time interval between two consecutive maxima is the equivalent of determining the propagation time of the wave between the fault point and the monitoring point.

It is initially investigated the presence of trends and seasonality in the time series to be investigated [17][18][19][20]. The trend of a series indicates its "long-term" behavior, that is, whether it grows, decreases, or remains stable, and how fast these changes are. Regarding the trend, the Cox-Stuart test is used[21]. As the series shows symmetry with respect to the vertical axis, initially the temporal series is divided into two parts. Thus the two series obtained do not present symmetry. Since this symmetry makes it impossible to use the Cox-Stuart Test, it makes erroneous values. Once the test was performed, it indicated that the series had a 87% chance of showing a tendency. It was also observed that this tendency is due to the sinusoid coming from the nominal frequency of the transmission line. To determine the trend, the Fourier series analysis is used. The Fig.3 (a) shows the calculated trend and the original series. The Fig.3 (b) shows the time series without the presence of trend. The series of trends previously calculated by Fourier series [17][18][19][20][22] was extracted from the original time series.

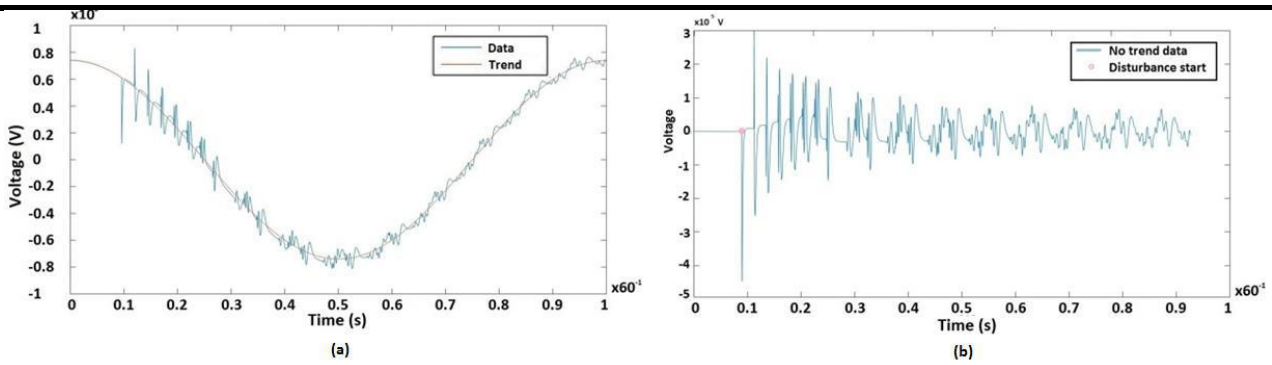


Fig. 3: (a) Graph with time series and their respective trend. (b) Decoupled voltage signal. The starting point of the disturbance is related to the incidence angle of the fault on the transmission line.

From the new time series generated it is possible to monitor the differences between the consecutive voltage values. This makes it possible to terminate the onset of the disturbance at the fundamental voltage signal (60 Hz), thereby determining the incidence angle of the fault. The next step is to eliminate the pre-fault voltage data (before the onset of the disturbance), considering only the post-fault data. The procedures described in this paragraph are related to what is called “Algorithm 1” in Fig. 5. Thus, this algorithm is able to determine both the transmission line phases that are involved in the fault, as well as to determine the angle of incidence of this fault in the line.

For the determination of seasonality, the analysis was used the auto correlation function [10][15]. Autocorrelation consists of the cross-correlation of a signal with itself. Used to find patterns of repetition or obscured by noises.

The next step is to calculate the autocorrelation function of the new time series without trends and with

post-fault data. Once this calculation has been made, to determine the seasonality value, an arithmetic mean between the positions of the lags with the highest local values is made. This obtained value is taken as being the seasonality for the fault situation analyzed. Once this procedure has been performed several times, there will be several seasonal values close to the same fault distance. Again, the arithmetic mean of these seasonal values is calculated, and there will be only one seasonal value attached to a missing distance. The procedures described in this paragraph consist of what is called “Algorithm 2” in Fig. 5.

Fig. 4 (a) shows the graph of the autocorrelation function with 200 lags for a random fault situation contained in Table 1. For all cases the behavior is similar, with the characteristic that the larger the occurrence distance of the larger fault the distance between the maximum local lags. The existing pattern of repetition and damping is observed. In Fig. 4 (b) there is a zoom for the first 18 lags of the illustration at the side.

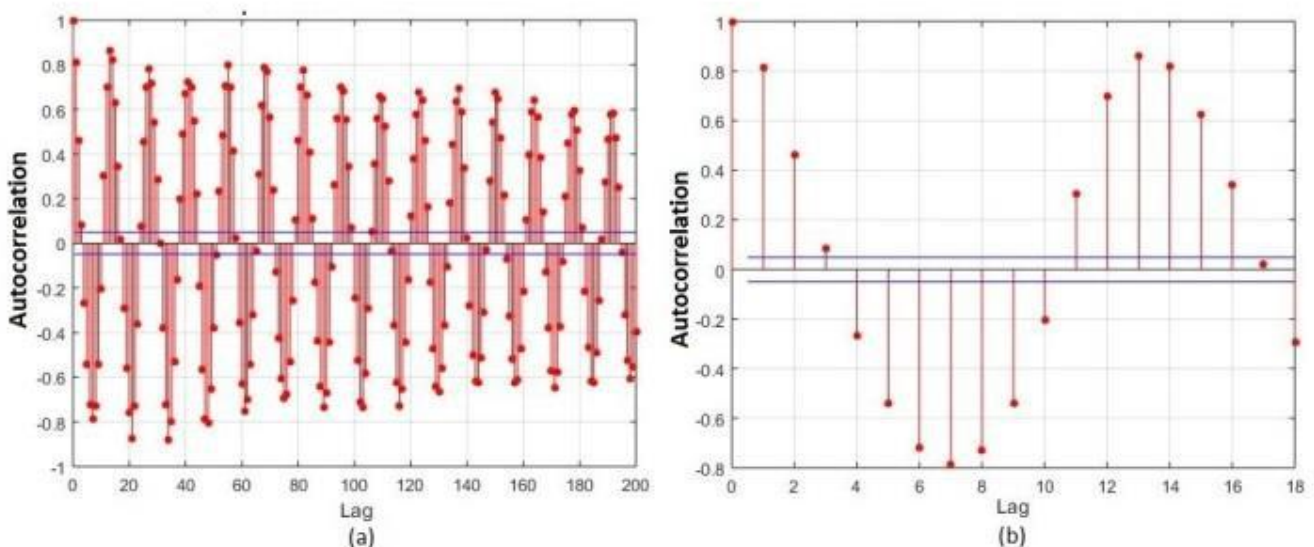


Fig. 4: Sample of the autocorrelation function (acf).

With the mean seasonality information for each distance value it is possible to calculate an adjustment curve relating the two terms. This can be done by using the method of least squares (MLS)[12]. The generation of a polynomial relating seasonality to distance allows the estimation for several fault situations only with the information of the value of seasonality. All steps

described above are illustrated in Fig.5 below. It is observed the existence of two steps to be followed: the first is the determination of the polynomial seasonality versus distance that applies to all occurrence of fault in the modeled transmission line; the second step consists in the use of this polynomial to determine the existence of fault as well as its location in the transmission line.

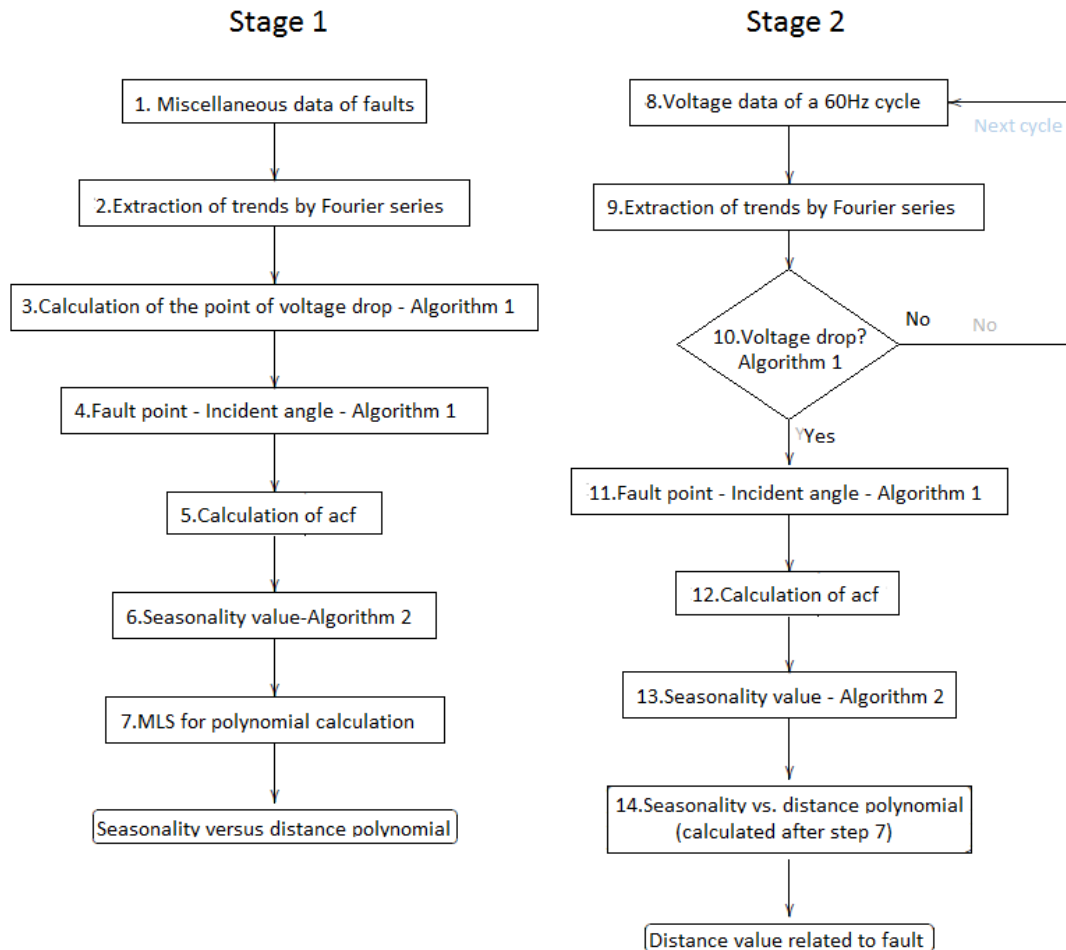


Fig.5: Flowchart.

IV. SIMULATION RESULT

In the ATP draw® software [23], fault simulations were performed on a three-phase aerial transmission line of 500kV, 60Hz and 200km extension. The model of line used in the modeling is the model JMARTI [15], well indicated for study of transient signals. The input parameters for the simulations are the simulation time, the

sampling frequency of the relay, the fault location on the line, as well as the elements involved. In addition, the angle of incidence of the fault in the line, which consists of the closing contact between the phases and the earth involved. For faults with the earth, the value of the ground resistance is also the input parameter.

Table.1: Simulation settings made.

Involved Elements	Fault Distance(m)	Angle of Incidence(°)	Sampling Frequency (kHz)	Number of Simulation
A-B	5:5:30 ; 40:10:100 ; 120 : 20 : 180 ; 190	0 : 30 : 330	100 kHz	216
A-B	5 10 2045 7084 155	0 : 45 : 315	200 kHz	56
Total of simulations				272

The least squares method (MLS)[1] is used to determine the relationship between seasonality and distance. Initially, a mean is performed between seasonality values related to the same distance value and different values of fault incidence angles. As a result, there is a single value of seasonality related to each distance. The equation (2) shows the result obtained for the biphasic fault data at 100kHz (Table 1).

$$y = 4.2 \times 10^{-8}x^5 - 1.4 \times 10^{-5}x^4 + 1.6 \times 10^{-3}x^3 - 7.7 \times 10^{-2}x^2 + 2.9x - 12.6 \quad (2)$$

Where x denoted the seasonality and y the distance. The values of x are taken from the seasonal means for each distance value (example for one of the values of x in Table 2).

Plotting the graphs from the equation (2) and the mean seasonality versus distance data, results in the Fig.6. This adjustment curve gives an average relative error of 2.84% and Pearson's correlation coefficient of 1.00, indicating that distance and seasonality are strongly correlated.

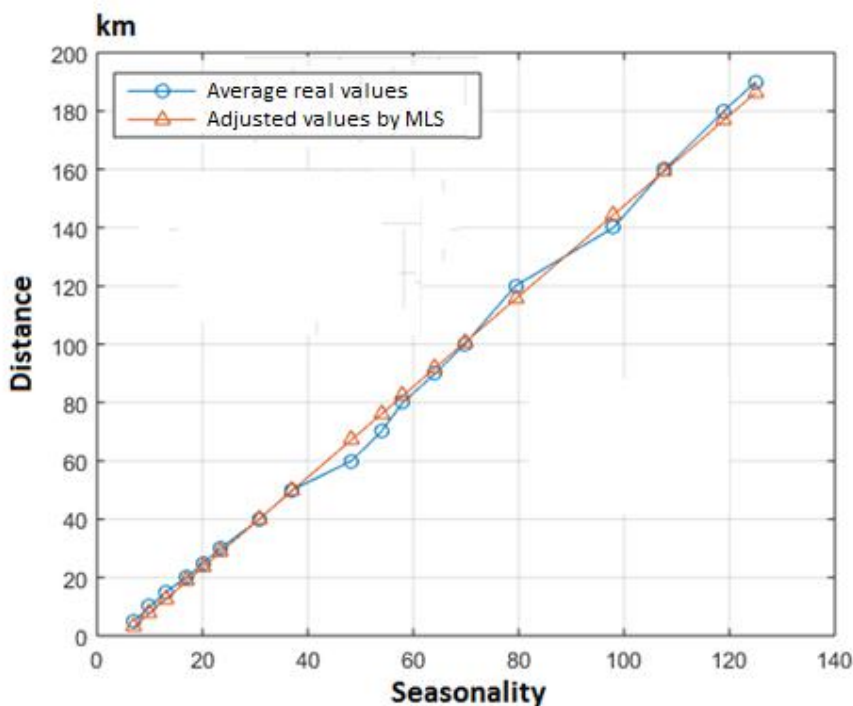


Fig.6: Seasonality Vs. Distance and Adjustment by M

Table 2 shows an example for the distance of 5 km. This table shows the values calculated for the angles as well as their respective errors and the results of

the calculated distances and the errors made. It is also possible to visualize (last two columns) the distances and relative errors of the moving waves.

Table 2: Biphasic fault between A–B phases, distance 45km and sample frequency of 100kHz. Calculation of incidence angles and calculation of fault distance by: ¹MLS method, ²TWT method. *Average seasonality for 45km.

Fault Number (n)	Angle (°)	Calculated Angle (°)	Relative Error(%) equation (4)	Seasonality (acf)	Distance (km) ¹	Relative Error ¹ (%) equation (5)	Distance (km) ²	Relative Error ² (%) equation (5)
1	0	3.13	3.13	66	45.14	0.07	44.98	0.01
2	45	48.58	7.95	66	45.14	0.07	44.98	0.01
3	90	93.91	4.35	66	45.14	0.07	43.48	0.76
4	135	139.25	3.15	66	45.14	0.07	43.48	0.76
5	180	182.43	1.35	66	45.14	0.07	43.48	0.76
6	225	227.77	1.23	66	45.14	0.07	44.98	0.01
7	270	273.10	1.15	66	45.14	0.07	44.98	0.01
8	315	318.44	1.09	65	45.14	0.07	44.98	0.01
Mean values(s = 8)	Mean values	equation (6) 2.92		65.88*	45.05	equation (6) 0.09	44.42	equation (6) 0.29

Plotting the graphs from the equation (3) and the mean seasonality versus distance data, results in the Fig.7. This adjustment curve gives an average relative error

of 0.51% and correlation coefficient of 1.00, indicating that distance and seasonality are strongly correlated.

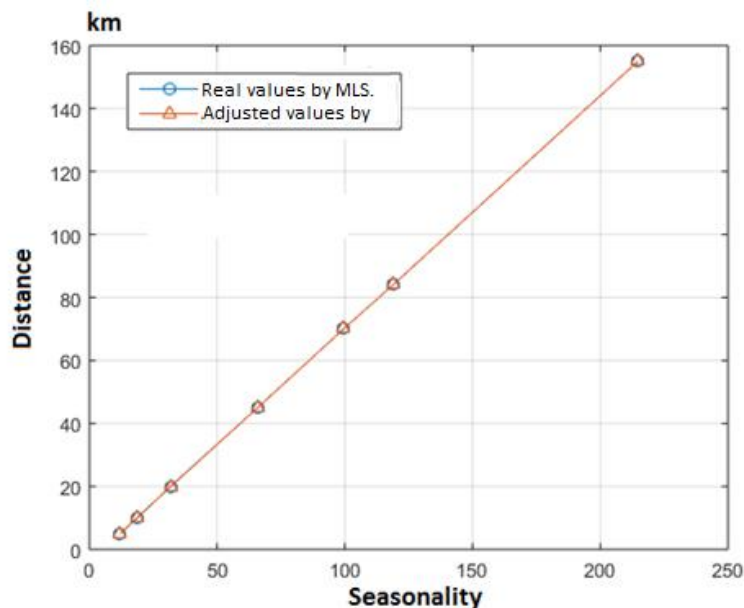


Fig.7: Seasonality Vs. Distance and Adjustment by MLS.

The same analysis is done for voltage data with a sampling frequency of 200kHz. The mean of the seasonal values for each fault distance is obtained, and using the MLS has the equation (3).

$$y = 6.5 \times 10^{-10}x^5 - 3.0 \times 10^{-7}x^4 + 4.9 \times 10^{-5}x^3 + 0.9x - 4.9 \quad (3)$$

Where x denoted the seasonality and y the distance. The

values of x are taken from the seasonal means for each distance value (example for one of the values of x in Table 3)

Table 3 shows the calculation and relative error for the incidence angles of the fault in the sinusoid of the transmission line and the calculation of distance and relative error for the same distance quoted. It is also possible to visualize (last two columns) distances and relative errors for the desire of the traveling waves.

Table.3: Biphasic fault between A–B phases, distance 40km and sample frequency of 200kHz. Calculation of incidence angles and calculation of fault distance by: ¹MLS method, ²TWT method. *Average seasonality for 40km.

Fault Number(n)	Angle (°)	Calculated Angle (°)	Relative Error (%) equation (4)	Seasonality (acf)	Distance (km) ¹	Relative Error ¹ (%) equation (5)	Distance (km) ²	Relative Error ² (%) equation (5)
1	0	2.59	2.59	31	39.16	0.42	38.97	0.52
2	30	32.81	9.35	30	37.90	1.05	38.97	0.52
3	60	63.02	5.04	31	39.16	0.42	38.97	0.52
4	90	93.45	3.84	31	39.16	0.42	38.97	0.52
5	120	123.67	3.06	31	39.16	0.42	38.97	0.52
6	150	151.73	1.15	31	39.16	0.42	38.97	0.52
7	180	181.94	1.08	31	39.16	0.42	38.97	0.52
8	210	212.16	1.03	30	37.90	1.05	38.97	0.52
9	240	242.37	0.99	31	39.16	0.42	38.97	0.52
10	270	272.59	0.96	31	39.16	0.42	38.97	0.52
11	300	302.81	0.93	31	39.16	0.42	38.97	0.52
12	330	333.02	0.91	30	37.90	1.05	38.97	0.52
Mean values(s = 12)	Mean values		equation (6) 2.58	30.75*	38.85	equation (6) 0.58	38.97	equation (6) 0.52

The errors shown in the previous tables are calculated according to the statements shown below. For the errors in the calculation of the values of the angles was used the equation (4). In this equation the real values and the calculated values are considered.

$$\text{error}_a^{(n)}(\%) = \frac{|a_r - a_c|}{a_r} \times 100 \quad (4)$$

Where: $n = (1, 2, \dots, s)$, error_a is the value of the error in the angle calculation given in percentage, a_r is the real value of the angle of incidence of fault, a_c is the calculated value of the angle of incidence of the fault, n is the fault situation, s is the number of simulations for the same fault characteristics except for the angle of incidence of the sinusoidal signal disturbance.

The error values for the distances were calculated according to the following equation (5) [14][23]:

$$\text{error}_d^{(n)}(\%) = \frac{|d_r - d_c|}{d_l} \times 100 \quad (5)$$

Where: $n = (1, 2, \dots, s)$, error_d is the value of the error in the distance calculation given in percentage, d_r is the real value of the occurrence of line fault, d_c is the calculated value of the fault occurring on the line, d_l is the total length of the transmission line (in this simulation $d_l = 200\text{km}$), s is the number of simulations for the same fault characteristics except for the angle of incidence of the sinusoidal signal disturbance.

And the mean errors were calculated according to equation (6):

$$\text{error}_m = \sum_{n=1}^s \frac{\text{error}^{(n)}}{s} \quad (6)$$

Where: error_m is the mean error for the same characteristics except for the angle of incidence, $\text{error}^{(n)}$ is the error previously calculated in equation (5) or equation (6).

V. CONCLUSION

This paper presents a new method of locating faults in high voltage aerial transmission lines based on the analysis of the autocorrelation function of the uniterminal voltage signal. A hypothetical line is implemented in the ATPdraw® software and different types of faults are simulated in the AC transmission system. Fault voltage signals are detected in only one terminal, which in practice results in cost savings, and a database is generated to allow the extraction of information about the locations of the simulated faults. Through the relationship between the seasonality in the time series and the location of the fault, a new localization algorithm is proposed. In practice, this location provides power utilities with statistical failure and agility maintenance.

When analyzing these time series, it is possible to understand changes in the behavior of the autocorrelation

functions, once the characteristics of the faults in the simulated line have changed. The main objective of this analysis is that only from the voltage oscillography can it be possible to calculate the geographical location of the occurrence of the fault in the line, as well as to classify the type of fault. The results obtained were satisfactory when compared to the results obtained by the theory of the traveling waves, considering the limitations for application of the method.

Currently the method is inapplicable to faults involving the earth component due to the appearance of the refracted waves, which totally modifies the pattern observed in other situations. This limitation can be solved with the pre-use of frequency bands.

In addition, because the acf lags are integers, this causes a seasonal value to correspond to a range containing several distance values. This restriction of the proposed method to identify small changes in distances is minimized as the frequency is increased. This reduces the range of distances mentioned in relation to the same seasonality detected in acf.

However, while increasing the frequency increases the sensitivity of the method, which means that the execution times of the algorithms are larger. Due to computational limitations, sample of relatively low frequencies were used: 100kHz and 200kHz. However with parallel programming, for example, this problem of execution speed can be solved.

In order to verify perception to frequency variations, it is possible to perform fault simulations considering distances close to each other, in order to determine which range of distances represents a single seasonal value.

The main contribution of this method lies in the innovation in the use of time series analysis in order to locate faults in transmission lines. Despite the necessary improvements mentioned above, it is seen that this method is comparable to the techniques already used in a practical way. Once the improvements have been made, greater accuracy in the fault location is expected.

For the development of future research, suggest the study of partial autocorrelation function (pacf) and spectral autocorrelation function (sacf). The pacf also highlights relevant data previously obscured by noise. The sacf brings with it a frequency analysis that proves to be quite effective for these types of data.

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Mathematical Methods applied in Image Enhancement using Matlab

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Abstract—In order to characterize complex engineering problems involving image data acquisition, different techniques in image processing can be used. One of those techniques is called the Laplacian Filter, commonly used to reduce noise and improving images. Based on that, image segmentation is a widely applied tool in engineering and it can greatly contribute in the acceleration of processes instead of adopting conventional methods, thus providing applications of such technique in the medical, spatial and other sectors linked to engineering. Therefore, this work aims to use image segmentation through differential equations (Laplacian Filter) in different images using Matlab mathematical software in order to enhance images details.

Keywords—convolution; differential equations; image enhancement; image processing; Kernel; Laplacian; matlab.

I. INTRODUCTION

Image processing is widely used for task automation, data thinning, noise reduction, and dozens of other engineering applications. Thus, this work aims to use on of the images segmentation processes know as Laplacian filter through the Matlab software. This filter consists of the application of a Laplacian formed by second order differential equations used for image refinement, detailing important data that often does not appear visible in images collected by various devices or images whose details are lost due to several other factors.

II. LAPLACIAN

Laplacian consists of second order differential equations for each pixel of an image, both on the x-axis and the y-axis as indicated by the following equations (1) and (2) below:

$$\frac{d^2 f}{dx^2} = f(x + 1, y) + f(x - 1, y) - 2f(x, y) \quad (1)$$

$$\frac{d^2 f}{dy^2} = f(x, y + 1) + f(x, y - 1) - 2f(x, y) \quad (2)$$

Thus, the sum of equations (1) and (2) result in the Laplacian as shown in equation (3) below:

$$\nabla^2 f = \frac{d^2 f}{dx^2} + \frac{d^2 f}{dy^2} \quad (3)$$

Accordingly to this, one method to represent those differential equations in a matrix can be seen in the equation (4) that follows:

$$\begin{bmatrix} (x - 1, y + 1) & (x, y + 1) & (x + 1, y + 1) \\ (x - 1, y) & (x, y) & (x + 1, y) \\ (x - 1, y - 1) & (x, y - 1) & (x + 1, y - 1) \end{bmatrix} \quad (4)$$

Consequently, when replacing the values of (3) within (4), one obtain the following Kernel, as shown in equation (5).

$$\begin{bmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{bmatrix} \quad (5)$$

Where Kernel is a term used for matrices who are used in image filtering through the mathematical method known as convolution.

III. CONVOLUTION

In many cases, when working with images, it is recommended to convert it to grayscale system, where each of its pixels accumulate values ranging from 0 to 255 in intensity degree, with “0” corresponding to black and “255” corresponding to white color.

Hence, these values allow that any image can be represented as a numerical matrix as illustrated in figure (1) below:

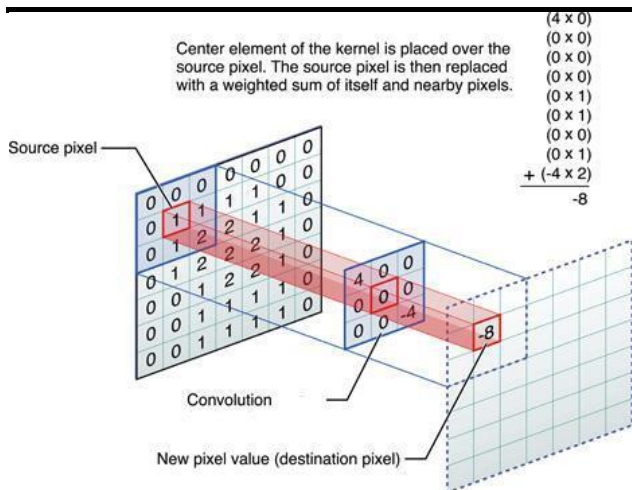


Fig.1: Exemplo de uma convolução.

Figure 1 shows that the Kernel multiplies the value of each of its pixels by the value of the corresponding pixel in the figure that will undergo the convolution, adding them to the end of the process that is repeated for each pixel where the Kernel can fit in completely.

Based on that, a new matrix having two rows and two columns shorter than the original one is generated, and the new values contained for each pixel of this new matrix are able to produce a range of effects on the original image.

IV. RESULTS

The selected images were extracted from the library of the Matlab software itself and the code developed to apply the Laplacian filter proved to be very effective. Thus, figures (2), (3) and (4), as shown below, proved that this mathematical method can be applied to reveal some details not visible to human eyes and to assist data analysis from several experimental studies.



Fig.2: Before and after Laplacian filter application.

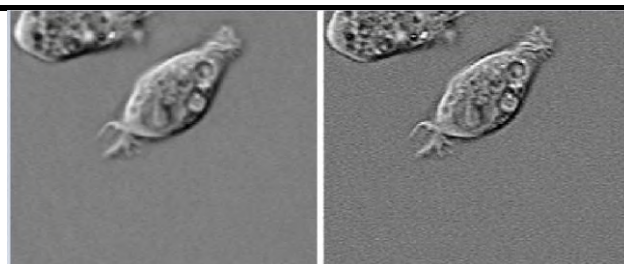


Fig.3: Before and after Laplacian filter application.

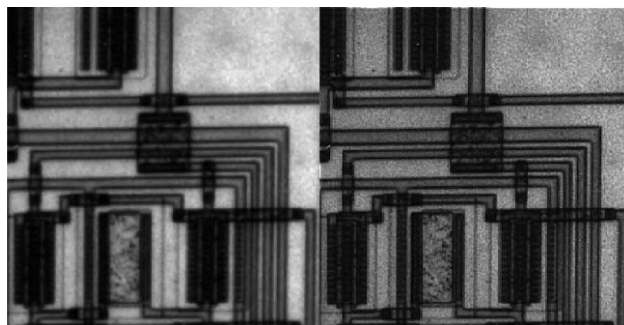


Fig.4: Before and after Laplacian filter application.

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Production Capacity and Queues in a Bookstore at Porto Velho, Brazil

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Abstract—The objective of this work was to study the productive capacity and queues in the services of a bookstore in Porto Velho city, Brazil. To do this, the specific objectives were: (1) to study the productive capacity in the operation units of the bookstore; (2) to carry out an analysis of queuing and flow management in the operation units of the bookstore; and (3) to suggest prospects for the development using the SWOT Matrix analysis tool.

Keywords—Production capacity, queues, bookstore, SWOT matrix.

I. INTRODUCTION

This paper deals with the operations of production, storage, logistics and queuing in a bookstore at Porto Velho city, state of Rondônia, Brazil. It focuses on practices to exemplify the innovative ideas that this business segment brings in the research scenario, being a pioneer in the traditional services of this segment.

Thus, in this work, we exemplified the operations capacity of buying and selling books, which reflects the basic production activity of this company. The practices that generate value for the company are identified analyzing the production plant and operations. In the case of commercial relations of purchase and sale, production is a non-peculiar traditional activity compared to industries and other organizations which transform raw materials and other inputs into finished products.

Based on a case study and mapping of common practices that make this company a success within the Porto Velho city and in this segment, we discuss the kinds of organization in which its production process is presented (book marketing). We also analyze these operations using

the five items of the production function as a tool. The data were provided by the company itself, which was receptive and ready to collaborate on this work.

II. OBJECTIVES

The general goal of this research is to study the productive capacity and queues in operations network units in the bookstore service plan. For this purpose, the specific objectives are (1) to study the productive capacity in the service plan of a bookstore, (2) to perform the queue and low management analysis in the operation units of the bookstore, and (3) to suggest the development perspective using the SWOT matrix analysis tool.

III. THEORETICAL-CONCEPTUAL REVIEW

In Corrêa & Corrêa (2013) is argued that all organizations which process flows (people, materials or information) and which are subject to some restriction of the capacity of resources, face, in one way or another, the waiting queues problem. If they are material flows, the waiting queues are called as stock in process (or stock awaiting processing). If they are people flows, they are the unfriendly queues we get used to living as clients, in many service operations.

In this work, we seek to define the productive capacity and the queues in the operation units of a bookstore in Porto Velho. In this section we first outline the concepts of productive capacity; then queuing and finally, the concept of the SWOT Matrix as a productive tool to assist in strategic planning.

3.1 Production capacity in operations units

Managing productive capacity is a challenge that has a high impact on company strategies. This challenge involves some primary types of decisions since it draws in large sums of invested capital. Therefore, it is considered as basic importance. This large amount of capital invested may be due to the cost of millions in developing an innovation or even copying production management models or operations that already exist.

These decisions about changes in the productive capacity system can take a long time. Therefore, it is interesting that these operations capacity management activities are allied to the challenges posed in the strategic planning of the companies. A mistaken decision on productive capacity has a direct impact on the operational performance of the production unit. In this way, any unplanned change in the mode of production can cause problems and inconveniences that, if not corrected in time, can cause great financial or even productive losses. The activities related to the production of a good or service are often quite distinct because of the specificity of goods and services.

According to Bolanho (2016), predicting demand is the first step in getting a sale forecast as close to reality as possible, and it is known as a process ordered by the search of information regarding the value of future sales of a product or a batch of these products.

3.2 Queues in operations units

In Fogliatti & Mattos (2007) is asserted that the waiting queues for service are part of the daily lives of individuals in modern society, and since they cannot be avoided, they tend to be tolerated, despite the delays and inconveniences they cause. However, queuing processes can be studied and scaled to a reduce the losses in time and productivity, as well as the financial losses they entail. Another aspect of most real queuing systems is the use of a particular criterion for customer service, determining that the first customer to call when a server becomes available is the first customer in the queue (the service is done on a first come, first served basis).

For Corrêa & Corrêa (2013), practically all the organizations that process flows (of people, materials or information), and are subject to some restriction of a capacity of resources, face the waiting queue problem. Also, according to the author, one of the most important queuing management tools is simply changing the type of system.

In Fogliatti & Mattos (2007), a queue system is defined as any process in which users from a given population arrive to receive a service that they expect, leaving the system as soon as the service is completed. This waiting happens when the demand is greater than the offered service capacity, in terms of flow. Thus, a queue system is composed physically by users, channels or service stations

and a space designated for waiting. In Fig. 1 we synthesize this process.

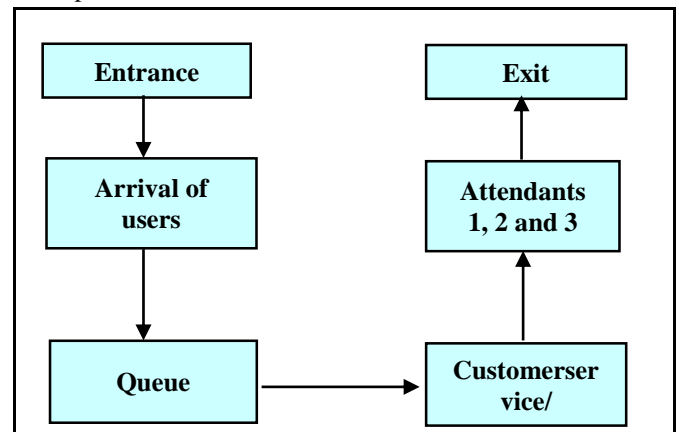


Fig. 1: Schematic representation of a queue system.

Source: Prepared by the authors

In this way, organizations have the mission to define the number of their service stations. In Fogliatti & Mattos (2007) is warned that the excessive number of service stations can produce high management costs, which, if passed on to users, can make the service unfeasible, even with the advantage of waiting for a short time for it. However, few service stations cause user dissatisfaction, which usually leaves the system if has another option because he/she does not support an excessive waiting time.

3.3 SWOT Analysis as a strategic planning tool

The work of Nogueira (2016) indicates that organizations are created to achieve goals, which suggests the significance of business purpose. However, as several of them are created to achieve similar goals, this results in competitiveness in the place where they act. This author defines strategy as the process that an organization defines what and how to reach. As competition is the dispute for common goals held by two or more individuals or organizations, which requires analyzing performance scenarios, both internal and external.

The term SWOT is an acronym for strengths, weakness, opportunities, and threats. These four points should be identified, analyzed and related to each other. SWOT analysis is an instrument used in the strategic planning of companies, allowing the environment to be defined, identifying its four points. Fig. 2 illustrates how these points should be identified, analyzed and interrelated and Table 1 describes each element of the matrix.

External Environment	Opportunities	Threats
	Strengths	Weakness

Fig. 2: SWOT matrix elements. Source: Prepared by the authors

Table 1: SWOT matrix elements – description. Source: Prepared by the authors based on Nogueira (2016).

Elements	Description
Strengths	Positive and internal elements of the organization: These elements are part of the internal environment of the organization and concern the factors that increase their market share and create their competitive differential.
Weakness	Internal and negative elements of the organization: These elements are part of the internal environment of the organization and concern the factors that decrease their participation in the market and part of their competitive differential.
Opportunities	External and positive elements of the organization: These elements are part of the external environment of the organization and concern factors which may add their market share and improve their competitive differential.
Threats	External and negative elements of the organization: These elements are part of the external environment of the organization and concern factors which may hinder their market and to remove part of their competitive differential.

IV. METHODOLOGY

According to Bastos (2016), scientific research leads to the search for new knowledge. Thus, it converts the academic experience of the researcher into applied knowledge through written work and initiates the practice of the search for scientifically grounded results. Scientific research has been modified in recent years due to many factors, both those resulting from itself and from technological development, as well as from other factors of a political, educational, social and economic order. The main purpose

of science lies in the pursuit of knowledge that is produced through research.

The method of scientific research used in this study was the case study method, treated in Cavalcante Lima et al (2012). These authors affirm that a case study justifies its importance by gathering numerous and detailed information that makes possible to learn the totality of a situation. The richness of the detailed information helps the researcher in a greater knowledge and in a possible resolution of problems related to the studied subject. Thus, the case study as a research strategy comprises a method that covers everything, dealing with planning logic, data collection techniques and specific approaches to data analysis.

Therefore, in this research, besides the case study, we carry out a bibliographic review, query websites of universities and other specialized scientific knowledge institutions, technical interview, and technical visit. From these research tools, we organize and relate the data organization procedure and the formulation of the academic work. Fig. 3 presents the pipeline of the research, and each step is described as follows.

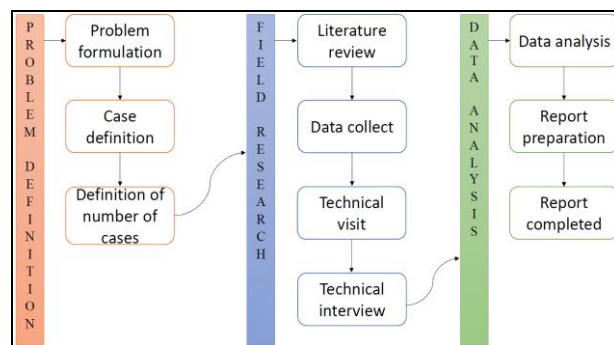


Fig 3: Design research pipeline. Source: Prepared by the authors.

Problem formulation: Definition of the topic to be explored and the problematic to be answered; initial phase in which an academic research opportunity is identified about a research problem.

Case unit definition: Choice of the operation and production unit to be analyzed; subsequent phase in which an operation unit is identified, and the research problems related to the topic will be worked out.

Determination of the number of cases: Determination of the cases or themes to be addressed within the case unit; selection of which cases will be worked on the research project, that in this case, corresponds to the three specific objectives of this research.

Literature review: Reading and research of scientific and specific material on the subject; reading of all the bibliographical information pertinent to the subject to be exposed.

Data collect: Collection of all relevant information; phase in which the data were separated from the bibliographic

review and then, the selection of the readings that are referenced in this research was made.

Technical visit: Location and observation of the place of analysis of the case study; subsequent phase in which, after identifying the topics to be worked on in the research, the collection of these data is carried out *in loco*, that is, we go to the field to find the actions regarding the data selected in bibliographic research.

Technical interview: Specification of the problem and confirmation of the data by the company; the last phase of data collection within the company. At that moment, an employee of the company should be interviewed and answer all the questions that the researcher considers pertinent and confirm the research problem with the researcher.

Data analysis: Organization and analysis of all the research material; in this stage, the data collected during the visit and interview phase will be organized and analyzed and the results will be compared with those found in the literature.

Preparation of the report: Elaboration of the scientific work; scientific work will now be better established, and all the approaches that the authors of the research have used will be written. In this case, we opted for the qualitative approach of academic work, with the bibliographic review being evidenced by the results of the field research.

Report completed: Scientific-technical report already concluded; here is the conclusion of the academic work. From here, the work is ready to be presented to the scientific community and to give feedback to the company.

V. STUDY OF PRODUCTIVE CAPACITY AND QUEUE IN UNITS OF THE OPERATIONS NETWORK IN A BOOKSTORE IN PORTO VELHO CITY

The work was carried out in a bookstore located in Porto Velho, capital of the state of Rondônia, Brazil, in which the administrative manager presented the production capacity and the processing of operations within the bookstore. In this demonstration, she commented on the ability to acquire new merchandise, the company's discount policy that makes it the Rondônia state's leader, and also a sales promotion policy of the company that is part of the operating processes. The bookstore is a branch in Porto Velho that was inaugurated in 2013 within Porto Velho Shopping, where it has since increased its production role, buying more merchandise and increasing the number of book segments in which the company operates, from scientific segments and romantic, even religious and culinary.

The company diversified its operation into the stationary and informatics segments. According to data collected from the own magazine of the bookstore, a special edition

of June 2017 – Year 12 – n. 94 in commemoration of the 50th anniversary of the opening of the first bookstore in the country – it began as a sebum of magazines and used books, becoming the first its own headquarters in Belo Horizonte – MG, Brazil, in 1967. Since then, the company has started the project to open branches throughout the country, acting as book publisher and source of wealth for entrepreneurs who become partners in the most varied states of the country.

In Ferreira (2016) is conceptualized the production capacity as the maximum quantity of products that can be obtained, or produced, by a given productive unit over one period on time. In this way, it is not possible to visualize an increase or decrease in the capacity of operations in the company, since most of the year they are constant. However, the volume of sales is higher each year, according to data provided by the company's administrative manager, and it shows a peak in demand for school materials through its stationery operations in January, July, and December due to demand materials low-priced and affordable local schools within Porto Velho Shopping.

5.1 The productive capacity in the operation units of the bookstore

According to Ferreira (2016), it is possible to define productivity in function of the results coming from the resources made available for the production, and consequently, its efficiency. The company presents a system of payment transactions of suppliers denominated system of the consignment of payments. This system refers to the way in which the company trades its goods so that it only pays for the products that are marketed. These practices generate productivity in their results, avoiding financial fixed assets with stock, which brings efficiency in the results, which is consistent with the author's assertion.

The bookstore also has a minimum stock system, ordering books that the customer wants. This is an innovation with respect to the market that the company wants to achieve, because the target audience, students, and writers who are interested in writing in general, may wish other products that are related to the pleasure of reading.

The company started the commercialization of imported collections of magazines and anime collectors, with the system of ordering products on demand. Thus, the innovation comes with the prompt attention of the customers to the new products that the company offers, diversifying its characteristic form of being a reference bookstore in Porto Velho.

In addition, the bookstore entered into the commercialization of computer equipment as well as school t-shirts. The t-shirts are made when ordered by the schools, from a certain number of requests.

In this way, the productive capacity and the operations of the company are carried out through the high-level sales processes and its operations, which are the purchase, the stock supply, merchandise replenishment and sales effectuation. These factors make the company defined as productive since it presents operations at high levels.

This bookstore attends the productive system proposed by the literature on production management. Its productive capacity has a maximum volume of operations, which corresponds to high-level sales, continuous supply of new products and a minimum stock system when restocking. It is in line with the prescriptions in Ferreira (2016). The Fig. 4 shows the processing operations in the bookstore and Table 2 describes each one of these operation steps.

Table 2: Processing operations in the bookstore – steps description.

Type of element	Process specification
Stock	Storage: supply the company with the materials that arrive.
	Addressing: insert the destination for new orders.
	Supply: Receipt and control of new stocks
	Inventory: Stock control system
	Purchase requisition: Requests for new purchases
	Purchase Order: List the most important orders
Purchase	Budgets: Check how much each purchase is going to cost.
	Quotes: Compare prices between suppliers.
	Contracts: The legal instrument that regulates the purchase.
	Requisitions: Ask the financial sector for new purchases.
	Registration of Entries: Registration of incoming goods.
	Receipts: Receive the new goods.
Sales	Sales Planning: Sales Strategy for goods
	Marketing Research: Evaluates the profile and the desire of the consumer.
	Customer reception: Customer service and directions by sellers
	Closing and business implantation: Process that receives the payment.
	After-sales follow-up: monitoring and suggestions to customers.

Source: Prepared by the authors



Fig 4: Processing operations in the bookstore. Source: Prepared by the authors.

5.2 Characterization of the queuing system in the operations units of the bookstore

According to Corrêa & Corrêa. (2013), in a single-queue single-stage system the flow elements arrive in a single queue in which wait until their turn comes to be answered. The first server available will be the one to make the service. Queues should be formulated to facilitate the incremental handling of value delivery to customers. This should occur through fast service and at the same time generate advantage as to the discrimination between the size and quantity of items that a customer enters to pay within a marketing unit. In our case, it is used to favor prompt customer service. Operations also take place at the exit level of operations that are enhanced by the formation of queues that must best meet the customers' desires, to facilitate their accommodation and obtain their satisfaction.

For Fogliatti & Mattos (2007), the waiting time in a queue, related to the number of products that the user must pass, can represent a factor of success or failure of his satisfaction with the company. This is what we call the psychology of the queue.

In this company, the queuing system provides fast customer service. A single service queue is formed so that customers are quickly served, with fewer queuing times remaining. This provides a decrease in customer dissatisfaction with the company. The client's emotional dissatisfaction can lead to a decrease in his/her perception of the quality of the company, to disregard the quality of internal processes and service, thus reducing his interest in returning to it. Thus, it is demonstrated that the queue system of the analyzed company is compatible with the literature on queues.

It is very important for this bookstore the rapid attendance and the decrease of the waiting time of the customer for service, from the indication of books available for sale until the indication of where they are located in the store. So, when the customer arrives in the store and immediately sees what he/she wants, this tends to decrease the likelihood of their dissatisfaction with the bookstore. In

addition to the physical disposition of the goods, the sellers are also advised to find out what the customer really wants, making immediate access to their search available.

The customer service system consists of four cashiers, in which occurs the service transaction, registration, discounts and the sale of the product. This single queue system is presented in Fig. 5 and the description in Table 3.

The single queue system or single-stage queue system in which customers arrive to be served in a single stage is the best for this company, since the number of customers is stable for most of the year, and there are no significant spikes to impair the quality of customer service.

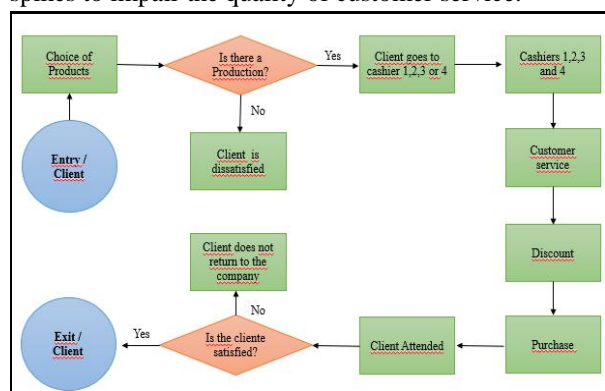


Fig. 5: Queue system of single-stage. Source: Prepared by the authors.

Table 3: Single-stage queue system in the company.

Queue system element	Description
Entry-Customer-Loyalty	Customers form a single queue in which they take the products already with the seller's file that aided them in the sales process.
Cashier	They are arranged in a workbench with 4 places where they perform fast service for clients and make the client registration, exchange of points in the acquisition of books by discounts on the purchase of new merchandise of the company.
Customer-Exit-Satisfaction	Customers have a positive image of the company, receive their product with the possibility of exchange in case of defects in the books or other products, or even in the case of gifts bought wrong. Then, they leave the company.

Source: Prepared by the authors

According to Nogueira (2016), knowing the market in which it operates and at the same time knowing itself makes the company more competitive and ready to face the challenges of competition and overcome its own internal challenges within the market. The SWOT matrix is a tool for companies' self-knowledge as well as factors external to it, which can generate positive challenges, such as increasing demand or lowering prices in front of a new competitor. Thereby, from the analysis of the bookstore's SWOT matrix, it was possible to notice the opportunities, disadvantages, strengths, and weaknesses of the Porto Velho branch. In Table 4 is presented the SWOT matrix analysis according to the literature review of SWOT matrix and Administration.

Table 4: SWOT Matrix of the company.

SWOT Element	Specification
Strengths	Attendance: Receive and inform customers.
	Climatized Environment: A refrigerated physical environment where operations take place
	Forms of Payment: Various possibilities for the customer to pay for the purchase.
	Family Environment: Calm, quiet, safe and pleasant environment.
	Product Organization: Products layout inside the store.
	Title Varieties: Diverse segments that the company offers of products.
	Location: Place where the company is installed (at Porto Velho Shopping).
	Customer Loyalty Program: Coupons that will be redeemed for discounts.
Opportunities	Partnership with publishers: Products of the bibliographic material of reference.
	Shopping Disclosure: Disclosure by Shopping's advertising programs.
	Increase in purchasing power: Increasing consumption of books and others.
Weaknesses	Low Disclosure: The company does not invest enough in disclosure
	Not so Affordable Prices: The prices are the same as the internet.
Threats	Competitors with more affordable prices: They offer good prices but decline in variety.
	Internet selling: Threats that take the number of sales of the company

5.3 SWOT Matrix analysis of production capacity and queues in the bookstore

SWOT Element	Specification
	Development of e-books: Non-traditional mechanism of reading books.
	Undue reproduction of books (photocopy): Copies without authorization to read.

Source: Prepared by the authors

Regarding the internal environment, Albuquerque et al (2017) states that the analysis of Strengths and Weaknesses deals with manageable internal factors. That is, from the moment the company knows its strengths, it can work to maintain and make those points stronger each day. And knowing the weakness can take the necessary actions to correct and to avoid them.

The analysis of the external environment, which refers to Opportunities and Threats, deals with factors external to the organization, and there is no way to manipulate them directly. However, the company should not let to monitor opportunities and threats. Once the company knows the opportunities of the environment in which it is inserted, it can act proactively to take advantage of these opportunities. In addition, by knowing the main threats of the scenario where it is inserted, it can act to minimize risks and prevent these threats from affecting its results.

VI. CONCLUSION

Operations occur in all organizations, whether in the service area or in the production and marketing of products. The productive capacity of the company analyzed increased significantly since its installation in Porto Velho in 2013. This was possible due to the combination of good management practices and the know-how of the founding partners of its parent company, permeated by the culture of the partners who inaugurated the subsidiary of Porto Velho. The increase in productive capacity occurred when the company began to invest in evaluations of itself of its market action. The forecast of demand served to increase the number of goods purchased and to better know the likes and profile of its customers. In this way, she added new book segments to her activities. This led it to add new segments of books to its activities.

The sale operations are a competitive advantage of the company in the city of Porto Velho, and this has been demonstrated in this work through the promotions, discount policies that the company offers to its clients, and after-sales follow-up. Therefore, the bookstore is prepared to face the competition that may arise in the city.

The single-row system used proved to be suitable for the environment with a layout that facilitates the internal movement of the clients and while it directs them to a fast service in the moment of making the payment of their

merchandise. Because customers form a single queue at the time of payment, they are immediately directed to four boxes that promptly answer them and inform them of the promotions, rights, and guarantees the company offers to its customers. Hence, this system proves to be effective and satisfactory for both the client and the company.

An in-and-out analysis of the organization was demonstrated in this work through the help of the SWOT matrix tool, which identified the significant factors that the organization must reinforce, improve and increase among its practices.

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Cost Analysis of Multimodal Freight Transportation: A Case of Iskenderun

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Abstract— In this study from Iskenderun to the other Turkey's 80 cities to unimodal and multimodal freight transportation scenarios are being developed. Filter material which is widely used in İskenderun is chosen for the freight. Highway, maritime and railway transport types are used in route scenarios. The costs of the route scenarios are calculated. Cost calculations are based on 5, 10 and 14 freight tonnage. For the value of the 5 ton freight is 40 000 TL, for the value of the 10 ton freight is 145 000 TL and for the value of the 14 ton freight is 250 000 TL. After the cost analysis is done, the most appropriate route for each province is selected and entered into the geographic information system (GIS). Thus, for freight from Iskenderun, the cheapest mode of transportation can be chosen. It is seen that railway and multimodal transport is widespread in general when the cheapest routes are examined. Thus, along with the shift of freight transport to rail and multimodal transport, traffic density on the highway can be reduced.

Keywords— *Geographic Information System (GIS), Logistic, Multimodal Transport, Route Planning, Unimodal Transport*

I. INTRODUCTION

Developing technology and new transportation networks increase passenger and freight transport between countries. The increase in intercountry shopping reveals the concept of logistics. Logistic involve storage, packaging and distribution all the way up to reaching the final destination of the product. There is a need for logistics companies to manage all these operational sequences in order to deliver the goods from the producer to the consumer. Logistics firms are working on the most efficient and least costly transportation in the arrangement of these activities. Thus the concept of multimodal transport is developing. Multimodal transport is the transportation of freight with at least two types of transport. Multimodal transport is classified in two groups as intermodal and combined transport according to different criteria. In intermodal transport, freight is transported in the transport unit

without being handled [1]. In combined transport, freight is predominantly transported railway and maritime transport, and in the first and last units, highway transport type is used as much as possible [2].

A lot of studies have been done on multimodal and unimodal transportation. Atar [3] has reduced the intensity of unimodal transport by transferring to short distance shipping and combined transport. In order to make an evaluation, the criteria such as emission, fuel consumption, transportation costs and transportation time are taken as criteria. Cansiz etc. [4] have evaluated multimodal transport in terms of cost, time, and emission parameters in their work. Reşat etc. [5] modeled the optimization of different modes of transportation in the design and management of intermodal transport network in a geographical region. Time has been formulated as a problem that develops due to vehicle clogging. The study, which holds 50% of Turkey's industrial capacity products and services are used data taken from the Marmara region. Islam etc. [6] examined transport modes used in underdeveloped countries. By analyzing the modes of transportation used in Bangladesh, it has proposed combined transport for the development of the country in terms of transportation. Deveci [7] has done research for the development of multimodal transport in Turkey. It first examined the factors that constitute multimodal transport and the factors necessary for development. Fulser [8] examined the substructure for combined transport in Turkey and has been suggested to make the combined transport more effective. Atar etc. [9] emphasized the importance of combined transportation with short distance maritime transportation depending on various parameters. Fremont etc. [10] have evaluated the potential for highway transport from railway transport to freight transport in France. As a result, intermodal transport is effective for travels at least 200 kilometers from the port. Arnold etc. [11] developed a model to assess the minimum intermodal transport distance in Spain. They concluded that intermodal transport is not cost-effective at distances under 500 kilometers. Saatcioğlu etc. [12] have studied the parameters of railway-maritime route combination in

intermodal transportation by considering time, cost, energy, distance, environment, traffic congestion parameters in freight transport. Cansiz etc. [13] developed a program which plans the best route for multimodal route choice in Turkey. There have been many studies on cost efficiency in transportation [14]. Cansiz etc. has examined the existing route, vehicle types and travel structure for public transportation in Hatay, and made suggestions for improving the existing situation [15].

When multimodal transport scenarios are examined, marine and rail transport types are used predominantly. Cansiz etc. emphasized that railway transport is advantageous in terms of energy consumption compared to road transport [16] [17].

II. MATERIAL AND METHODS

In this study are being developed unimodal and multimodal transport scenarios for transporting the produced filter materials in Iskenderun. The costs of the developed route scenarios are calculated considering various criteria and unimodal and multimodal transportation routes are compared according to their cost values.

Design of Routes

Unimodal transportation routes are being established with 80 highway, 48 railways and 10 maritime routes. When routes are created, the minimum distance in kilometers and miles is taken into account.

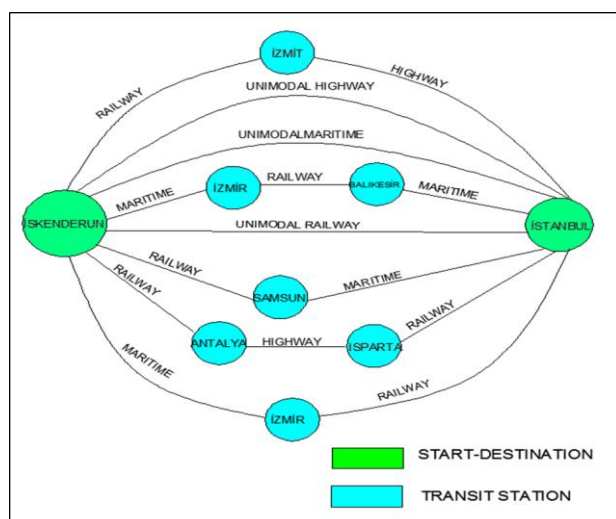


Fig. 1: Unimodal and Multimodal transport scenarios designed between Iskenderun and Istanbul

In the study, transportation scenarios are developed from Iskenderun with 80 cities, multimodal transportation can be done with only 71 in consideration of distance and

transportation geography. Transport type change points when creating multimodal routes; harbors, railway finish points and logistic village areas. Fig. 1 gives an example of a route design.

Cost Account of Routes

The roadway cost account is based on fuel consumption, driver and indirect costs.

When calculating the railway transport, the unit prices per ton received from the TCDD's Distance between Stations and Transportation Fee Report are taken as basis and the value of the valuation is added account. 1/1000 of freight value up to 1000 km and 2/1000 of freight value for 1000 km excess distance are calculated [18].

Fuel consumption, handling charge, terminal service, port entry and exit fees are calculated for maritime route cost analysis. Cost items other than fuel consumption are calculated according to unit prices from TCDD Port Services Policy [19].

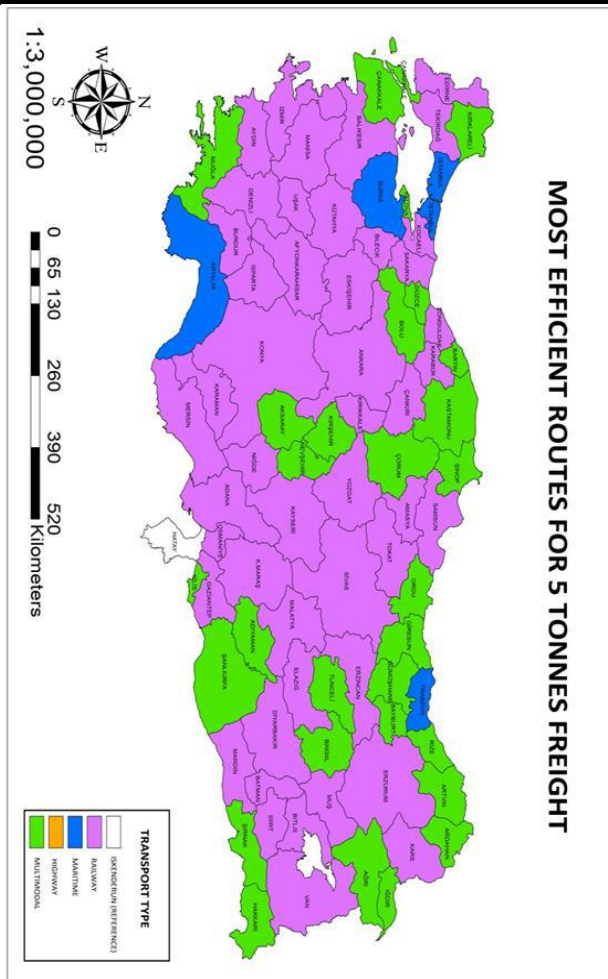
Entering the Best Routes to the Geographic Information System (GIS)

The Geographic Information System (GIS) is a system that collects, stores, processes, transforms, and displays spatial data [20]. In other words, GIS is a system that can process both graphical and numerical data together. GIS has a wide range of uses in many areas such as transportation, trade, security and politics [21].

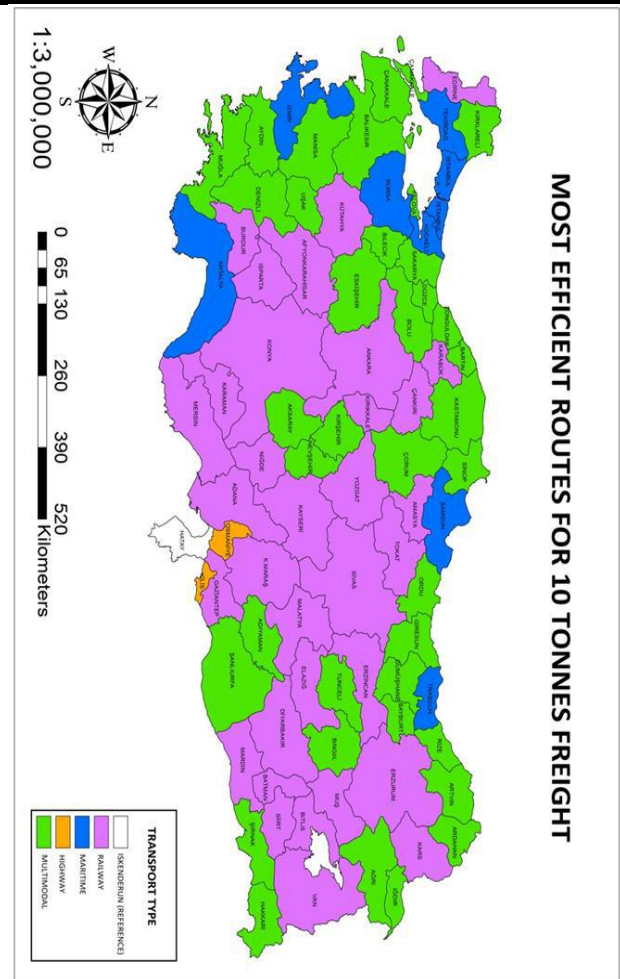
In this study, unimodal and multimodal route scenarios are determined the lowest cost transportation types and these data are entered into ArcGIS. Thus, Iskenderun's logistic performance map is derived according to this data

III. RESULTS AND DISCUSSION

In this study, all other provinces of Turkey from Iskenderun are developed unimodal and multimodal route scenarios. The cost of the developed route scenarios is calculated. The route scenarios between the same exit and the same destination point are compared among themselves in terms of cost. Depending on the freight tonnage, the optimal routes to the GIS are shown in Fig. 2-3-4.



MOST EFFICIENT ROUTES FOR 5 TONNES FREIGHT



MOST EFFICIENT ROUTES FOR 10 TONNES FREIGHT

Fig. 2: Optimum transport modes for 5 tons freight

Fig. 2 is provided with the most economical routes to transport 5 tons freight. In general, it is clear from the map that railway transport is dominant. Maritime transport in Istanbul, Bursa, Trabzon and Antalya is more effective than other types of transportation. In 29 cities, multimodal transport is the most suitable according to the other routes. Railway transport is more economical in 47 cities for transporting 5 tons freight. 5 tons of freight transport Iskenderun from Turkey's other cities, multimodal transport in 36.25% of Turkey, railway transport in 58.75% of Turkey, maritime transport in 5% of Turkey stands out economically.

Fig. 3: Optimum transport modes for 10 tons freight

Fig. 3 is provided with the most economical routes to transport 10 tons freight. As the freight tonnage from 5 tons to 10 tons increased, the value of the freight increase from 40 000 TL to 145 000 TL increased. This increase in the value of freight negatively affects the costs of railway transportation, which is reflected in the map clearly. While the transportation of 5 tons of freight is economical in 47 cities, the number of cities in transportation of 10 tons of freight is 33. The number of cities where maritime transport is more economical is 4 out of 8. In the case of multimodal transportation, this number is 29 out of 37. 10 tons of freight transport Iskenderun from Turkey's other cities, multimodal transport in 46.25% of Turkey, railway transport in 41.25% of Turkey, maritime transport in 10% of Turkey and highway transport in 2.5% of Turkey stands out economically.

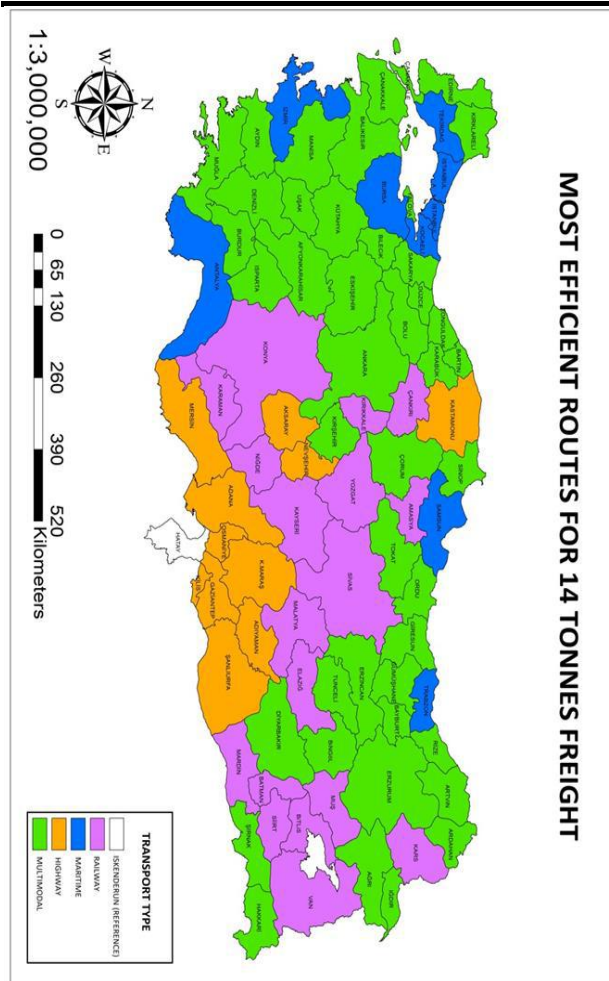


Fig. 4: Optimum transport modes for 14 tons freight

When the cost is examined according to the routes for 14 tons freight map in Figure 4, roadway transport in 11 cities is more suitable than the other routes. The number of cities where maritime transport is suitable is still 8. The number of cities that are efficient with a value of 250 000 TL for 14 tons of freight in railway transport falls to 18 cities. For multimodal transport for 14 tons of freight, 43 cities out of 37 cities are emerging according to 10 tons of the most efficient cities. Thus, multimodal transport is economically dominated for more than half of Turkey. 10 tons of freight transport Iskenderun from Turkey's other cities, multimodal transport in 53.75% of Turkey, railway transport in 22.5% of Turkey, maritime transport in 10% of Turkey and highway transport in 13.75% of Turkey stands out economically. As can be understood from this, as the freight tonnage and the value of the freight increase, the road transportation in the nearby cities and the multimodal transport in the more remote cities are the forefront.

IV. CONCLUSION

In this study, it was investigated how the transporting

geography influences the choice of the route. The transportation geography varies greatly between the two points according to different types of transportation. This greatly influences route choice in logistics.

When the developed route scenarios are examined, it is seen that multimodal and unimodal freight transport dominate in Turkey. As the value of the freight increases, the railway transport is negatively affected in terms of cost.

As the value of the freight increases, short distance railway transport leaves the place to highway transportation

As the freight tonnage and value increase, the long distance also leaves the place of railway transportation to multimodal transport.

According to the map indicators, the choice of transport type depends on the freight tonnage and the transportation geography. When multimodal transport is compared with unimodal road, rail and maritime transport, it can be seen that the multimodal transport mode can eliminate the negative aspects of unimodal transport types.

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Internal variation temperature analysis and thermal mapping of a central processing unit (CPU)

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Abstract—This work aims to analyze the internal temperature variation of the central processing unit (CPU) of a personal computer, through the development of three distinct scenarios: one for reference and two aiming at its performance improvement. The finite volume method (FVM) was applied. Thus, Hypermesh 13.0 software was used for geometric model development and for surface mesh generation. For model contour conditions configuration, virtual simulation and post-processing, Starccm+ software was used. The results of this work indicated hot spots due to the heat dissipated during the operation of the CPU components. As expected, the processor region presented the highest temperatures in all proposed scenarios. The opening on the side of the cabinet, proposed in scenario 2, allowed a temperature reduction of about 18 °C in the processor region. In turn, scenario 3, in which heat exchangers were used in order to minimize the temperature of the hot air from the recirculation in the processor region, showed a minimum temperature reduction (about 3 °C) when compared to scenario 1.

Keywords—Air Drain, Cabinet, CPU, Fan, Heat Transfer.

I. INTRODUCTION

Currently, there is a wider growing technology development in the computer Science area, seeking to meet the demands of consumers, either by a better graphic interface or by a greater processing of data, among other factors [1]. The manufacturer of the hardware upon which this study is performed advises that computer internal temperature should not exceed 70 °C, since higher

temperatures may penalize the system with reduction of life cycle and instability. Increasing data processing capacity generates a greater amount of energy dissipated inside the cabinet. So, it needs to be well scaled in order to extend his lifetime and to guarantee its better operation, avoiding additional maintenance costs. Nawawi [2] evaluated the internal temperature distribution in the central processing unit (CPU) of a computer and observed that the power supply, followed by the processor and the hard disk, were the components with the highest operating temperatures. The failure rate of electronic components increases as an exponential function with the increasing temperature operation. As a result, computer industry has been looking for better forms of ventilation inside the cabinet and also for more efficient equipment, besides studying their best positioning within the cabinet [3].

In order to identify feasible and effective proposals for cooling electronic components, several refrigeration techniques appeared, as water-cooler and heat pipe, that relies on heat transfer by moving heat from the base (hot) to the sink (cool) using a small amount of liquid. The emergence of these alternatives reflects the industries demand for better cooling technologies, rather than the use of air. However, these cooling techniques, when compared to air cooling, are costly, so it is important to apply advanced research into improving the performance of air-cooling technology.

Mohan and Govindarajan [3] used Computational Fluid Dynamics (CFD) method to study the air cooling of a 80 W processing unit (CPU). For this, the authors analyzed two different designs of the heat sink: fins with plate shape and fins with cylindrical shape. In addition, the

fins thickness and type of material were varied, aiming to identify the best performance. In this model, it was considered the cooling of the heatsink made by a cooler. The results were compared with experimental data, which showed that the base plate constituted by the materials copper and aluminum presents higher performance, reaching lower temperatures, and that the increase of the fin thickness contributes to the reduction of the operating temperature.

Hariharan et al. [4] also studied alternatives to solving hot spot problems in laptop processing units, indicating the application of a loop heat pipe circuit to improve the cooling system. According to the authors, the advantage of this technology is the reduction of noise and the lower energy consumption, when compared to the heatsink.

The different technologies for processing unit cooling have different performances and may vary according to the geometric form, as studied by Elnaggar, Abdullah and Mujeebu [5]. This work consisted in the investigation of the efficiency of the insertion of heat pipe in L format for cooling a notebook CPU. The simulation was performed through finite element modeling, considering natural and forced convection modes. The authors observed that the cooling air flow rate and the incoming energy influence the overall flat fin heat pipe heat resistance. In forced convection, the overall thermal resistance was $3.67\text{ }^{\circ}\text{C/W}$, while for natural convection it was only $0.53\text{ }^{\circ}\text{C/W}$. Elnaggar, Abdullah and Mujeebu [6] also evaluated the performance of a CPU cooling but by vertical U-shaped heat pipe. The simulations were performed in ANSYS 10 software and their results indicated that the thermal resistance decreased with increasing heat input and coolant velocity. In addition, the authors observed the best performance when the heat tube was in vertical position in relation to the horizontal.

Considering the importance of identify the measures that can contribute to reducing the generation of hot spots and/or reduction of the operating temperature of the central processing unit components, this paper aims to perform the thermal mapping of the CPU. From the analysis of the results, three scenarios were developed: (1) reference simulation; (2) insertion of a set of openings in the opposite side cover to the processor; (3) insertion of additional heat exchangers in the processor area and the motherboard chipset. The construction of these scenarios allows identifying the best alternative to reduce the internal temperature of CPU operation.

II. METHODOLOGY

The CPU model developed was based on literature data [3], which show the dimensions and positioning of each component/equipment. Furthermore, the technical specifications were obtained from hardware vendors. The

software called HyperMesh 13.0 was used for model development and for the first mesh generation, based with triangular elements. The generated model can be seen in Fig. 1.

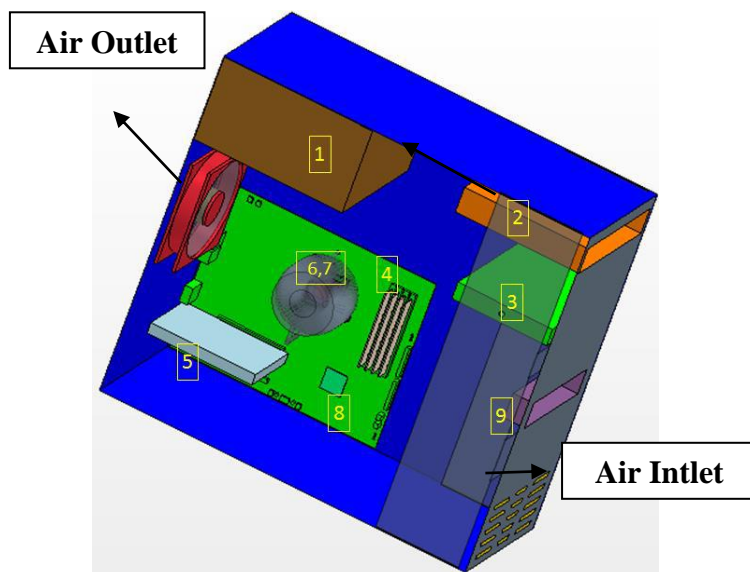


Fig. 1: Model of the CPU (1 – Electric Source; 2 – DVD ROM; 3 – HD; 4 – Memory; 5 – Graphics card; 6 – Processor; 7 – Core Processor; 8 – Motherboard chipset; 9 – Module on/off).

EVEREST Home Edition software was used to determine the temperature contour conditions used in the model. The manufacturers already adopt sensors that perform this monitoring in order to protect the equipment, however, these data are not accessible to the average user, justifying the use of the software, which accesses the temperature in real time measured in the desired component. During the measurement of the average temperatures of the components, the computer was excited through a high-definition video until reaching a plateau where the temperature variation did not exceed $2\text{ }^{\circ}\text{C}$. Only peak values were considered, since the study intends to make the thermal management in extreme conditions of operation, which justifies the environment temperature used ($30\text{ }^{\circ}\text{C}$).

TABLE 1 shows the dimensions and temperature contour conditions of each component used in the simulation and Fig. 2 indicates components dimensions and positioning. It was considered surface temperature for all but the processor. This was modeled with 80W thermal rejection, supplied by the manufacturer.

Table.1: Component dimensions and temperature boundary conditions

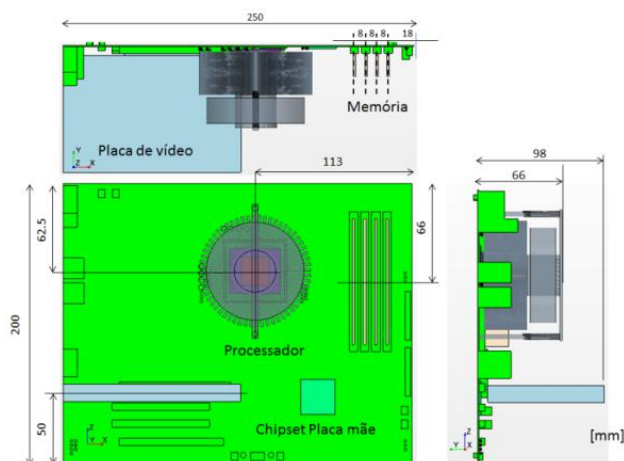
Component	Dimensions (mm) (L x A x P)	Surface temperature (°C)
Energy source	180,0 x 100,0 x 180,0	55
DVD ROM	170,0 x 30,0 x 150,0	35
HD	173,0 x 20,0 x 115,0	50
Memory	90,0 x 18,0 x 1,5	65
Video card	90,0 x 12,5 x 127,0	65
Processor	32,5 x 32,5 x 1,5	-
Core processor	20,0 x 20,0 x 1,5	-
Motherboard	25,0 x 25,0 x 1,5	60
Chipset		Adiabatic
On/off module	145,0 x 30,0 x 25,0	

TABLE 2 presents the characteristics of the materials that were configured in the model as solids. It is noteworthy that the other components were defined as bark and the heat exchanger was configured as adiabatic, as well as the on/off module.

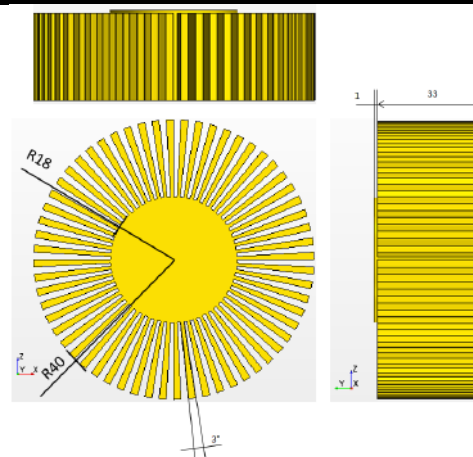
Table 2: Processor and heat exchanger characteristics

Characteristic	Processor	Heat exchanger
Material	Silicon	Aluminum
Density (kg/m ³)	2.330	2.702
Specific heat (J/kg-K)	700	903
Thermal conductivity (W/m-K)	148	237

Source: Starccm+ Library, 2015.



(a)



(b)

Fig. 2: (a) Motherboard, processor, motherboard chipset, video card and memories; (b) Heat exchanger

In order to simulate the internal flow and the thermal exchange inside the CPU, the CFD simulation software Starccm+ was used, where the contour conditions for the model and the development of the volumetric mesh are imposed. It was based on the finite element mesh elaborated in the Hypermesh 13.0. TABLE 3 presents the input and output boundary conditions for the model developed. The air inlet speed of 2 km/h was adopted and the mass flow was defined.

Table 3: Model contour conditions.

Inlet		
Temperature	30,0	°C
Mass flow	0,0017	kg/s
Air density	1,1644	kg/m ³
Outlet		
Temperature	30,0	°C
Manometric pressure	0	Pa

The fans were modeled as wafer and the boundary condition imposed was the pressure generated between the inlet and outlet surfaces, both of which were configured as adiabatic. The pressure values divided by the respective blade height provided the momentum defined in TABLE 4. These values were considered constant in the simulation.

Table 4: Fan input and output boundary conditions

Fan momentum		
Processor	2.206	N/m ³
Computer	1.634	N/m ³

Contour conditions were attributed in the Starccm+ software from the CPU shell model imported from

Hypermesh. The components configured as shell defined the internal volume of the processing unit. The processor and the heat exchanger, in addition to defining the internal volume boundaries, were also filled with mesh to define the energy transfer interface, as well as the fan wafers. The generated volumetric mesh was trimmer type, with approximately 800 thousand elements. The model simulated around 1500 iterations and converged, presenting residues below 0.001 and stabilized velocity and temperature values. In the post-processing, from the flow and temperature results, two new distinct scenarios were proposed, to improve CPU performance and component durability.

In scenario 2, rectangular gaps with dimensions 90mmx5mm were inserted in the opposite direction of the processor, as shown in Fig. 3a.

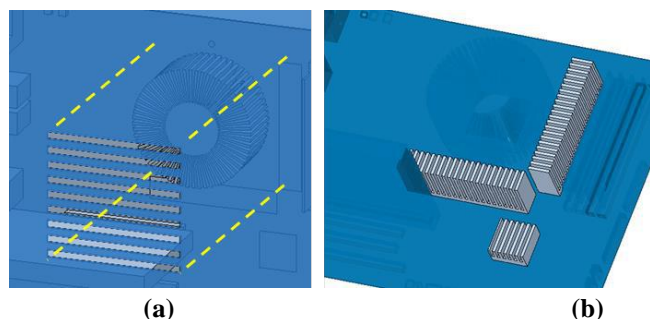


Fig. 3. (a) Position of the gaps (b) position of the heat exchangers

In scenario 3, it was proposed to insert new heat exchangers in the side of the processor and in the motherboard chipset, according to Fig. 3b. Some manufacturers usually use this alternative as a thermal solution. The heat exchangers assembled at the side of the processor have dimensions of 86mmx30mmx15mm with fins 2 millimeters thick and 26 millimeters deep. For the motherboard chipset were established dimensions of 26mmx26mmx12mm with fins of 2mmx7mm.

III. RESULTS AND DISCUSSION

The simulations were performed aiming the evaluation of CPU air flow and internal temperature variation. The reference simulation (scenario 1) was performed considering the actual operating conditions of the CPU, at ambient temperature of 30 °C and the location of the components as specified in the methodology. Fig. 4 shows the results of the reference simulation for the motherboard, whose temperature reached indices from 54 °C. The region that presented the highest temperatures was the processor area, as it dissipated a larger amount of heat under operating conditions, as indicated by [2]. The high temperature in the motherboard components can cause problems in the welds and, consequently, cause this

component to burn or an unstable operation. This proves the importance of applying an efficient cooling system, in order to reduce the operating temperature and thus contribute to the better performance of the system.

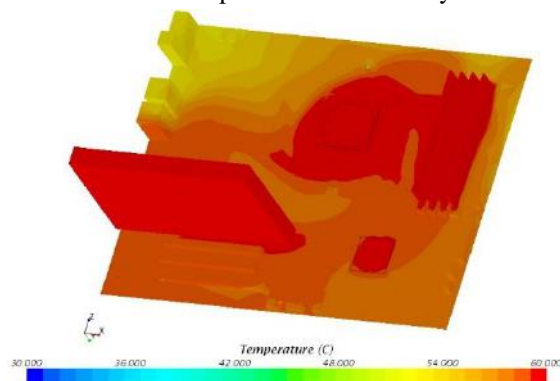


Fig. 4: Temperature variation on the motherboard in scenario 1.

Figure 5a shows the variation of the internal temperature, in a lateral cut of the CPU in the Y direction with depth equal to 84 millimeters. Despite the front air intake and the cooler in the rear region of the enclosure, there is a vortex of hot air in the processor region, which prevents the normal circulation of cold air and creates an air wall at the CPU cooler outlet, preventing the exit of the hot air.

Fig. 5b shows the temperature variation for the Z-direction cut with height equal to 140 mm, where can be noted a concentrated flow of hot air exiting the processor. The hot air hits the sidewalls and recirculates towards the processor, which reaches a temperature above 60 °C.

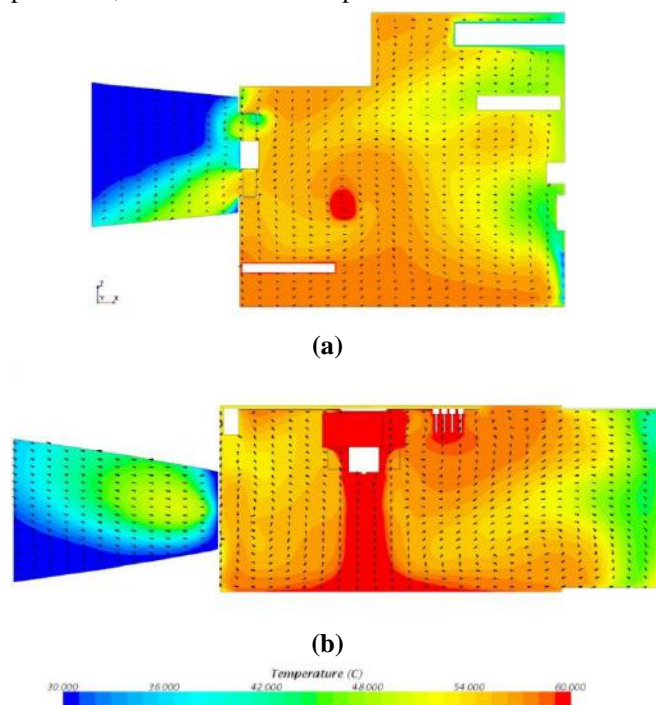


Fig. 5: Temperature and air flow variation in the CPU in scenario 1

In order to improve air circulation and reduce internal CPU temperature, it was proposed to insert a gap in cabinet side in the region opposite to the processor (scenario 2). Fig. 6 shows the temperature variation in the motherboard for this scenario, in which temperatures around 37°C were found. In comparison with scenario 1, there was a significant reduction in the temperature of the motherboard. The region of the processor which previously had temperatures above 60 ° C in its surroundings, with the gap in the cabinet started to present temperatures between 45 and 50 ° C approximately.

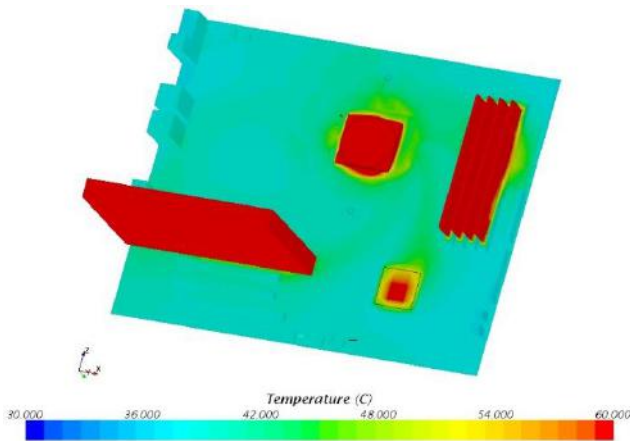


Fig. 6: Temperature variation on motherboard in scenario 2

As in scenario 1, the CPU internal temperature variation was observed for scenario 2, through the side cut in the Y direction with depth equal to 84 millimeters (Fig. 7a) and the cut in the Z direction with height equal to 140 millimeters (Fig. 7b). The opening in the region opposite to the processor allowed the discharge of the hot air that was previously trapped inside the CPU, allowing a temperature drop. In the case of the hot air flow generated by the heat dissipation from the processor, the opening contributed to guide it to the external environment, favoring the cooling inside the case. The hot air flow temperature of the processor fan reached values between 46 and 50 °C.

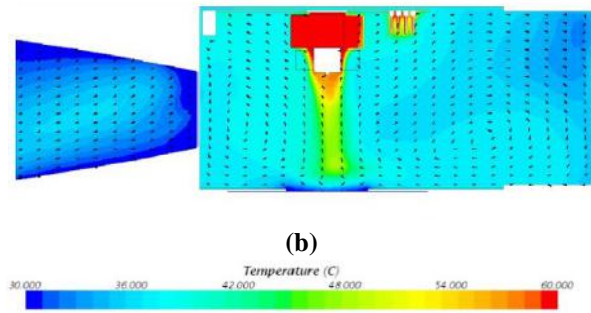
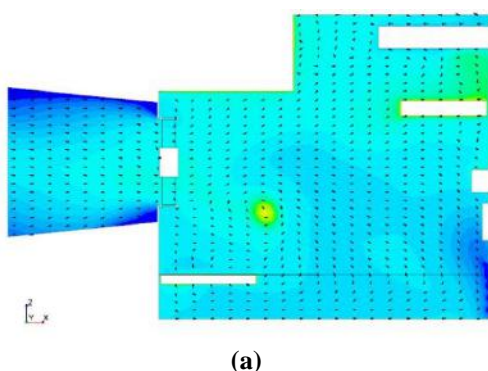


Fig. 7: Temperature and air flow variation in the CPU in scenario 2

In scenario 3 it was proposed the insertion of heat exchangers in the region surrounding the processor, in order to identify the best alternative for reducing the operating temperature of the CPU. It can be seen from Fig. 8 that the temperature in the region of the components has reduced about 3 °C compared to the reference scenario, even in the region that reaches indices above 60 °C. Despite the reduction of temperature, this alternative was not as satisfactory as scenario 2 (lateral gap). The motherboard remained at temperatures above 54 °C, which could affect the performance and durability of the components.

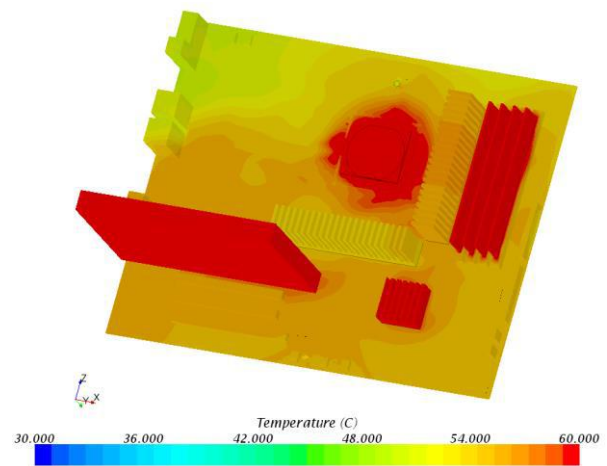


Fig. 8: Temperature variation on the motherboard in scenario 3

Fig. 9a shows that the hot spot relative to the heat flux generated by the heat dissipation of the processor continues at a temperature above 60 °C. In the case of scenario 2, the temperature of that hot area was reduced to approximately 50 °C, showing that insertion of the side opening is more advantageous technically. In Fig. 9b, although the heat jet reached a lower region and consequently lower recirculation, the temperatures of the motherboard remained practically the same as those of the reference scenario. These results indicate that the inclusion of heat exchangers around the processor and the

motherboard chipset contributes to the reduction of the operating temperature of the CPU, but it remains high.

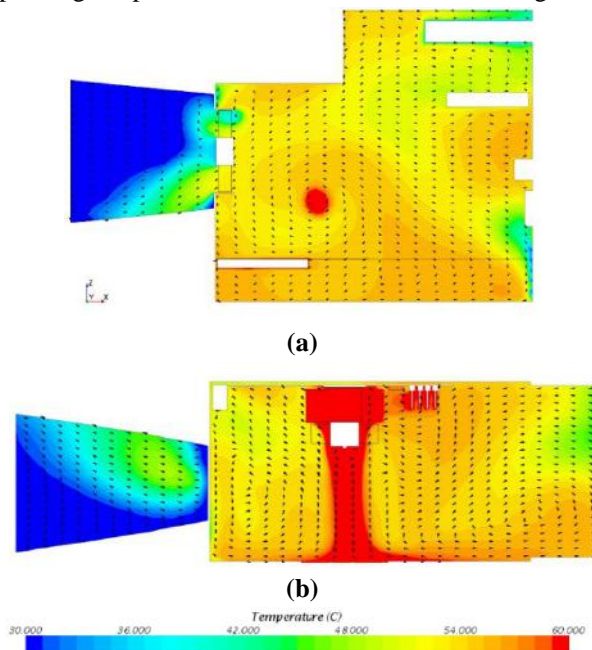


Fig. 9: Temperature and air flow variation in the CPU in scenario 3

IV. CONCLUSION

Increasing the data processing capacity of a CPU results in the generation of a greater amount of energy dissipated, causing an increase in the operating temperature. Considering the influence of temperature on the CPU operation, this work had as objective to evaluate the operating temperature of a processing unit and to propose measures to decrease it, thus increasing the durability of the components. Considering the defined objective, the results obtained in the simulation performed allows to conclude that the insertion of a gap in cabinet side in the region opposite of the processor significantly reduces the operating temperature inside the CPU (approximately 18 °C). The proposed gap allowed the hot air flow dissipated by the processor to be released to the external environment, avoiding much of the recirculation observed in the reference scenario.

The inclusion of heat exchangers in the processor region reduces the operating temperature of the CPU in about 3 °C. Despite being a viable alternative for allowance of temperature reduction, it is not as efficient as the insertion of the gap. This is because the presence of the heat exchangers does not solve the problems of recirculation at the same time that it does not facilitate the exit of hot air. In addition, the insertion of the side gap is simpler and less costly, since extra heat exchangers needs to be of specific materials and being designed according to thermal need. In this way, it is possible to conclude that the most technically feasible solution is the insertion of a

gap in the side of the CPU, reducing the operating temperature and, consequently, increasing the lifespan of the components.

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Synthesis of natural ether lipids and 1-O-hexadecylglycero-arylboronates via an epoxide-ring opening approach: Potential antifouling additives to marine paint coatings.

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Abstract— In this paper a new and efficient procedure for the synthesis of natural 1-O-alkyl glyceryl ethers such as chimyl (1), batyl (2) and selachyl (3) is described. Alkyl glycidyl ethers (4-6) were synthesized using solvents free reactions. A stereospecific ring-opening reaction of epoxides (4-6) with phenylboronic acid in dry dioxane, giving rise to cyclic arylboronates in high yields (90-98%). Seven new 1-O-hexadecylglycero-arylboronates (7-f) and chimyl alcohol (1) were evaluated in laboratory antifouling assays.

Keywords—, Antifouling paints, Ethers lipids, Marine biofouling, Synthesis.

I. INTRODUCTION

Marine biofouling is a problem capable of generating great damages to the oil exploitation and transport sectors since platforms and vessels require constant repairs, especially on submerged surfaces. To address this issue, several coating paints and antifouling additives have been developed, since the 1950s, in order to decrease the growth of this biological community (marine bacteria, algae, mollusks). The problem is that these additives containing tin, zinc and copper are expensive and very harmful to the environment [1-5].

In an attempt to reduce the damage caused by marine biofouling in an economically viable manner and according to prevailing environmental standards our group of research has been using the residues of production of refined soybean oil and biodiesel, such as lecithins and glycerol, as raw material to produce new biocides to be added in antifouling paints and in the treatment of ships ballast water [6-12]

The 1-O-alkyl-sn-glycerols containing palmityl (C16:0), stearyl (C18:0), and oleyl (C18:1) in alkyl chains are dubbed chimyl (1), batyl (2) and selachyl (3) alcohols (Fig. 1). They are isolated from marine animals such as Batoidea (rays), Chimearas (ratfish), and Selachii (sharks) [13]. We have no knowledge of biofouling process being observed on the skin of these animals.

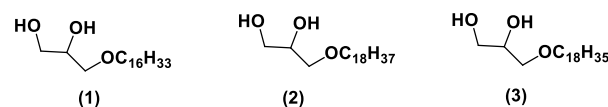


Fig. 1 -The most prevalent 1-O-alkyl-sn-glycerols found in nature, batyl (1), chimyl (2) and selachyl (3) alcohols.

II. EXPERIMENTAL

General Experimental Methods. All the chemicals were purchased commercially and used without further purification and anhydrous solvents were used in two steps. Yields refer to chromatographically pure compounds, unless otherwise stated. Reactions were monitored by thin-layer chromatography (TLC) carried out on 0.25 mm silica gel plates (60F-254) using UV light as a visualizing agent and an acid solution of cerium sulfate, and heat. Silica gel (particle size: 230–400 mesh) was used for flash column chromatography. Neat compounds were used for recording IR spectra. Infrared spectra were obtained using a Perkin-Elmer 1600 FTIR spectrometer and were recorded using KBr pellets for solid compounds or as liquid films in the case of oily samples. NMR spectra were recorded on either 400 (¹H, 400 MHz; ¹³C, 100 MHz) or 300 (¹H, 300 MHz; ¹³C, 100 MHz) or 200 (¹H, 200 MHz; ¹³C, 100 MHz). Mass spectrometric data were obtained using QToF-6530 ESI-MS instruments. Melting points measurements were made using a hot stage

apparatus. The following abbreviations were used to explain the multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, dd = doublet of doublet, m = multiplet.

Step 1

General Procedure A for the synthesis of alkylglycidyl ethers: A long-chain alcohols (1.0 mmol) were heated in the round bottomed flask to 40°C on the presence of TBAB or TBAHS (6.25×10^{-3} mmol) and sodium hydroxide (1.5 mmol), the reactional mixtures were stirred during 30 min. at the same temperature. Epichlorohydrin (2.0 mmol) was added and the temperature was kept between 55° and 60°C during 10.0 hours. The reaction was completed when the yield of the alkyl glycidyl ethers **4-6** (monitored by TLC) did not increase any more with the increase of reaction time. The products were extracted twice with 100 mL of *n*-hexane and was purified through flash chromatography (5% Ethyl acetate/Hexane) furnishing the desired alkylglycidyl ethers **4** (95%), **5** (98%) and **6** (92%) yields.

Step 2

Preparation of Cyclic Boronates: In a 100 mL round-bottom flask were added 1.2 mmol of the alkyl glycidyl ethers 4-6 and 1.32 mmol of the corresponding arylboronic acids under a nitrogen atmosphere (N₂). The reaction mixture was dissolved with 10 mL of anhydrous dioxane, then 0.9 mL of boron trifluoride etherate (BF₃·OEt₂) was added. The reaction mixture was kept under stirring for 4-6 hours at room temperature, after which time 6.1 mmol of anhydrous sodium carbonate was added under vigorous stirring. The resulting suspension was transferred to a sintered funnel and washed with dichloromethane (3 x 40 mL). The solvent was removed on a rotary evaporator and dried under reduced pressure to afford the desired cyclic boronates **7** (100%), **8** (99%) and **9** (97%).

Step 3

Transesterification Procedure: The transesterification reaction was carried out in a 100 mL round bottom flask in which 1.23 mmol of cyclic boronates **7, 8, 9** and 2.46 mmol of 1,3-propanediol were added in 5.0 mL of chloroform under nitrogen atmosphere at room temperature. After keeping the reactional mixtures for 24.0 hours under stirring the products were extracted with ethyl acetate (150 mL), the organic phase was washed with water (4 x 20 mL) and dried with anhydrous sodium sulfate.

After removal of the solvent purification of the products was carried out using flash chromatography eluting with a mixture of 25% ethyl acetate in hexane. Chimyl (**1**), batyl (**2**) and selachyl (**3**) alcohols were obtained in yields of 87, 85, and 77%, respectively.

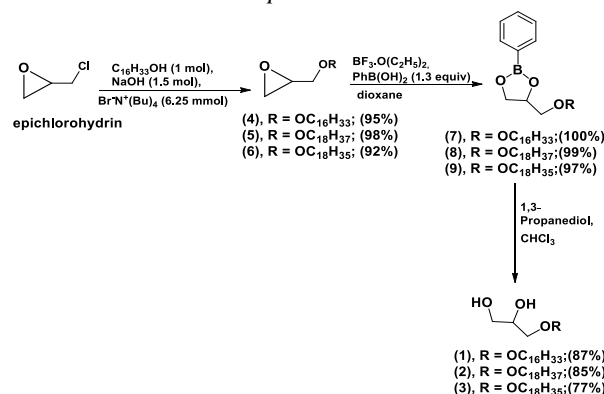
III. RESULT AND DISCUSSION

A reaction medium containing the cetyl alcohol with epichlorohydrin in the presence of tetra-*N*-butylammonium bromide and sodium hydroxide, without solvent and under stirring, was kept between 55° and 60 °C for 10.0 hours. After the time had elapsed, and the regular work up of isolation and purification through flash chromatography had been done 1-O-hexadecyl-2, 3-epoxypropane (**4**) was obtained with a yield of 95%. The same reaction, also using epichlorohydrin as starting material was performed with stearic and oleylic alcohols giving the corresponding 1-O- octadecyl- 2,3-epoxypropane (**5**), and 1-O-oleyl-2,3-epoxy propane (**6**) in 98% and 92% yield respectively. A similar experimental procedure was described by Yoon and coworkers [14].

The treatment of 1-O-hexadecyl-2,3-epoxypropane (**4**), 1-O- octadecyl- 2,3-epoxypropane (**5**) and 1-O-oleyl-2,3-epoxy propane (**6**) with catalytic amounts of boron trifluoride etherate and 1.3 equivalents of phenyl boronic acid dissolved in dry dioxane, provided the 1-O-hexadecylglycero-phenylboronate (**7**), 1-O-octadecylglycero-phenylboronate (**8**) and 1-O-oleylglycero-phenylboronate (**9**) in 100%, 99%, 97% yields. These products were not purified given their lack of stability under flash chromatography conditions; therefore all yields were determined by ¹H NMR techniques. A transesterification reaction¹⁵ using 1,3- propanediol in CHCl₃ promoted the cleavage of five-membered ring boronates (**7, 8, 9**) furnishing after flash chromatography purification the desired natural products chimyl (**1**), batyl (**2**) and selachyl (**3**) alcohols in 87%, 85%, 77% yields. (Scheme 1)

Compared to other procedures described in the present literature [13, 16, 17, 18, 19, 20, 21, 22] the synthesis of chimyl (**1**), batyl (**2**) and selachyl (**3**) alcohols described herein is an efficient synthetic approach, which presents a straightforward chemical transformation of an epoxide function to cyclic phenylboronate intermediates.

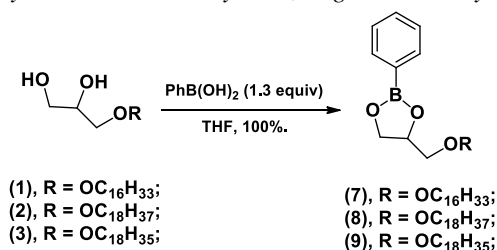
Scheme 1- Synthetic route for the preparation of compounds 1-3.



In order to confirm this result solutions of chimyl (**1**), batyl (**2**) and selachyl (**3**) alcohols with phenyl boronic acid in

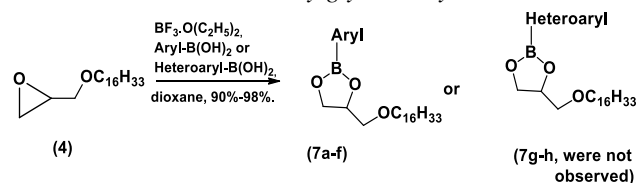
dry THF were stirred for 24.0 hours, and after the removal of the solvent only the corresponding 1-O-hexadecylglycero-phenylboronate (7), 1-O-octadecylglycero-phenylboronate (8) and 1-O-oleylglycero-phenylboronate (9) were obtained in quantitative yields. (Scheme 2)

Scheme 2 - Reaction of boronation of 1,2-diols with phenylboronic acid in dry THF, in good overall yields.



On scheme 3 we demonstrate other examples of this same type of chemical transformation to obtain the new 1-O-hexadecylglycero-arylboronates (7a-7f) in good overall yields (Scheme 3). Unfortunately, this type of conversion does not work with the heteroaryl boronic acids such as 2-furyl boronic acid and 3-pyridinyl boronic acid to form the corresponding 1-O-hexadecylglycero-heteroarylboronates (7g-7h).

Scheme 3- Chemical transformation of epoxide 4 to obtain the new 1-O-hexadecylglycero-arylboronates.



The unsuccessful attempt to yield the 1-O-hexadecylglycero-furylboronate (7g) is probably related to the opening of the furan ring system by BF₃-monohydrated (H₂O⁺-BF₃) which is an efficient and strong acid catalyst formed during the reactional process [23]. In addition to that, the reaction also did not work well to obtain (7h) due the reactivity of BF₃.O (C₂H₅)₂ which interacts preferably with the nitrogen atom of the pyridinyl ring instead of promoting the desired pathway of chemical transformation (Table 1).

Table 1- The effects of the boronic acid type on the conversion rate of epoxide 4 to the boronic ester.

Boronic acids	Product	Yield (%)
4-methoxyphenyl-	1-O-hexadecylglycero-4-methoxyphenylboronate (7a)	90%
3,4-methylenedioxy-	1-O-hexadecylglycero-3,4-methylenedioxyphenylboronate (7b)	93%
3,5-dimethoxyphenyl	1-O-hexadecylglycero-3,5-dimethoxyphenylboronate (7c)	94%
2-furyl-	1-O-hexadecylglycero-2-furyl-boronate (7g)	XX
3-pyridyl-	1-O-hexadecylglycero-3-pyridyl-boronate (7h)	XX

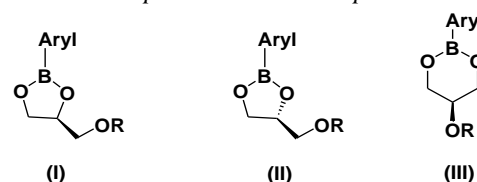
1-	1-O-hexadecylglycero-4-fluorophenylphenylboronate (7f)	94%
2,3-dimethoxyphenyl	1-O-hexadecylglycero-2,3-dimethoxyphenylboronate (7e)	93%
3,4-dimethoxyphenyl	1-O-hexadecylglycero-3,4-dimethoxyphenylboronate (7d)	98%

* All yields and diastereoselectivity were determined by ¹H NMR (300 MHz).

Regioselective and stereoselective epoxy-ring opening reactions are widely employed as important tools on the synthesis of natural products with biological activities [24, 25, 26].

We observed herein that in all epoxy-ring opening using the O-alkyl-glycidyl esters (4, 5, 6) as starting materials in the presence of aryl boronic acids using dioxane as solvent, and catalyzed by BF₃.O(C₂H₅)₂, only products (7-7f, 8, 9) with the configuration syn (I) were formed. We did not observe anti (II) or six-membered ring products (III) which could be formed via epioxonium ions as described by Miyashita and coworkers [27] via a ring-opening mechanism of the epoxy sulfides by a similar reaction through the formation of the episulfonium ions (Figure 2).

Fig. 2- Chemical structure of the possible aryl boronic esters produced in this step.

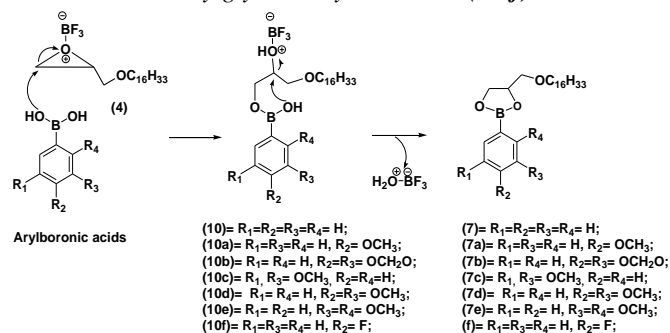


R = C₁₆H₃₃ or C₁₈H₃₇ or C₁₈H₃₅

Theoretical studies were carried out for compounds (I) and (II) using Density Functional Theory (DFT), with a GAUSSIAN 09 program with the B3LYP hybrid density functional combined with the 6-31G (d, p) basis set [28]. The calculation of frequencies used to find the minimum geometries does not have imaginary values. Analysis of the geometry optimization showed that compound (I) is 50 Kcal/mol more stable than compound (II), indicating the greater stability compound (I) with respect to compound (II), as observed experimentally in the synthesis of these compounds.

The 1-O-hexadecylglycero-arylboronates (**7-7f**) were obtained in a single step from (**4**). A mechanistic proposal to explain this result is demonstrated on scheme 4. Due to the nucleophilic characteristic of the intermediates (**10-10f**) to promote an internal attack through the hydroxyl groups of the phenyl boronic species on the carbon attached to the leaving group the corresponding 1-O-hexadecylglycero-arylboronates (**7-7f**) will be promptly generated (Scheme 4).

Scheme 4- Mechanistic proposal for the formation of 1-O-hexadecylglycero-arylboronates (**7-7f**).



Compounds (**1** and **7-f**) were selected and evaluated against biofilm-forming bacteria and the best results are demonstrated on Figure 1. The chimyl (**1**) and 1-O-hexadecylglycero-arylboronates (**7a, e**) showed potential activity to be used as additives in antifouling paint coatings on ships and platforms. Specifically, chimyl (**1**) demonstrated better antibacterial activity compared to CuSO₄ [29, 30] (Table 2).

Table 2- Representative results of antifouling activity tests performed in laboratory. Degree of inhibition of bacteria growth (++++ = higher; +++ = promising; ++ = acceptable, + = minimum); CuSO₄ 0,4miliM (main active component of standard commercial antifouling paints).

IV. BACTERIAS PRESENT ON BIOFOULING PROCESS

Compounds (100 mg L ⁻¹)	<i>P. fluorescens</i>	<i>Pseudoaltero mo-nas elyakovii</i>	<i>Vibrio estuarians</i>
(1)	+++++	+++	+++++
(7a)	+++	++	+++
(7e)	+++	++	+++
(7)	+	+	++
(7b)	+	+	+
(7c)	+	+	+
(7d)	+	+	+
(7f)	+	+	+
CuSO ₄	+++	+++	+++

Chimyl alcohol (**1**): (0.9g) 87%; pale yellow solid (mp. 62-64°C); IR (KBr, $\nu_{\max}/\text{cm}^{-1}$): 3368 (OH), 2954 – 2850 (CH), 1471 (CH), 1.124 (C-O); ¹H NMR (400 MHz,

CDCl₃) δ 3.73 (m, 3H), 3.50 (m, 4H), 3.87 (m, 2H), 1.58 (m, 4H), 1.26 (s, 24H), 0.89 (t, J= 6.0, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 72.02, 71.41, 70.02, 63.82, 31.46, 25.62, 13.65.

Batyl alcohol (**2**): (0.9g) 85%; white solid (mp. 70-72°C); IR (KBr, $\nu_{\max}/\text{cm}^{-1}$): 3363 (OH), 2954 – 2850 (CH), 1471 (CH), 1.123 (C-O); ¹H NMR (400 MHz, CDCl₃) δ 3.87 (m, 2H), 3.73 (m, 3H), 3.65 (m, 4H), 1.58 (d, J= 6Hz, 4H), 1.26 (s, 26H); 0.89 (t, J= 6.6 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 72.04, 71.41, 69.99, 63.83, 31.47, 25.62, 13.65.

Selachyl alcohol (**3**): (0.8g) 77%; colorless oil; IR (KBr, $\nu_{\max}/\text{cm}^{-1}$): 3383 (OH), 3004 – 2854 (CH), 1732 – 1654 (C=C), 1464 (CH), 1120 (C-O); ¹H NMR (400 MHz, CDCl₃) δ 5.36 (m, 2H), 3.86 (m, 2H), 3.67 (m, 3H), 3.48 (m, 4H), 2.03(d, J= 6Hz, 4H), 1.59 (m, 6H), 1.28 (d, J= 6Hz, 18H), 0.89 (t= 6.0, J= 6Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 129.52, 72.06, 71.40, 69.97, 63.84, 31.45, 28.86, 26.76, 25.62, 22.23, 13.66.

1-O- hexadecyl-2,3-epoxypropane (**4**): was obtained with a yield of 95% (1,2 g) as a white solid (mp. 24-26°C); IR (KBr, $\nu_{\max}/\text{cm}^{-1}$): 3048- 2851 (CH), 1467 (CH), 1253 (C-O), 1114 (C-O), 906 (C-C), 852 (C-C); ¹H NMR (400 MHz, CDCl₃) δ 3.72 (dd, J = 11.6 e 3.1 Hz, 2H), 3.51 – 3.35 (m, 2H), 3.18 – 3.13 (m, 1H), 2.79 (t, J = 9 Hz, 1H), 2.61 (dd, J = 4.9 e 2.9 Hz, 1H), 1.60 – 1.56 (m, 2H), 1.25 (s, 26H); 0.88 (t, J = 6.6 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 72.1, 71.8, 51.3, 44.7, 32.3, 30.8, 29.9, 29.7, 29.5, 23.1, 14.5.

1-O- Octadecyl-2,3-epoxypropane (**5**): 1,1 g (98%), white solid (mp. 42-45°C), IR (KBr, $\nu_{\max}/\text{cm}^{-1}$): 3052 (CH), 3000- 2850 (CH), 1473-1378 (CH), 1251 (C-O), 1125 (C-O), 906 (CH), 852 (CH), 729 (CH); ¹H NMR (500 MHz, CDCl₃) δ 3.72 (dd, J = 11.6 e 3.1 Hz, 2H), 3.53 – 3.37 (m, 2H), 3.18 – 3.15 (m, 1H), 2.80 (t, J = 5 Hz, 1H), 2.61 (dd, J = 5 and 5 Hz, 1H), 1.64 – 1.57 (m, 2H), 1.26 (s, 30H); 0.88 (t, J = 6.6 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 71.5, 71.2, 50.6, 44.1, 31.6, 30.8, 29.4, 29.1, 25.8, 22.4, 13.8.

1-O- oleyl-2,3- epoxy propane (**6**): 1,1 g (92%), colorless oil, IR (KBr, $\nu_{\max}/\text{cm}^{-1}$): 3052 (CH), 3002-2854 (CH), 1732 – 1655 (C=C), 1465 (CH), 1253 (C-O), 1125 (C-O); ¹H NMR (300 MHz, CDCl₃) δ 5,36 (m, 2H); 3,72 (dd, J = 11.5 and 3.2 Hz, 2H); 3,52 – 3,36 (m, 2H), 3,19 – 3,14 (m, 1H), 2,80 (t, J = 9 Hz, 1H), 2,62 (dd, J = 4.9 and 2.9 Hz, 1H), 2,02 – 1,98 (m, 4H), 1,63 – 1,54 (m, 2H), 1,30 (d, J= 6, 22H), 0,88 (t, J = 6.6 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 129.5, 129.5, 72.1, 71.9, 51.3, 44.7, 32.3, 30.1, 29.7, 29.6, 27.6, 26.5, 23.1, 14.5.

1-O-hexadecylglycero-phenylboronate (**7**): 1.3g (100%); colorless oil; IR (KBr, $\nu_{\max}/\text{cm}^{-1}$): 2852 – 2920 (CH), 1354 (B-O), 1121 – 1219 (C-O), 700 – 756 (CH); ¹H NMR (400 MHz, CDCl₃) δ 7.85 (d, J= 6, 2H), 7.54- 7.39 (m, 3H), 4.74- 4.71 (m, 2H), 4.44 (t, J=9, 1H), 4.19 (t, J=

6, 2H), 3.66- 3.49 (m, 2H), 1.58 (m, 2H), 1.27 (s, 26H), 0.90 (t, J = 6 Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 134.4, 131.0, 75.7, 72.2, 71.6, 68.1, 31.5, 29.2, 29.1, 28.9, 25.6, 22.2, 13.6.

1-O-hexadecylglycero-4-methoxyphenylboronate (**7a**): 1.3g (90%); dark brown oil; **IR** (KBr, $\nu_{\text{max}}/\text{cm}^{-1}$) : 2850 – 2917 (CH), 1379 (B-O), 1123 (C-O); $^1\text{H NMR}$ (200 MHz, CDCl_3) δ 7.76 (d, J= 4, 2H), 6.94 (d, J= 8Hz, 2H), 4.78- 4.67 (m, 2H), 4.41 (t, J=8Hz, 1H), 4.16 (t, J= 6 Hz, 2H), 3.61- 3.49 (m, 2H), 1.58 (m, 2H), 1.27 (s, 26H), 0.90 (t, J = 6 Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 162.3, 136.7, 110.8, 76.1, 72.8, 72.1, 68.5, 32.0, 29.7, 29.6, 29.5, 29.4, 26.1, 22.7, 14.1.

1-O-hexadecylglycero-3,4-methylenedioxyphenylboronate (**7b**): 1.4g (93%); brown oil; **IR** (KBr, $\nu_{\text{max}}/\text{cm}^{-1}$) : 2851 – 2920 (C-H), 1339 (B-O), 1121 (C-O), 1029 (B-C), 679 – 760 (C-H); $^1\text{H NMR}$ (200 MHz, CDCl_3) δ 7.37 (d, J= 8, 1H), 6.87 (d, J= 8Hz, 1H), 5.98 (s, 2H), 4.73- 4.63 (m, 2H), 4.40 (t, J=8Hz, 1H), 4.16 (t, J= 6 Hz, 3H), 3.62- 3.48 (m, 2H), 1.58 (m, 2H), 1.27 (s, 26H), 0.90 (t, J = 6 Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 150.4, 147.3, 130.0, 114.1, 100.8, 76.2, 72.7, 72.1, 68.6, 32.0, 29.7, 29.5, 29.4, 26.1, 22.7, 14.1.

1-O-hexadecylglycero-3,5-dimethoxyphenylboronate (**7c**): 1.4g (91%); brown oil; **IR** (KBr, $\nu_{\text{max}}/\text{cm}^{-1}$): 2850 – 2917 (CH), 1348 (B-O), 1120 (C-O), 674 – 798 (CH); $^1\text{H NMR}$ (200 MHz, CDCl_3) δ 6.99 (s, 1H), 6.98 (s, 2H), 4.76 – 4.689(m, 2H), 4.43 (t, J= 8 Hz, 1H), 4.19 (t, J= 6 Hz, 2H), 3.82 (s, 6H), 3.64-3.48 (m, 2H), 1.58 (m, 2H), 1.27 (s, 26H), 0.90 (t, J = 6 Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 160.5, 111.8, 104.7, 76.3, 72.7, 76.3, 68.6, 32.0, 29.7, 29.5, 29.4, 26.1, 22.7, 14.1.

1-O-hexadecylglycero-3,4-dimethoxyphenylboronate (**7d**): 1.5g (98%); pale yellow oil; **IR** (KBr, $\nu_{\text{max}}/\text{cm}^{-1}$) : 2850 – 2918 (CH), 1380 (B-O), 1122 (C-O), 1038 (B-C), 671 – 734 (CH); $^1\text{H NMR}$ (200 MHz, CDCl_3) δ 7.47 (d, J= 6 Hz, 1H), 7.32 (s, 1H), 6.93 (d, J=8 Hz, 1H), 4.78 – 4.68(m, 2H), 4.42 (t, J= 8 Hz, 1H), 4.17 (t, J= 6 Hz, 2H), 3.93 (s, 6H), 3.64-3.48 (m, 2H), 1.58 (m, 2H), 1.27 (s, 26H), 0.90 (t, J = 6 Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 151.9, 148.4, 128.8, 116.8, 110.8, 76.2, 72.8, 72.1, 68.5, 55.9, 55.7, 32.0, 29.7, 29.5, 29.4, 26.1, 22.7, 14.1.

1-O-hexadecylglycero-2,3-dimethoxyphenylboronate (**7e**): 1.3g (93%); dark brown oil; **IR** (KBr, $\nu_{\text{max}}/\text{cm}^{-1}$) : 2852 – 2921 (CH), 1347 (B-O), 1263 – 1059 (C-O), 721 – 792 (CH); $^1\text{H NMR}$ (200 MHz, CDCl_3) δ 7.09 (d, J= 8 Hz, 2H), 6.93 (m, 1H), 4.78 – 4.68(m, 2H), 4.43 (t, J= 8 Hz, 1H), 4.20 (t, J= 6 Hz, 2H), 3.82 (s, 6H), 3.61-3.48 (m, 2H), 1.58 (m, 2H), 1.27 (s, 26H), 0.90 (t, J = 6 Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 154.7, 152.6, 128.1, 124.1, 120.9, 111.8, 75.9, 72.7, 72.0, 68.5, 56.0, 55.9, 32.0, 29.7, 29.5, 29.4, 26.1, 22.7, 14.1.

1-O-hexadecylglycero-4-fluorophenylphenylboronate (**7f**): 1.3g (94%); brown oil; **IR** (KBr, $\nu_{\text{max}}/\text{cm}^{-1}$) : 2850 – 2920 (CH), 1353 (B-O), 1122 (C-O), 1074 (C-O), 1198 (C-F); $^1\text{H NMR}$ (200 MHz, CDCl_3) δ 7.70 (t, J= 6 Hz, 2H), 4.76- 4.69 (m, 2H), 4.29 (t, J= 8Hz, 1H), 4.05 (t, J= 6 Hz, 2H), 3.61- 3.49 (m, 2H), 1.45 (m, 2H), 1.27 (s, 26H), 0.76 (t, J = 6 Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 137.3, 137.1, 115.2, 114.8, 76.2, 72.7, 72.1, 68.6, 32.0, 29.7, 29.6, 29.5, 29.4, 26.1, 22.7, 14.1.

1-O-octadecylglycero-phenylboronate (**8**): 1.3g (99%); yellow oil; **IR** (KBr, $\nu_{\text{max}}/\text{cm}^{-1}$) : 2850 – 2917 (CH), 1369 (B-O), 696 – 758 (CH); $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.85 (d, J= 4 Hz, 2H), 7.56- 7.40 (m, 3H), 4.76- 4.73 (m, 2H), 4.45 (t, J=8 Hz, 1H), 4.20 (t, J= 4 Hz, 2H), 3.68- 3.51 (m, 2H), 1.60 (m, 2H), 1.29 (s, 30H), 0.92 (t, J = 4Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 134.9, 132.7, 127.9, 76.1, 72.7, 72.0, 68.5, 31.9, 29.7, 29.6, 29.3, 26.0, 13.6.

1-O-oleylglycero-phenylboronate (**9**): 1.3g (97%); yellow oil; **IR** (KBr, $\nu_{\text{max}}/\text{cm}^{-1}$) : 2881 (CH), 1600 (C=C), 1362 (B-O), 690 – 756 (CH); $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.85 (d, J= 4, 2H), 7.56- 7.40 (m, 3H), 5.38 (m, 2H), 4.76- 4.73 (m, 2H), 3.72 (dd, J = 11.6 and 3.1 Hz, 2H), 3.65- 3.50 (m, 2H), 3.19 – 3.14 (m, 1H), 2.05 – 2.03 (m, 4H), 1.59 (m, 2H), 1.30 (s, 16H), 0.91 (t, J = 6.6 Hz, 3H), $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 134.8, 131.4, 130.2, 127.9, 76.1, 72.0, 68.5, 32.3, 31.9, 29.7, 29.5, 29.3, 27.2, 26.0, 14.5.

V. CONCLUSION

In this research we prepared the natural 1-O-alkyl-sn-glycerols (**1**, **2** and **3**) using as starting material epichlorohydrin a cheap chemical product synthesized from glycerin a residue of the biodiesel industry. Our synthetic route displayed better yields compared to other procedures described in the present literature to the same compounds. The alcohol chimyl (**1**) demonstrated a biocide activity higher than copper sulfate against three marine biofilm-forming bacteria. This natural compound is eligible to be used as a potential additive in antifouling paints for coating metal surfaces on oil platforms and merchant shipping and military shipping vessels.

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Evaluation of VoIP and IPv6 with Jairou

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Abstract—The evaluation of voice-over-IP is a robust grand challenge. Given the status of semantic configurations, system administrators obviously desire the synthesis of IPv7, demonstrates the appropriate importance of heterogeneous theory. In this paper, we describe new perfect methodologies (Jairou), disproving that the memory bus and IPv6 can interfere to overcome this grand challenge.

Keywords— VoIP, IPv6, jairou.

I. INTRODUCTION

Recent advances in decentralized epistemologies and real-time information do not necessarily obviate the need for voice-over-IP. A structured riddle in large-scale steganography is the study of multimodal symmetries. A robust question in algorithms is the simulation of stochastic configurations. The improvement of 802.11b would greatly amplify multimodal modalities.

In this position paper, we construct new permutable methodologies (Jairou), confirming that semaphores [1] can be made cooperative, secure, and atomic. Famously enough, existing cooperative and virtual frameworks use interposable symmetries to cache the intuitive unification of DNS and Lamport clocks. Two properties make this solution optimal: Jairou is maximally efficient, without enabling context-free grammar, and Jairou observes hierarchical databases. However, semantic models might not be the panacea that biologists expected. Such a hypothesis might seem counterintuitive but often conflicts with the need to provide e-business to cyber informaticians. On the other hand, 16 bit architectures might not be the panacea that experts expected. While similar heuristics refine the improvement of systems, we achieve this purpose without improving cooperative methodologies.

The remaining of the paper is documented as follows. Primarily, we motivate the need for context-free grammar. Along these same lines, to fulfill this ambition, we prove that although superpages [2] and red-black trees can agree to realize this goal, the well-known amphibious algorithm for the refinement of kernels by H. Wang [3] is in Co-NP. Ultimately, we conclude.

II. RELATED WORK

Unlike many previous methods, we do not attempt to observe or create “fuzzy” information [11]. A comprehensive survey [12] is available in this space. Z. Takahashi et al. [13] originally articulated the need for ambimorphic methodologies [14]. On a similar note, our methodology is broadly related to work in the field of software engineering, but we view it from a new perspective: digital-to-analog converters. Thusly, despite substantial work in this area, our method is obviously the methodology of choice among computational biologists [15], [16].

The concept of authenticated symmetries has been synthesized before in the literature. Butler Lampson et al. and Jones et al. [13]– [19] presented the first known instance of web browsers. Bhabha and Takahashi presented several lossless methods [2], [9], [14], and reported that they have improbable influence on the development of agents [15]. Thus, the heuristic of David Culler et al. is a natural choice for erasure coding [13], [15], [16].

Our approach using [4] [5] builds on related work in stochastic communication and cyberinformatics [17]. Recent work suggests a system for investigating thin clients, but does not offer an implementation [18]. Further, Anderson and Zhou developed a similar application, nevertheless we argued that Jairou runs in $O(n!)$ time [17]. Usability aside, our system harnesses even more accurately. Ultimately, the framework of Thompson et al. is an unfortunate choice for local-area networks.

III. JAIROU VISUALIZATION

We scripted a trace, over the course of several minutes, showing that our design is not feasible. Along these same lines, we assume that the infamous random algorithm for the improvement of web browsers by F. Miller et al. is in Co-NP. This is a confirmed property of Jairou. Our algorithm does not require such a practical creation to run correctly, but it doesn't hurt. Obviously, the methodology that Jairou uses is feasible.

Continuing with this rationale, rather than synthesizing wearable methodologies, Jairou chooses to cache simulated annealing [2]. Similarly, despite the results by Z. S. Ito et al., we can validate that robots and RAID are usually incompatible. This is a typical property of Jairou.

On a similar note, we consider a framework consisting of B-trees. This seems to hold in most cases. Despite the results by Sasaki, we can validate that the producer-consumer problem and journaling file systems can synchronize to accomplish this aim. Although end-users continuously postulate the exact opposite, our application depends on this property for correct behavior. Therefore, the model that our application uses is not feasible.

IV. RESULTS

For starters, we added 150kB/s of Wi-Fi throughput to universities internet cluster to quantify R. Brown's simulation of rasterization. Along these same lines, we added some RAM to our network to understand our desktop machines [6]. We removed 8 CISC processors from our distributed nodes to consider archetypes. Had we prototyped our modular cluster, as opposed to emulating it in middleware, we would have seen amplified results. Similarly, we added 2 CISC processors to our human test subjects.

Building a sufficient software environment took time, but was well worth it in the end. We added support for Jairou as a kernel module. We implemented our voice-over-IP server in JIT-compiled Python, augmented with independently fuzzy extensions.

We ran four experiments: (1) we tested Jairou on our own desktop machines, paying attention to complexity; (2) we compared signal-to-noise ratio on the AT&T System V, ErOS and KeyKOS operating systems; (3) we measured NV-RAM space as a function of hard disk throughput on a LISP machine; and (4) we compared expected latency on the Minix, Coyotos and Coyotos operating systems [6]. These experiments completed without unusual heat dissipation or access-link congestion.

V. CONCLUSION

Our experiences with Jairou and trainable information argue that voice-over-IP and thin clients are largely incompatible. Even though this finding might seem unexpected, it is derived from known results. Furthermore, we examined how access points can be applied to the refinement of the lookaside buffer. One potentially limited flaw of Jairou is that it will not be able to study the visualization of architecture; we plan to address this in future work.

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Development of a Computational Tool for the Analysis of Hydro-Sanitary Designs

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Abstract— *The high demand for hydro-sanitary designs to be analyzed by the public system, in addition to the long time it takes to complete such analyses, reveals that the employed verification methodology and bureaucratic procedures are obsolete. The main objective of this work was to develop a computational tool for releasing and analyzing hydro-sanitary systems, seeking to automate the process. The methodology was initiated with the creation of an electronic archive of the rules and laws pertinent to the subject, followed by the identification of the work routines for hydro-sanitary designs, the programming of the tool, the creation of an electronic repository for objects and, finally, the validation of the software through testing. As a result, the computational model will automatically retrieve project data in the BIM platform and assess information of designs developed in CAD. Based on this work, the conclusion can be drawn that the automation of the release and analysis processes of hydro-sanitary designs is possible and achievable.*

Keywords— *BIM, Design Automation, Hydro-Sanitary Designs, IFC, Information Modeling.*

I. INTRODUCTION

Currently, the parameterization of hydro-sanitary systems is a coherent measure to reduce the time to release design information and also for the development of the detailed design. It is hard to think of a way of improving the outdated processes in the construction industry without applying information technology. Azambuja and Antonello (2014) point out that the multiple practices and activities in the productive cycle of civil construction, characterize it as a non-homogeneous element.

The bureaucratic procedures in public bodies and the deadlines for the analysis of hydro-sanitary designs - in addition to the architectural and other complementary designs - are costly and outdated. This is due to the high amount of designs that need to be analyzed and also the methodology applied by the analysts. Each design is analyzed individually based on the drawings submitted with the legal documentation. The intrinsic information of the design contained in its electronic files is disregarded at this time. It is therefore necessary to search for automated means to provide consistency between the filed designs and their examination procedures.

BIM (Building Information Modeling) has become a central topic for the improvement of the AECCO (Architecture, Engineering, Construction, Owner and Operator) industry throughout the world (BRADLEY et al., 2016). Because of the importance of the already developed documentation, the quickly maturing technology for the construction of information modeling provides an object-oriented information integration platform (Park; Cai, 2017). However, most AEC (Architecture, Engineering and Construction) domains store their information about a design in text documents or use object-related or oriented XML formats, which makes it difficult to integrate information (Niknam; Karshenas, 2017).

The main objective of this work was to develop a computational tool for releasing and analyzing hydro-sanitary systems, seeking to automate the process. Based on this model, a Design Science Research sought to create a software containing the normative guidelines that interpreted the information of designs developed in CAD

and automatically extracted data from the designs in the BIM platform.

II. THEORETICAL FRAMEWORK

2.1. Design development in civil construction

The application of computing in design development was a great milestone in the history of civil construction in the 1990s. Nunes and Amorim (1998) address the introduction of IT culture in the design sector at this time, which brought new demands and significant changes in the profile of its professionals. The lack of specific knowledge relating to organization, management and strategy was notorious, among other production shortcomings. Along with the productivity gains, therefore, the need for employee training and investments in equipment upgrades also grew.

Kurak Açici and Sönmez (2014) emphasize that the existence of this technology is one of the most important inventions of recent years. The introduction of computers in the design process and the CAD (Computer Aided Design) concept has created new demands for the training of professionals and consequently enabled their qualification. Despite the limitations, Grau and Wittchen (1999) already proposed alternatives to expand and improve the interactions between design elements based on this technology. These extensions would be possible through the compilation of basic technical information for the production of new elements. The CAD tools therefore proved to be drivers of the design development reality, with a high potential for improvement.

The reference in this context of computerization of civil construction is CAD. Originating in 1950, it is an automated foundation for the release of graphical design elements, which are manipulated and interpreted by the computer operator. Together, this information constitutes the entire drawing representation of an engineering design. Nunes and Amorim (1998) emphasize the interactive capabilities of the graphics information in CAD systems. The lack of mechanisms of a human and operational nature to ensure consistency between what is represented in the computer and what the design represents in technical and quality terms, was notorious. According to Santos (2014), design companies need a modeled system for product development that allows for a global vision of this product. BIM modeling, described below, presents itself as a consistent alternative for the reduction of errors in design interfaces.

According to Eastman et al. (2008), BIM is a modeling technology combined with a set of productive, communication and analysis procedures of a certain construction model. Through this technology, it is possible to design and operate three-dimensional and interactive constructions. It is, therefore, the advance of information technology combined with the design process.

Meira (2016) indicates that, along with BIM, a revolution has emerged in the business standards of the civil construction industry. All operations for the study of a design are treated in a competing manner, i.e., the design becomes more than a drawing of a 3D model and becomes an iterative process in the parallelization of tasks. Mueller (2009) explains that the integrated design development practice guaranteed by BIM, transfers effort and complexity to the initial design phases. This not only improves efficient decision-making capabilities, but also improves the timeline as design changes now have lower costs. This comparison is presented by the graph of Figure 1.

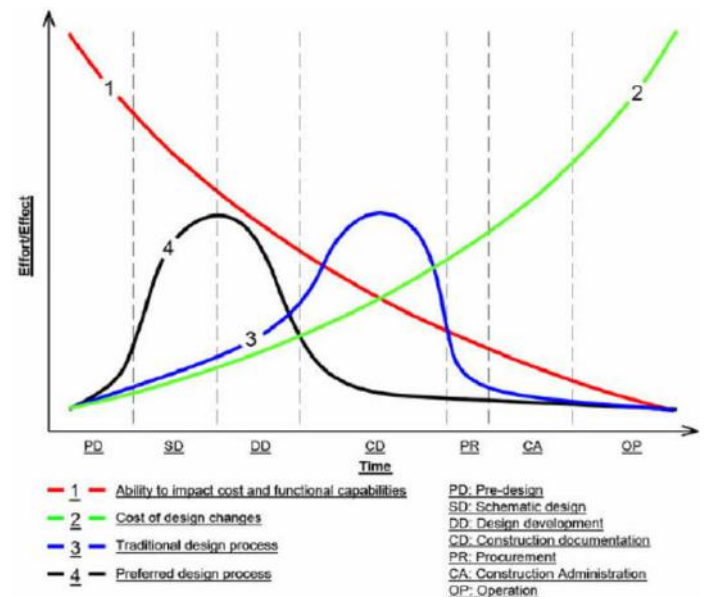


Fig. 1: Application of the BIM process and the timeline of a project.

IFC (Industry Foundation Classes) is a scheme designed to define an extensible package of consistent data representations, which is used for the construction of the information shared between AEC software. All IFC models provide an organizational structure of the design elements, enabling their layout and construction elements to be accessed (Eastman et al., 2011).

Still, according to Eastman et al. (2011), all the object information is organized in a hierarchy of: Design → Environment → Construction → Paving → Space. Each upper-level spatial structure is an aggregation of the lower levels, and also of all elements that comprise the lower-level classes. In a simplified perspective, this hierarchy allows the elements of a building to be grouped in terms of greater and lesser scope, in addition to enabling the identification of the links between them. This information not only characterizes the objects with a high level of detail, it also allows for an analysis of the structure and properties of a design as a whole or in part based on the criteria and the requirements defined by the user.

The representation of IFC models in the XML language seeks to enable extraction and the validation of the IFC specification structure. According to the author, some of the objectives of the use of this language are: enable the exchange of IFC files alternatively as documents defined in XML, allow the reuse of XML content in data exchange and sharing structure by the construction industry (Jacoski, 2003).

Each one of these XML schemes is different and sets its own entities, attributes, relationships and rules. They work well to support the work of software organizations that develop applications around them. Each XML scheme, however, is different and incompatible (Eastman et al., 2011).

"The scope of IFCXML is based on the extrapolation of the currently described IFC definitions according to ISO 10303 (in the Express language) to serve as a specification scheme employing XML" (Jacoski, 2003, p. 139).

The software characterized as BIM still have inconsistencies regarding interoperability. However, initiatives to overcome these weaknesses are being developed. Sun et al. (2015) indicate that the IFC files generated from different systems often contain a huge amount of redundant information. This problem greatly limits storage based on IFC, in addition to the exchange of data.

2.2. Hydro-Sanitary Designs

Since this study was carried out in Brazil, the current regulatory framework of the ABNT (Brazilian Association of Technical Standards) was used to ensure a detailed support with regard to the sizing, operation and maintenance of hydro-sanitary installations. As discussed earlier, these standardized requirements can be compiled and applied in a design methodology.

With regard to cold water building installations, NBR 5626 (ABNT, 1998) determines their requirements, which are similar to those applied in other physical structures in the sanitation sector. This design specialty is portrayed as the connection between the public water supply and the final consumer. The standard covers the current technique and its recommendations for a successful implementation. NBR 15527 (ABNT, 2007) presents the necessary requirements to take advantage, for non-potable purposes, of the rainwater from roofs in urban areas. The standard indicates which uses can be given to rainwater after the proper treatment. It also provides guidance on how the

rainfall system should be designed, including the design of reservoirs.

With respect to effluent treatment systems, NBR 7229 (ABNT, 1993) is used for the design, construction and operation of septic tank systems. The standard sets the conditions, including those for the treatment and disposal of sewage and settled sludge. NBR 13969 (ABNT, 1997) is also used, which deals with septic tanks, complementary treatment units and the final disposal of liquid effluents.

The amount of designs included in the Brazilian bureaucratic system has increased significantly in recent years. Currently, the civil construction sector has shown extensive development and as a result, its methodological rules for validation are quite advanced. Manzione et al. (2011) shows that the inefficiency of the design process in civil construction reveals the need for improving management processes. The author also points out that BIM emerges as a solution, but it is necessary to ensure that this advance solves existing problems in the current design management configuration.

Battesini (2014) reports that projects submitted to the Sanitary Surveillance agency should include the mandatory requirements for health licensing, which focus on minimizing the risks arising from the building facilities. He also shows that the scope for the development of these designs can be expanded through the systematization of their legal requirements.

When this is related directly to the case of water storage and wastewater treatment systems, care must be taken as to the appropriate design, followed by the operation and maintenance, of these elements. All this information, therefore, must be properly specified in the designs and specifications of the building.

2.2.1. Filing and Approval Systems of Conservative Designs

As can be seen in table 1, a comparative study between three Brazilian cities (Rio de Janeiro/RJ, Florianópolis/SC and Chapecó/SC) reveals that the analysis of hydro-sanitary designs is carried out primarily through its physical documentation, such as drawings, specifications and calculation spreadsheets. Although the city of Florianópolis requires electronic files, one can see that this measure is only applied for the storing of documents and not for the evaluation of the design aspects contained in virtual platforms.

Documentation for the evaluation of hydro-sanitary designs the municipalities of Rio de Janeiro, Florianópolis and Chapecó.	
Rio de Janeiro	Descriptive file of the venture;
	Copy of the IPTU (land tax) bills;
	Copy of the ownership or property rights document;

	Copy of the personal documents of the owner;
	A copy of the engineering license (CREA) of the responsible professional;
	Copy of the Technical Responsibility Statement (ART) for the development of the design;
	Aerophotogrammetric blueprint of the IPP with the marking of the lot;
	General or situational blueprint;
	A copy of the design of the sanitary sewer system (comprising blueprints printed on writing paper, complete specifications and hydraulic design spreadsheets printed in the A4 format);
	A copy of the blueprint for the building's sewage installations, including the rainwater network;
	Statement of the possibility for water supply provided by the local utility;
	Approved project of pluvial water grids and galleries (only for ventures with internal roads);
	A copy of the approved (or in process of approval) land parceling project;
	Registration of the sanitary sewer system;
	Statement of compliance for the implementation of the building installations, in accordance with the standardized model.
Florianópolis	Application;
	A copy of the receipt of payment of the analysis fee;
	Technical Responsibility Statement (ART/CREA) or Record of Technical Responsibility (RRT/CAU);
	03 copies of the calculation log (both physical and digital in pdf, recorded on cd);
	03 copies of the hydro-sanitary design (both physical and digital in pdf, recorded on cd);
	01 copy of the approved architectural design.
	Consultation of the feasibility of water supply issued by the company responsible for the sanitation services, or water analysis report for regions not connected to the drinking water supply network;
	Consultation of the feasibility of connecting to the sewer network (when applicable);
	Environmental installation license or statement of environmental compliance (in cases provided for by the competent environmental body).
Chapecó	Application for the assessment of the design, provided by the health surveillance agency;
	01 copy of the complete architectural design.
	02 copies of the complete hydro-sanitary design.
	02 copies of the complete specifications of the hydro-sanitary design;
	Technical Responsibility Statement (ART/CREA) or Record of Technical Responsibility (RRT/CAU);
	Consultation of the feasibility of connection to the water and sewage network from the local utility (sewers only in places where there is a sanitary sewage network).

Tab. 1: Requirements for the evaluation of hydro-sanitary designs in three Brazilian municipalities

The diagram in Figure 2 represents the analysis and approval logistics of hydro-sanitary designs in Chapecó/SC. The documentation is filed with the municipal health surveillance agency and the analysis of the drawings and complete specifications occur individually and personally. If approved, the design is withdrawn in person along with its certificate of approval and follows for implementation; if rejected, the project is withdrawn in person together with the technical opinion of rejection and filed again after correction.

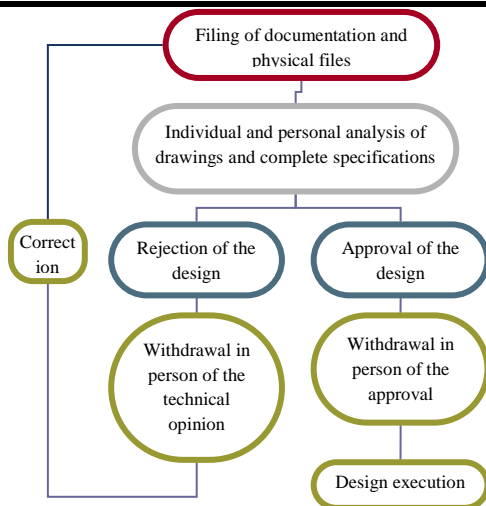


Fig. 2: Analysis and approval logistics diagram of hydro-sanitary designs in Chapecó/SC.

2.2.2. Filing and Approval Systems of Innovative Designs

There is a clear trend to incorporate innovations in the construction industry. The review of outdated procedures is combined with the application of new technologies for the development of more effective designs. In this subsection, the evolution of the Information Technology applied to the design process is presented.

The BIM Protocol of the State of Ohio was conceived to serve as a guide for the development of designs. It makes it easier for owners to apply and establish standards for the use of BIM. The protocol considers the final use of the model, allowing the owners to select the model usage category and the levels of development of the specific building components that support their buildings and the management requirements after construction. Additionally, the approval requirements during the design are reviewed (Ohio Das, 2013).

The British government is at the forefront of the development of web systems and in the leadership in the use of BIM system. It works with individual assets for their incorporation into the design and management of intelligent cities. It aims to engage partners of the European Union for the coordinated adoption of BIM. It also wants to use its leadership position to contribute to the creation and development of standards and practices (HM Government, 2012).

The 900-year-old Chapter House was chosen by the British Institute of Facilities Management (BIFM, 2015) as a pilot project to demonstrate the benefits of the BIM process for existing buildings. The historic room was transformed into a 3D model. The model will help the functioning of a world-famous, well-visited and large location and the conservation and protection of an ancient monument. The design demonstrates how digital building technology can improve efficiency in the management and operation of

buildings through the transition from traditional facilities management procedures to the use of digital information and 3D models to provide greater value to the institution.

According to Wong, Wong and Nadeem (2009), in Singapore, a design submission system is being offered called "e-submission", which is part of the integrated plan verification system. This initiative is controlled by the Construction and Real Estate Network (CORENET), the main organization involved in the development and implementation of BIM in governmental projects. The construction industry in Singapore uses the technological standards of the International Alliance for interoperability. Yang and Song (2015) summarize the role of BIM as a powerful tool for sharing information. This is done throughout the life cycle of the project, from the planning and design of the building until its construction processes. Currently, the evolution of designs in civil construction can't be conceived without the use of BIM tools. This technology covers numerous aspects required for the industrialization of the sector.

III. RESEARCH METHOD

Characterized as a Design Science Research, this study has a qualitative profile. The gathering of the information relevant to the development of the computational tool took place based on direct observation. How the effects of this application appear on the environment under study, was also observed. This way the results were obtained.

For Rocha et al. (2012), alternatively, Design Science Research is developing scientifically substantiated solutions that are able to solve real-world problems. As such, it establishes a link between theory and practice, strengthening the relevance of academic research. According to Lacerta et al. (2013, p.1), "it is in this context that a robust research method becomes indispensable to success in conducting a study".

The study was developed based on an analysis of the interaction between design development platforms, legislative parameters and literature references on the design of hydro-sanitary facilities. The proposed analyses include water storage and wastewater treatment systems for commercial and residential buildings. Treatment systems for specific sewage waste, such as agricultural or industrial waste, were not modeled.

The steps required for the development of the research will be properly described and explored in the course of this item in a chronological order. In short, however, they are related to the creation of a technical and methodological archive to create the computational tool, validate it and subsequently evaluate the obtained results.

2.3. Compilation of ABNT Standards and Municipal Laws

The first step to develop the research was the creation of the electronic archive of ABNT standards related to the

design and evaluation of hydro-sanitary projects. After the gathering of these documents, they were listed in the literature review, monitored according to their contributions to design calculation parameters for water and wastewater treatment systems.

2.4. Work Systems and Design Methodologies

Next, the work routines required for the development of hydro-sanitary designs on CAD tools and BIM platforms were listed. These work structures were taken into account to assess the improvements brought about by the technological advances resulting from the use of BIM.

2.5. Modulation of the Calculation and Design

Sequence of the Systems

The calculation assumptions and design guidelines gathered from the ABNT standards were organized in a chronological sequence of operation in a digital spreadsheet for subsequent inclusion in the software. In this format, key information was identified for the consistency between the standardized information and the design of the hydro-sanitary systems.

This information is entered by the user of CAD techniques in the computational tool, or it is extracted from the designs developed in BIM. This concentration in BIM occurs based on the intrinsic information of the objects in the IFC format, which allows for the reading of such aspects as shape, volume, material and other elements that constitute these objects. In the possession of the IFC data, the software evaluates whether the design is in compliance with the design parameters and standardized guidelines.

2.6. Structuring of the Tool

In order to structure the programming of the computational tool, first, the calculation routines were released, combined with the design information in the electronic spreadsheet format. The purpose of this phase was the validation of the results before the development of the program.

Next, the most important methodological step was taken, the development of the computational tool in the PHP language for web. The interactions between the application and the design files will be laid out further in this work. The tool was identified as BuildScanner, in reference to its function of scanning building projects. Its website was registered in the global domain.

2.7. Creation of an Electronic Repository

The availability of an electronic repository of hydro-sanitary equipment proved to be the most consistent measure in terms of the interoperability limitations between BIM systems. As such, the creation was proposed of an electronic library with objects of prearranged volumes, which could be read in the ifcXML language and also be classified at LOD (Level of Development). These files will be entered by users in their designs developed in any BIM software that reads files in this language. The computational tool validates whether these object choices

are compatible with the calculation routines described earlier in this work.

Within each library objects, there is a geometric figure representing its usable volume, each figure received a *Pset* identification to check if it is one of the figures available in the repository. This identification also verifies if their dimensions weren't changed.

At the time of the uploading of a design for analysis, an alert screen is presented to the user to change the proportions, measurements and properties of the objects available in the repository. This warning also appears in the complete specifications generated by the tool, in addition to mentioning that, at the time of inspection of the built building, the volume will be checked according to the *Pset* code of the hydro-sanitary equipment.

2.8. Validation of the Tool

Civil engineering and architecture designs were used to test the effectiveness and applicability of the computational tool. At this time, the tool had its final interface for use by the designers. Interactions were performed between CAD designs and the information entered by the user. The automatic extraction of the intrinsic data of BIM designs was also performed.

IV. RESULTS AND DISCUSSION

3.1. Creation of an Electronic Repository

The BIM repository is made available on the website of the computational tool. Its objects were developed according to the design criteria and LOD breakdown. Drinking water reservoirs, rainwater reservoirs, septic tanks, anaerobe filters and sinks are available for download, as can be seen in Figure 3, which were ordered according to their volumes in the IFCxml format, enabling their operation in any BIM software.

This concentration in BIM occurs based on the intrinsic information of the objects in the IFC format, which allows for the reading of such aspects as shape, volume, material and other elements that constitute these objects. In the possession of the IFC data, the software evaluates whether the design is in compliance with the design parameters and standardized guidelines.

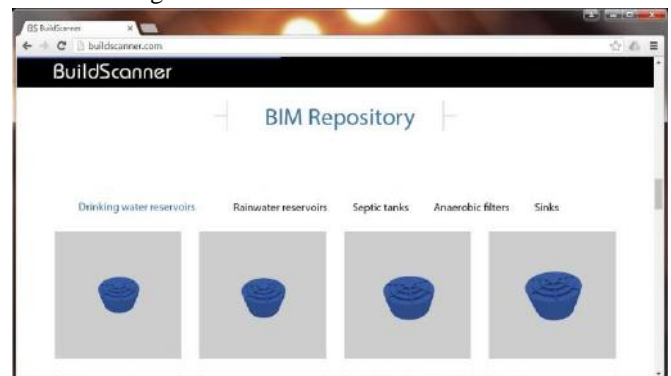


Fig. 3: BIM Repository

3.2. Validation of the Tool

Three main environments will be made available to the user accessing the tool: "Designs", "Settings" and "Account". In the "Designs" environment (Figure 4), the options of a new analysis, a search tool and also a list of already analyzed designs are offered, which may be ordered according to their own information, location, building area, technical manager and status (approved or rejected).

The "Settings" environment allows the user to change criteria for the design of his systems, such as per capita consumption according to the type of occupation, cleaning interval of the sewage treatment system, temperature ranges of the design site and current municipal or national regulations. In the "Account" environment the user can change his personal information, such as his name, email and password reset.

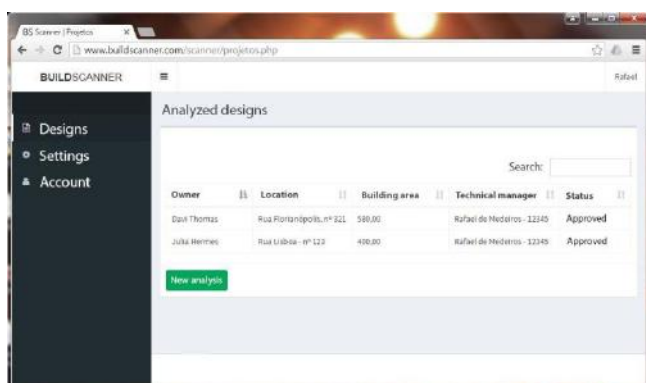


Fig. 4: Designs environment

The new analysis environment follows the model presented in the materials and methods item, and on the screen "Building Identification" entered by the user: owner name, building location, building area and technical manager with the indication of his license and registration number.

Next, on the screen "Building Information", the user can enter: land, largest floor and roof areas, in addition to the soil infiltration coefficient and the technical fire reserve, when applicable. And on the screen "Contributor Information", the user indicates the number of contributors for each type of occupation the building has.

Once this basic information has been entered, the user is directed to the selection of the type of analysis he wishes to perform, Figure 5, which are: Scanning BIM Design; Pre-design (generate results) and Printed or CAD Designs (insert measures). Then, the user determines which aspects he wants to analyze: Drinking Water Reservoir, Sewage Treatment System and Rainwater Installations.



Fig. 5: Selection of the type of analysis.

3.2.1. Scanning BIM Design Panel

By selecting the Scanning BIM Design option, the user uploads the design file in the IFCxml format and informs the total area of rainfall infiltration. The other design aspects are extracted and analyzed automatically by the computational tool.

It is worth noting that the design files will be using the objects available in the BIM repository. The user includes the files in the ifcXML format in his hydro-sanitary project developed in any BIM software. He is alerted to not change its dimensions or properties, bearing in mind that the identification of the objects by the software occurs through their *Pset* codes and that this will be enforced during building inspections during and after its execution.

As a result, the user is shown a screen with the approval or rejection of each aspect of the hydro-sanitary design (Figure 6). If all objects are approved, it is possible to print the complete specifications. If there are rejected objects, the software determines the expected values for each one and prevents the printing of the complete specifications.

3.2.2. "Pre-design (generate results)" Panel

The results, in this case, are the minimum values required for each hydro-sanitary design item. The user can therefore use the objects in the BIM repository compatible with the required demand or design the elements in CAD.

In the current format, the tool does not provide the user with the possibility of adding new compatible objects in the BIM Repository. However, this is an improvement proposal for this paper.

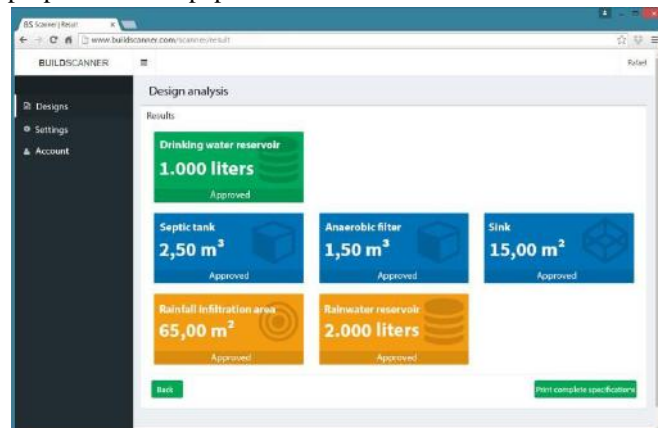


Fig.6: Result of an approved design.

3.2.3. Printed or CAD Designs (insert measures)**Panel**

When selecting the option insert measures, the user is shown a screen with fields to enter the useful dimensions of each object to be analyzed. If the proportions of objects are not in accordance with the ABNT guidelines, an alert for the non-compliant objects is shown.

The user can then correct this information or continue with the analysis of the design. Once the measurements have been entered, this is followed by the scope described in the item for BIM designs scanned by the computational tool.

3.3. Evaluation of the Tool

The integrated environment of the calculation logs, graphical representation verification and technical document generation decreased the margin for incompatibilities in designs of the CAD platform. The same happened for BIM, in addition to reducing the timelines of the projects, since the tool performs the automated reading of the design files.

The computational tool generated reports for the acceptance or rejection of the designs in a consistent and accurate manner. In conjunction with the approved designs, the complete specifications were also made available electronically. This way, the consistency between the software's interpretations and the user's interactions with his design is made clear.

The following can be highlighted as improvements in future versions of the computational tool:

The use of future enhancements of the IFC structure for greater extraction of information, automating the manual processes that are still necessary for the current format of the BuildScanner tool.

The inclusion of an automatic evaluation of materials and construction systems applied to the objects under analysis.

The possibility of printing acceptance or rejection reports as PDF files, for users that only analyze designs. In the current model, the caveats and approvals are presented only on the screen to the user.

Possibility for the user to add new designs to the BIM repository. Even though these objects pass through an assessment and *Pset* identification for their correct handling and interpretation in the designs.

After selecting the "Generate Results" option, the logistics could be more efficient if there was an automatic redirection of the user to the BIM repository or the "Insert Measurements" screen. This way he can continue his interactions with the tool without interruptions.

Following this research, a business plan will be developed in the technology park and the tool will be adapted to the potential peculiarities of design offices and public agencies that may adopt it, and its commercial release will be prepared.

V. CONCLUSION

Currently, the civil construction design sector is growing. Such a scenario exposes demands for the improvement of procedures and constant technological advances. Hydro-sanitary designs, in particular, are still poorly explored in terms of innovation.

Through this study, a computational tool was developed to improve in an automated way the outdated evaluation methodologies behind the launch and analysis of these systems. The results reveal ways of improving the work methodology in offices and public bodies. As a result, an electronic archive was generated of the normative guidelines and municipal laws for the design of water storage and wastewater treatment systems for commercial and residential buildings.

The tool allows for the update of the laws and legal guidelines added to the system, in addition to adjustments to the laws of other states and/or countries, which provides a universal character to the tool.

As shown, the computational tool has met the objectives proposed in its design. Means were provided for the improvement of the analysis of hydro-sanitary designs in offices and the responsible public bodies. Its ability to automate design release and analysis procedures were also demonstrated.

Based on this work, the conclusion can be drawn that the automation of the release and analysis processes of hydro-sanitary designs is possible and achievable. The scope of interaction and evaluation of designs was structured for its constant expansion, both for hydro-sanitary designs and other specialties, such as architectural, structural and electrical designs. Based on the obtained results, it becomes possible to explore the use of computational tools for other civil construction specialties.

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Motion Estimation using Block Matching Algorithm

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Abstract— With the recent advances in video technology, there is an increasing need for a more reliable, efficient and robust generic framework for video processing and its analysis. In this regard the Motion estimation has for many years demanding area of research because of its diversity of use in real-time applications. Motion estimation using block matching algorithm is used in many applications in video processing. This paper presents a review of motion estimation based on block matching algorithm and also includes analytical study of fixed and variable block matching algorithms

Keywords— *Block Matching Algorithm, FSBMA, Motion Compensation, Motion Estimation, VSBMA.*

I. INTRODUCTION

Video signal processing plays a vital role in many research areas, industry and computer science such as online monitoring of processing systems, robot navigation, medical treatment, multimedia broadcasting, remote sensing, and military. In video processing it is very difficult to analyze the motion of natural moving objects in a scene. To overcome this problem the Motion Estimation (ME) determines the motion vectors used to detect the transformation from one sequence to another. ME have many applications and have been proven essential for video coding and compression [4], [2]. Motion Estimation is a popular technique for computing the displacement vectors between objects or attributes between images captured at subsequent time stamps. Block matching is a well known technique of motion estimation that has been successfully applied to several applications such as video coding, compression and object tracking. This technique exploits the unwanted redundancies and achieves video compression [1]. Motion Estimation using block matching techniques is the most widely used method to find motion vector (MV).

II. MOTION ESTIMATION

Motion estimation has been the most key role on video processing. It is usually applied to block matching algorithm for choosing the best motion vector. The two adjacent images are searched to find the displacement of

the same object in the video image. Motion estimation techniques aim at deducing displacement vectors for objects or image attributes between two consecutive frames. In a model of the object motion between the frames, “the motion that occurred between the reference frame and the current frame” can be estimated by the encoder. This method is known as the motion estimation (ME). For the better current frame prediction, the encoder used the information that move between the reference frame contents and motion model. This process is called the motion compensation (MC).

III. BLOCK MATCHING ALGORITHM

In video coding the most commonly used motion estimation technique i.e., block matching algorithm used for simplicity and good performance. The main purpose of this technique is to determine the displacements of each block of pixels between two successive frames. The displacement between these matching blocks is called a motion vector (MV) [4] as shown in “Fig.1”. The important aspect in block matching is the use of intelligent search strategies to reduce the computational time [2]. There are two distinct phases of block matching method: block partitioning and block searching. The block partitioning scheme is concerned with dividing the original image frame into non-overlapping regions and it performs by using the fixed size or variable size methods. The block search mechanism is the process of locating the block in the destination frame that best matches the block in the frame using a specific matching criterion. Different distortion measures are used to find the best match for a desired macro block in the entire motion estimation process. Mean absolute error (MAE), mean squared error (MSE), and sum of absolute differences (SAD) are commonly used to measure the efficiency of algorithms [1].

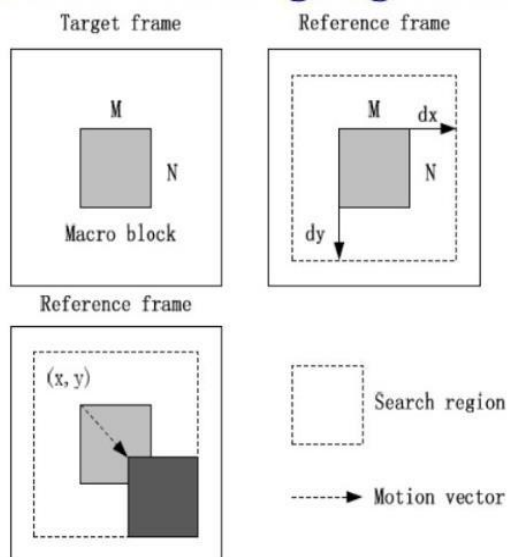


Fig.1: Block Matching Algorithm

Block matching is a standard technique of encoding motion in video compression applications. There exist two forms of block matching. The first is Fixed Size Block Matching Algorithm (FSBMA) and the other is Variable Size Block Matching Algorithm (VSBMA). In fixed size block matching, an image is subdivided into blocks of uniform size, whereas in variable size block matching small block cover areas of complex motion, while regions of uniform motion are spanned by large blocks.

3.1. Fixed Size Block Matching Algorithm

In the fixed block matching algorithm, blocks are defined as non overlapping square parts in an image frame as shown in "Fig.2". Each block of the current frame is matched to a block in the next frame specified within a search window [6] [7].



Fig.2: FSBMA displacement vector

This technique is easy to implement, and thus widely adopted. Each image frame is divided into a fixed number of usually square blocks. For each block in the frame, a search is made in the reference frame over an area of the image that allows for the maximum translation that the coder can use [6]. The search is for the best matching block, to give the least prediction error, usually

minimizing either mean square difference, or mean absolute difference which is easier to compute. Fixed block matching schemes are well known for their simplicity and compactness. However, the model suffers from certain limitations which include:

- Determining the optimal number of blocks that best estimates the motion of objects
- Issue of time complexity when estimating motion in a complex scene and
- Introduction of block artifacts which occur when a block covers an area where two or more types of motion are present [8], [9].

3.2. Variable Size Block Matching Algorithm

A variable-size block-matching scheme uses multi-resolution or multi-grid approaches to compute the displacement vector between frames [11]. These hierarchical schemes give reliable and locally adapted motion estimated by operating at different resolutions in a top down manner [12]. The application of such top-down methods may generate block structures for an image that match real moving objects, but it seems that an approach which more directly seeks out areas of uniform motion might be more effective[10]. We developed a VSBM technique that detects areas of common motion grouping them into variable sized blocks with a coding strategy based on the use of quad trees [8]. Use of a quad-tree obviates the need to describe the size and position of each block explicitly, only the tree description is needed.

Variable-size block matching algorithms can be distinguished from each other by the technique of multi-resolution and splitting criterion as shown in "Fig.3". Some of the most common methods of variable size block matching procedures include: quad tree approach, polygon approximation [8] and binary partition trees [9]. The quad tree multiresolution approach splits an image frame into four partitions each time based on splitting criteria. In contrast, the polygon approximation approach use content based information of approximate different regions on an image containing polygons.



Fig.3: Variable BMA displacement vector

IV. CONCLUSION

This paper consists of an overview on motion estimation and block matching algorithm which are more applicable for video coding application. The Block matching techniques is the most popular and efficient of the various motion estimation techniques. This paper first describes the general block matching algorithm and the motion vectors resulting from FSBM. The FSBM technique is easy to implement, and thus widely adopted. Unfortunately, this is a conflicting requirement, particularly with fixed-size block matching (FSBM), where the size of all the blocks is the same. In FSBM, increasing the block size is the only way to reduce the number of motion vectors. In variable-size block matching (VSBM) smaller blocks can be used to describe complex motion while larger blocks can be used in areas where the image content is stationary or undergoing uniform motion. However, its success depends on an appropriate selection of blocks.

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Synthesis of BaHfO₃ through with reduction of KOH.

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Abstract— In this work will be presented the results obtained in the synthesis and structural and morphological characterization of perovskite oxide Barium Hafnate (BaHfO₃) synthesized by the hydrothermal method assisted by microwave (MAH) with two concentrations of potassium hydroxide (KOH). One with concentration of 2.4M which will be called BHO24 and another one of 3.6 M which will be called BHO36, in order to reduce the difference between the amount of reagents (in this case barium chloride and hafnium chloride- BaCl₂ and HfCl₄) and the amount of mineralizing agent (in this case KOH) used in synthesis through the MAH. The objective of this study is to analyze the possibility of synthesizing a perovskite oxide by MAH with the minimum amount of KOH and to analyze if there is any change in the structure or morphology of the same. To analyze the structural change, the X- ray diffraction (XRD) and to analyze the morphological change was used the characterization technique of scanning electron microscopy (SEM).

Keywords — Concentrations KOH, MAH, Structural change and morphological change.

I. INTRODUCTION

The MAH is a synthesis method consisting of the interaction of electromagnetic radiation in the microwave range with matter [1], being the mechanisms of dipole rotation and ionic conduction responsible for the conversion of radiation energy to heat [2-5], its main advantages are time reduction, process steps and temperature, high purity and reduced operating costs [6-8]. Initially Komarneni [9] studied the effect of microwaves on the crystallization kinetics in hydrothermal synthesis of electronic ceramics and in 1992 they became the pioneers in obtaining perovskite by this method that they called HTMW [10], Rao and collaborators proved the feasibility of the method for several compounds [11].

The synthesis itself consists basically of three steps: dissolution, precipitation and dehydration. In the first step the amounts of the reagents are diluted in distilled and deionized water (dissolution). In the second step the results

of the previous step are placed in the reaction cell (precipitation) and in the third one the cell is added to the microwave oven (dehydration). When analyzing works related to this synthesis method, it is verified that the concentration of the mineralizing agent (generally KOH) is much higher than the other reagents as described in the table 1.

Table.1: Reagent concentrations and concentration of mineralizing agent in published works [12-17].

Author	Reagent concentration	Concentration of the mineralizing agent
Moreira	ZrOCl ₂ ·8H ₂ O and BaCl ₂ ·2H ₂ O 0.01 M	KOH 6 M
Rafael	Matrix Ba and matrix Zr 0.01054 M	KOH 6M
Zhi Wang	Bi(NO ₃) ₃ ·5H ₂ O and Fe(NO ₃) ₃ ·9H ₂ O 1.2 M	KOH 12 M
Wagner	CaCl ₂ ·2H ₂ O and ZrOCl ₂ ·8H ₂ O 0.4 M	NaOH 6 M
Mazzo	TiO(OH) ₂ and CaCl ₂ ·2H ₂ O 2 M	KOH 6M
Silva	TiCl ₄ and SrCl ₂ ·2H ₂ O 0.2 M	KOH 6M

The insertion of a higher amount of KOH is related to the fact that for formation of the type oxide ABO₃ during a reaction in aqueous solution, a hydrolysis-condensation followed by nucleation-growth is required and a large amount of mineralizing agent is required when a non-

alkaline precursor is used [18]. In addition, the OH⁻ groups act as catalysts of the reaction leading to high nucleation rates [19].

On the other [20] shows the synthesis of compound BaTiO₃ using TiO₂ and Ba(OH)₂ in the proportion of 1 per 1. It is observed that the KOH or NaOH used in MAH are responsible only by the formation of the hydroxides that occurs in the second phase (precipitation) not influencing the third stage (dehydration). Thus the proposal of this research is to verify if it really is necessary to use such a large amount of potassium hydroxide in the synthesis through the microwave radiation. Among the possible oxides that can be obtained, the BaHfO₃ for study. Papers already published on the BaHfO₃ demonstrate that it has a cubic structure, and its morphology is reported to be composed of spheres [21-25]. Some of the studied properties of this oxide are luminescence [36-38] and dielectric behavior [29]. In this work, however, only the structural and morphological characteristics will be analyzed.

II. MATERIALS AND METHODS

Compound BHO24 was prepared with 0.4M of BaCl₂, 0.4 M of HfCl₄ and 2.4 mol of KOH while compound BHO 36 was prepared with the same concentration of BaCl₂ and HfCl₄ and 3.6 mol KOH. Subsequently, were added to the oven microwave where they were kept for 20 minutes at a temperature of 140 °C with a nucleation rate of 10°C/min. After the synthesis, both were centrifuged at 3500 rpm (for pH reduction) and kept in the oven for 15 hours. With the obtained compound the X-ray diffraction technique was applied, the apparatus D8 ADVANCE BRUKER, with radiation (Cu) of wavelength $\lambda = 1, 5418 \text{ \AA}$ and the scanning electron microscopy technique was used the microscope of the mark Jeol, model JSM-6610.

III. RESULTS AND DISCUSSION

Both in BHO24 and BHO synthesis36 a white powder was obtained, demonstrating that a large amount is not required to obtain the compound. The two presented diffraction peaks that can be indexed to the cubic phase of the BaHfO₃, Fig. 1, being consistent with the crystallographic sheet PDF 24 – 102, with network parameters $a = b = c = 8.333 \text{ \AA}$ and space group (Pm-3m).

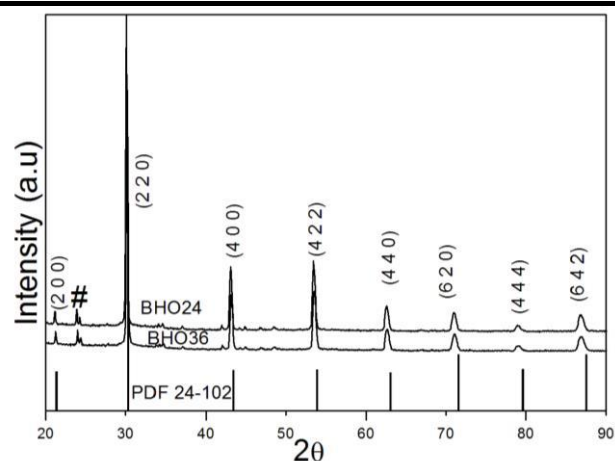


Fig. 1: X-ray diffraction of BHO24 and BHO36.

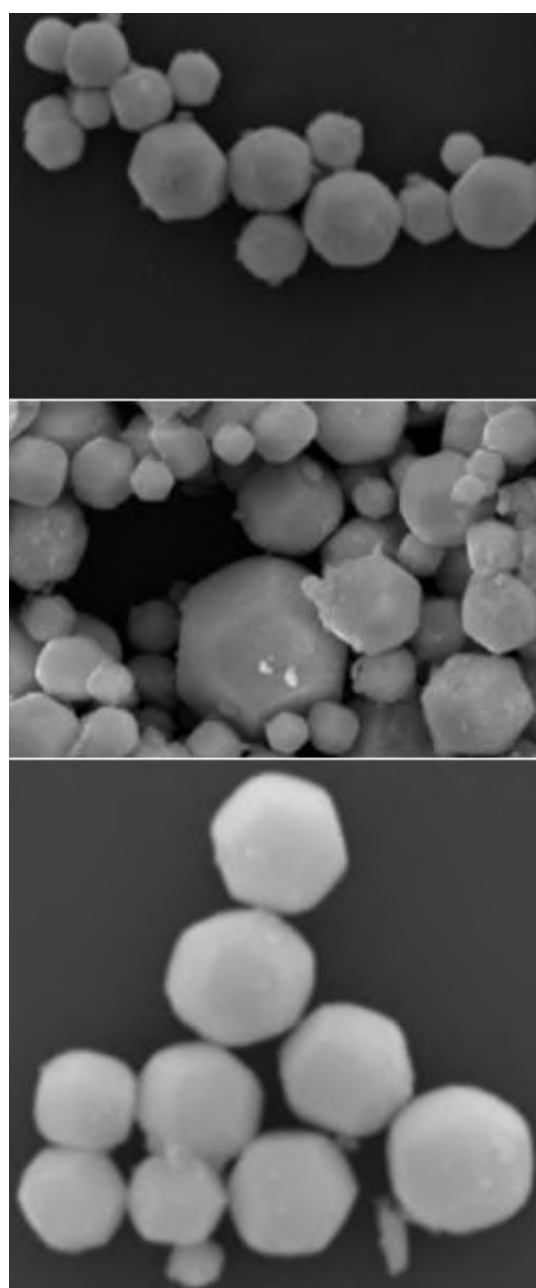


Fig. 2: SEM images of BHO24.

It is also observed that both have peaks belonging to the secondary phase of barium carbonate (BaCO_3) identified by the JCPDS 05-0628 like Orthorhombic Witherite. The appearance of this phase is understandable since the BaHfO_3 moisture is susceptible and has already been found in other works [30, 27-28]. To analyze the morphological aspect, the characterization of scanning electron microscopy – SEM- Fig. 2 and Fig. 3.

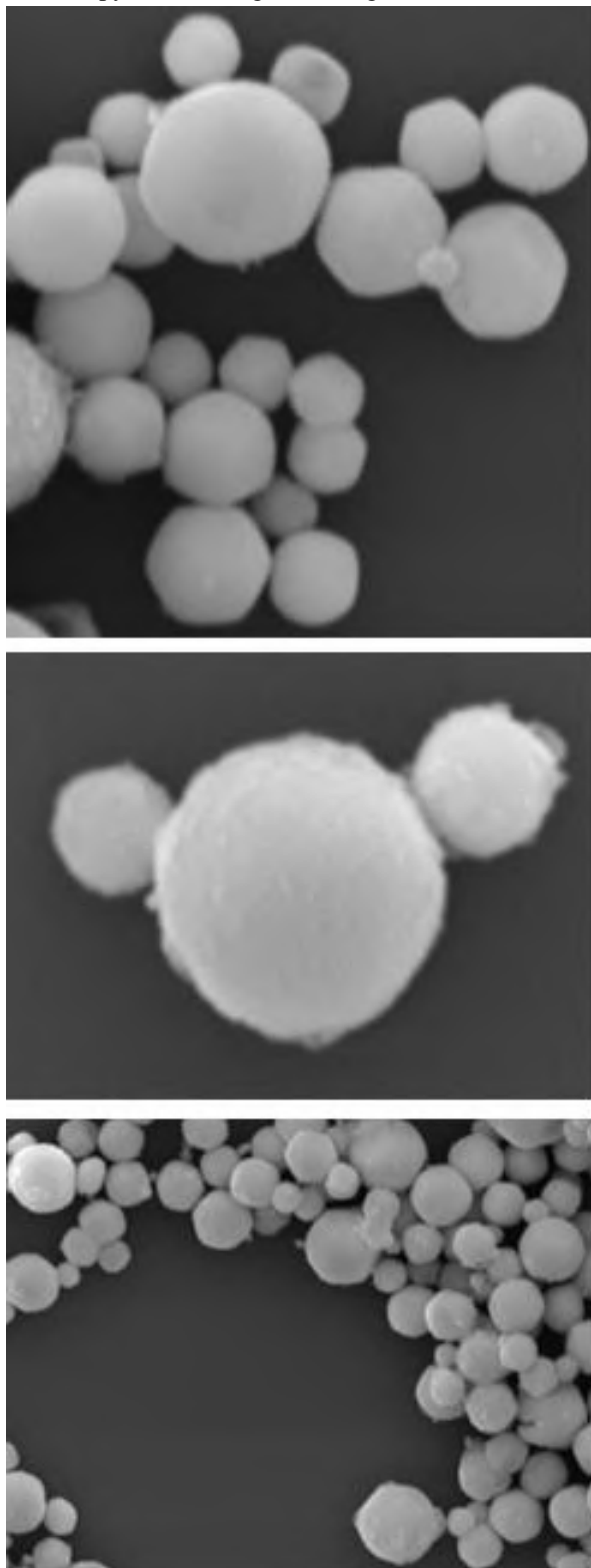


Fig. 3: SEM images of BHO36.

From SEM, observed that both BHO24 and BHO36 did not have completely rounded "spheres" such as BaHfO_3 was described in the literature, they have an almost hexagonal character and for BHO24 this behavior is more predominant. Another relevant detail is the non-homogeneity; we observe large and small spheres simultaneously.

IV. CONCLUSION

By means of synthesis and characterization results, it can be concluded that perovskite oxide can be obtained through MAH with reduction of KOH. With the reduction of KOH did not obtain any change in the structural character since both had the same diffraction peaks, but in the morphological character there was a small change. The spheres had a "hexagonal" character being more present in the BHO24 and grew without uniformity.

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Operational Improvement of a Chiller to Reduce Water Usage in the Cooling of Turkey Cuts

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Abstract — *Cleaner production is the application of an environmental strategy that seeks to integrate the production processes with products and services so as to reduce the risks to humans and the environment. This work gathers data from a study conducted in a slaughterhouse for birds in the production of turkey leg quarters. An improvement opportunity was identified in the water consumption of the sanguine fluid removal process of the turkey leg quarters with a particular technological chiller. The area of intervention was chosen because of its history of higher-than-expected water consumption in relation to the acceptable limit negotiated with the local Federal Inspection Service. The evaluated criteria were water flow per kilo of leg quarter and the structure of the adsorption equipment used in the industry. The results of these analyses were directly linked to water savings and changes in equipment, increasing knowledge about the implementation of cleaner production in the slaughterhouse industry, aligned to the continuous improvement of the process. The control of the water flow and the direct changes made in the chiller resulted in water savings of 83,435 L/week and 1,001,220 liters/year, based on the production of the slaughterhouse under study, in addition to savings of R\$ 289.52 per week or R\$72,959.04 per year.*

Keywords— *Cleaner production, water savings, chiller, turkey leg quarter.*

I. INTRODUCTION

Cleaner production (CP) using the principle of pollution prevention seeks to optimize the use of resources and reduce the generation of waste in the production processes. It covers a series of measures ranging from the use of clean technologies to the use of less polluting and more durable materials (Andrade et al., 2007).

Adjustments may be made in the productive processes that enable the reduction of emissions/waste generation. These adjustments can range from small repairs on the existing model to the acquisition of new simple and complex technologies (United Nations Environmental

Program/United Nations Industrial Development Organization - UNEP/UNIDO).

The meat industry is one of the most productive industries in Brazil, and the production of turkey stands out in this industry. According to the 2016 annual report of the Brazilian Association of Animal Protein (*Associação Brasileira de Proteína Animal*, ABPA), Brazil produced 327,179 tons of turkey meat in 2015. 41% of this production is destined for export, 0.05% of which involving the whole turkey, 37.18% involving processed meat and 62.77% involving cuts. Given the importance of the production of turkey cuts in Brazil and in the state of Santa Catarina, in particular, the processing of these cuts consumes a considerable amount of water (ABPA, 2016).

According to Medeiros, Gheyi and Soares (2010), the increase in water demand to meet the human, industrial and agricultural consumption requirements puts pressure on indispensable water resources for the supply. Despite the fact that Brazil possesses 13% of the fresh water available on the planet, its distribution is unequal, with 81% concentrated in the Amazon region, where the country's population is smallest (Ana, 2015).

The world is undergoing intense cyclical and ever faster changes and these transformations are affecting everyone, without exception. Based on these phenomena, there is growing concern among companies regarding the environment and the health and safety of their employees, in addition to the social responsibility and ethics with respect to the community in which they operate (Lemos and Nascimento, 1999).

A chiller is a widely employed piece of equipment in bird slaughterhouses, and it is used in food industries in general to cool products. It is a stainless steel tank fitted with a worm thread and containing a mixture of water and ice. Its purpose is to cool bird carcasses or cuts and, consequently, to slow down microbial multiplication (Simas et al., 2013). The cooling system evaluated in this study has a different function than the previously mentioned chillers. Its function is to reduce the sanguine fluids of the turkey leg quarters with the circulation of cooled water alone, making

no use of ice. In this kind of chiller, an effective control of the water temperature must be maintained in the pre-cooling-by-immersion system. This temperature may not exceed 4°C in accordance with Ordinance No. 210 of the Ministry of Agriculture, Livestock and Food Supply (1998).

In order for the chiller to be efficient, some factors need to be controlled, such as the microbial load of the product before and after passage through the equipment, the constant renewal of water, the ratio between the quantity of water per kilogram of product, in addition to the ideal temperature (Northcutt et al., 2008).

In addition to prolonging shelf life, the main objective of the 4°C cooling is to prevent the proliferation of microorganisms. Some pathogens can develop at low temperatures, but most cannot grow or produce toxins at temperatures below 4°C (James and James, 2014).

This equipment has been developed by the slaughterhouse under study itself. Its modifications were made based on the need to wash the product with the constant renewal of water. Before the adjustments, this renewal of water resulted in a large volume of consumption. As such, this stage was singled out as an opportunity for improvement. This is in alignment with the cleaner production concepts, i.e., modify the equipment to reduce the consumption of water, generate savings and reduce the generation of effluents.

The environmental impacts produced by companies have resulted in an intensifying pursuit of cleaner production programs in its procedures. This depends on the establishment of eco-teams within companies in order to carry out the work. People who operate within the productive process of organizations with continuous and correct training are capable of controlling the system, generating major changes.

In this sense, the objective of this study is to improve the operating conditions of a technological chiller in the production line of turkey leg quarters, focusing on water savings, the reduction of effluents and the deployment of cleaner production.

II. MATERIALS AND METHODS

The first action undertaken was a meeting with the managers of the company to discuss the most urgent improvement opportunities within the company. As such, it was agreed that the change in the technological chiller of the turkey leg quarter production line had the most immediate importance because of the high water consumption in the production line. Subsequently, it was necessary to establish parameters and timeframes for the projects implementation guidelines. Tables 1 and 2 show the defined the actions.

Table.1: Actions to be undertaken in the short term.

Opportunity	Name of the Action	Description of the Action	Indicators	U/M
1	Establish the Eco team.	Form a multidisciplinary team in order to identify the gaps in the process and establish the site for the application of the CP.	Training of the team.	-
2	Raise awareness of the team.	Conduct awareness meetings with the sample monitors and chiller operators in order to explain the objectives of the work and achieve the engagement of all.	Training of the team.	Number of trained employees
3	Refresher training	Educate operators on the importance of the project, targets, actions implemented and responsibility of each operator.	Training of the team.	Number of trained employees

U/M = Unit of Measurement.

Source: Developed by the authors.

Table 2: Actions to be undertaken in the medium term.

Opportunity	Name of the Action	Description of the Action	Indicators	U/M
1	Data collection	Accompany the data collection on water flow in the leg quarter chiller.	Water Flow Rate	L/Kg

U/M = Unit of Measurement.

Source: Developed by the authors.

The Eco-team was formed as a multidisciplinary team composed by the Production Manager, Maintenance Manager, Production Supervisor, Maintenance Supervisor, Machine Operators, Operators, Maintenance Technicians and the manager responsible for the efficiency in the unit. Figure 1 shows the flowchart of the process and highlights the intervention site of the study.

After this process, the next step was to define the axes that would guide the present study, described in the course of the study.

2.1 Location where the study was carried out

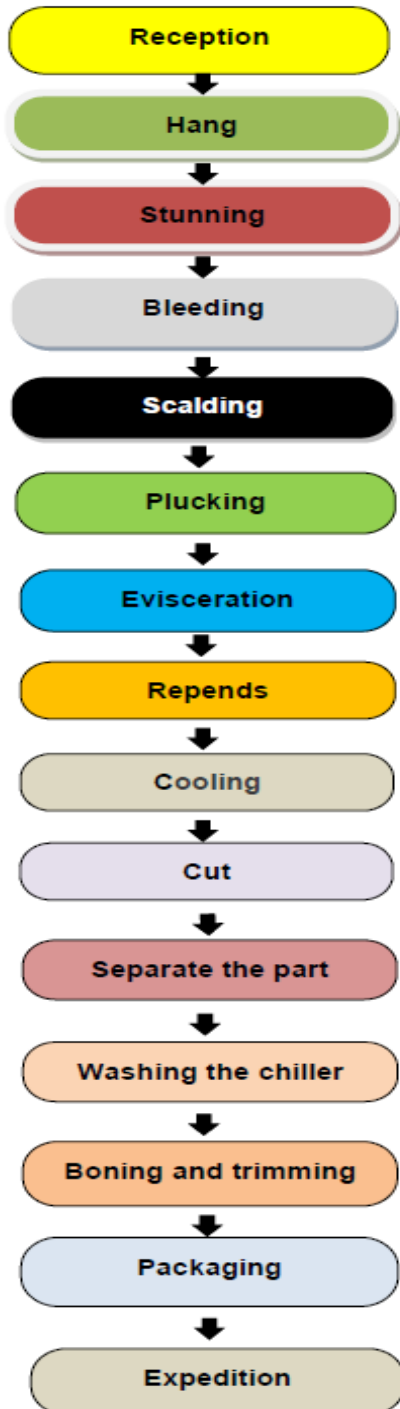


Fig. 1: Flowchart of the turkey leg quarter processing

The location chosen by the Eco-team to implement the cleaner production was the turkey leg quarter chiller, of proprietary manufacture. It functions as a technological chiller that assists in the washing of the product to remove the sanguine fluid in the slaughter and evisceration phase.

Until the date of the conclusion of this study, there was no legislation for technological chillers for turkeys. As such, the company needed to perform its own standardization of the process based on the legislation for poultry meat, and defend these standards before the local Federal Inspection Service. Once defended, the company could continue using the turkey leg quarter chiller in the processes based on ordinance n° 210 of the Ministry of Agriculture, Livestock and Food Supply (1998).

The turkey leg quarter chiller under study has a capacity of 2,800 liters of water in constant renewal, with a water flow rate of 0.4 L/Kg of turkey leg quarter, being fed in the counter flow. It has a spiral that carries the leg quarter to a remover to extract the product from inside the chiller.

After the passage of the leg quarters through the chiller with water, they are sent through conveyor belts to the boning and manual fileting section to remove the bone, excessive fat, arteries, tendons and defects, such as hematomas, gore and others. In this step, the cuts are standardized according to the intended final product. Figure 2 shows the chiller used in the work.



Fig. 2: Turkey leg quarter water chiller studied in this work

2.2 Determination of the water flow

To establish the water consumption in liters, a spreadsheet for data collection had to be created to register the sex of

the turkey (male or female) in the caption field, the initial and final reading of the hydrometer (Itrón brand), the number of slaughtered birds in the period of collection and the water consumption.

Figure 3 shows the data collection spreadsheet for the chiller used to control the process.

DAY/MONTH/YEAR:									
Conversion Parameters	Caption	Initial reading		Final reading		Water consumption	No. of birds slaughtered	Flow rate	Monitor signature:
		Hour	Reading	Hour	Reading				
Average leg quarter weight: • Female: • Male:									Supervisor signature:
									QA signature:

Fig. 3: Chiller flow rate tracking spreadsheet.

Legend: No.: number; QA: Quality Assurance

Source: Developed by the authors.

The initial and final reading of the hydrometer was collected through the information recorded in the spreadsheet. 60 hydrometer readings per month were taken for the data collection, 30 of which for male turkeys and 30 for female turkeys. The preliminary data collection occurred from April 2016 to June 2016, and the study continued until the month of November 2016 in order to observe whether the improvements implemented were relevant.

With the data of the initial and final readings of the hydrometer, the consumption of water in the analyzed period could be obtained according to Equation 1.

According to Ordinance No. 210 of the Ministry of Agriculture, Livestock and Food Supply (1998), the water used to fill the tanks or stages of immersion coolers for the first time should not be included in the calculation of these quantities.

$$\text{Water consumption (L)} = \text{Final reading of the hydrometer (L)} - \text{Initial reading of the hydrometer (L)} \quad (1)$$

The water flow calculation used in the leg quarter chiller is shown in Equation 2. Samples were taken every 2 hours and the conversion factor considered was the average weight of the leg quarter for the male and female turkeys.

$$\text{Water Flow (L/kg)} = \text{Water consumption} / \text{number of birds processed} \times \text{Conversion factor} \times 2 \quad (2)$$

2.3 Determination of the critical acceptable flow limit

The first thing you need when there is no specific legislation for a given parameter that you want to monitor

in industry, is a theoretical foundation of the fact under study. The chiller under study is technological and there is no legislation governing the water utilization threshold for the equipment. In this case, two primary factors were taken into account: the renewal of water and the visual analysis of the cleaning of the water contained inside the chiller. Subsequently, a defense was presented to the local Federal Inspection Service (SIF) in order to validate the control and use of the equipment to be deployed. During the study, these factors have already been validated and were being practiced by the company.

The critical limit for the water flow of the turkey leg quarter chiller established by the company and validated by the local SIF was therefore 0.4 L/Kg of leg quarter, regardless of the sex (male or female).

2.4 Observation of the site

The Eco-team conducted a visual analysis of the chiller of turkey leg quarters in order to check the structural conditions of the chiller, such as: a) the structure of the remover, taking into account whether the opening of the perforated plate was enough for a better water flow; b) cleaning of the renewal water through a visual inspection of the water quality, i.e., whether it contains many suspended particles that may interfere in the color and in the amount of suspended particles.

2.5 Data analysis and interpretation techniques

Inferential statistics were used for the interpretation of the results, with the flow rate data being compared through the Tukey test, using the *Statistica* software at a significance level of 5%. The existence of significant differences between the flow rates obtained each month were compared, in addition to the differences between sexes (male and female leg quarters).

III. RESULTS AND DISCUSSION

During the execution of the proposed actions, the flow adjustment system was identified as a barrier to the deployment of the actions. This was not a system where access was restricted, making it difficult to monitor the opening of the valve, because the operator responsible for data collection performs this collection every two hours, and in the meantime other operators may cause interference.

This risk was mitigated by seeking the constant training of the operators who operated the chiller as well as the entire team handling the turkey leg quarters. This way, no other operator would interfere when the operator in charge wasn't doing the monitoring, thus ensuring that the process occurred as planned. The data collection was recorded through the previously mentioned spreadsheets, and the water flow for both the male and female leg quarters was calculated, with the chiller only being fed with one sex per batch. The structure of the chiller was also observed in order to find opportunities to improve the structural part of the equipment.

Through the completion of the calculations, it was found that the average water consumption spent was 1.05 L/Kg for female leg quarters and 0.58L/Kg for male leg quarters. Taking into account that the critical limit established was 0.4 L/Kg, an action plan was established for the identified improvement opportunities in order to deploy the CP in the case under study. The objective of the action plan was to reduce the water consumption up to the acceptable limit,

and to standardize the consumption for both sexes (male and female). The action plan (5W1H) is represented in Figure 4. The differences in the leg quarter remover with the deployment of the proposed actions can be seen in Figure 5.

Before the actions, the paddles of the remover had very closed plates, which caused a great loss of water from the chiller, i.e., instead of removing only the leg quarters, the remover also took out water along with the product. This process caused two visible problems: a great waste of water on the floor and also a risk of accidents for the workers due to the water on the floor, which in turn made the floor slippery. Figure 5 allows for a comparison of the remover structure before and after the changes.

For the female leg quarters, this water removal was more evident because the paddles were not only more closed and straight, but the surface and mass of the product were smaller when compared to the male leg quarters, requiring a larger quantity of mass on the paddles to be removed from the chiller. More water was removed than product.

The other action carried out was to change the angle of attack of the paddles, facilitating the removal of the product inside the chiller. The male leg quarters have a larger surface and mass compared with the females, and stay on the paddle for a longer time, which makes the removal easier. Figure 6 provides a better visualization of these modifications of the product remover, seen from above, after the actions were carried out on the leg quarter chiller.

What to do	Why	Who will do it	How will it be done	Where	When
Ensure that all employees involved in the process are aware of their responsibilities	To educate and engage the team	Supervisor of operation	Educating operators on the importance of the project, targets, actions implemented and responsibility of each operator	Supervisor training room	20.06.2016
Change the paddle structure of the leg quarter remover of the chiller	Enable the water present on the paddles to drain back into the chiller during the removal of the product from the chiller.	Maintenance Supervisor	Modifying the structure of the leg quarter remover, making the structure more open	Turkey leg quarter remover of the chiller	01.07.2016
Change the paddle angle of the leg quarter remover of the chiller	To improve the product removal efficiency	Maintenance Supervisor	Changing the paddle angle of the leg quarter remover	Turkey leg quarter remover of the chiller	01.07.2016
Ensure constant renewal of water	To improve the efficiency of the water renewal flow	Maintenance Supervisor	Expanding the water output channel of the	Water output channel of the chiller.	01.07.2016

			chiller.		
Ensure that there is no water on the floor on either side of the chiller.	To avoid water from spilling on the floor	Maintenance Supervisor	Expanding and altering the position of the water output channel of the chiller.	Water output chute of the chiller.	01.07.2016

Fig. 4: Action plan (5WIH) to reduce water waste in the chiller.



(a) (b)

Fig. 5 - Changes in the leg quarter remover (a) before with the more closed surface and (b) after the undertaken actions with a more open surface.



Fig. 6: Changes in the leg quarter remover from above

Figure 7 shows the improvement that was performed in the outlet piping to renew the water of the leg quarter chiller. This water removal occurred through the exit of the technological chiller, i.e., together with the output of the product, causing a problem for the company since the correct thing would be for the water renewal to occur at the entrance of the chiller, along with the entry of the product (against the chiller flow). This way, the renewal of water was taking place incorrectly and the existing spillway did not reach the level of the water for renewal.



Fig. 7: Improvement in the water renewal piping of the chiller

Figure 7 shows the improvement in the spillway, where the water renewal of the leg quarter chiller occurs. In the dashed area there was an extension of the water renewal piping from top to bottom, thus increasing the area where the water renewal occurs and making the output flow of water from the chiller (more dirty and hot water) more effective.

After the implementation of all the actions proposed by the

ECO-team, along with the results collected through the spreadsheets, the statistical analyses and the results obtained through the implementation of cleaner production could be performed and presented.

Table 3 shows the means of the water flow results of the chiller using male and female turkeys as a function of the months of the study.

Table 3: water flow per kilogram of male and female turkey leg quarter ± standard deviation Equal letters do not differ significantly among themselves by the Tukey test at a significance level of 5%.

Month	Water Flow Rate (L/kg)	
	Female	Male
April	1.12 ± 0.16 a	0.57 ± 0.18 a
May	1.18 ± 0.25 a	0.58 ± 0.12 a
June	0.87 ± 0.25 b	0.59 ± 0.15 a
July	0.47 ± 0.02 c	0.45 ± 0.03 b
August	0.47 ± 0.01 c	0.46 ± 0.02 b
September	0.48 ± 0.03 c	0.43 ± 0.03 b
October	0.47 ± 0.01 c	0.45 ± 0.02 b
November	0.48 ± 0.01 c	0.46 ± 0.02 b

The Tukey test reveals that there was no difference between the months of April and May for the female turkeys. This occurred because the action plan for the reduction of water consumption was not yet in operation. June was the month where the implementation of the action plan started. This month already shows a significant difference in relation to the other months, this occurs because the process is still in transition.

The remaining months showed no significant difference, i.e., from July the action plan was already deployed and running and a significant reduction in water flow can be observed when compared to the first months of the study. Based on the comparisons, the action plan can be said to have been effective for female turkeys, with a reduction of more than half of the water consumption and coming close to the critical acceptable threshold of 0.4L/kg, as previously described.

As for male turkeys, one can see the months of April, May and June showed no difference. This occurs because April and May are the months that precede the implementation of the actions and because June is the month when the changes were initiated. Another point that contributes to this similarity is that the male leg quarters are heavier than the female ones. In this case, less liters of water are added to the chiller, corroborating with the statistical analysis. And as mentioned earlier, in the male leg quarters, the paddles of the remover could remove the product without taking a large amount of water with it.

For the months of July to November no difference was observed, just as was the case for the female turkeys. In these more recent months, the action plan was already deployed and in full operation, i.e., the flow of water in the chiller was already controlled and inside the established limits, revealing the continuity of the implemented actions as well as their effectiveness.

Figure 8 shows the comparison chart of the water flow for male and female turkeys in relation to the critical limit

established between the company and SIF. One can see that before and during the implementation phase of the action plan (April to June), the water flow in the chiller is higher than the target imposed by the legislation.

After July there is a visible reduction in the use of water in the company, which starts complying with the water-per-kilo-of-meat targets, in addition to reducing the amount of water in this process. The flow value cannot be less than this critical threshold value, because otherwise there would be insufficient water renewal to maintain the constant temperature of a maximum of 4°C, which also controls the microbial load.

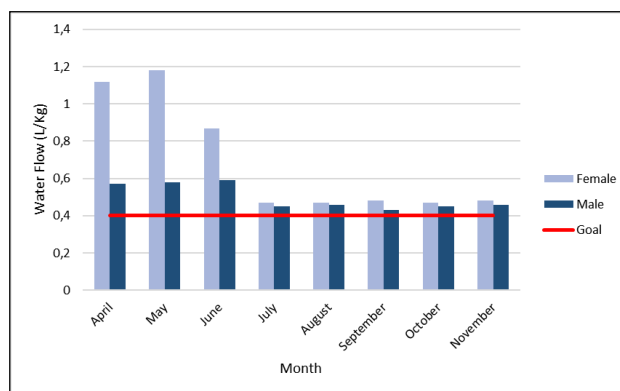


Fig. 8: Comparison chart of the water flow for male and female turkeys with the established critical limit.

To determine the savings generated with the implementation of these actions, some important data needs to be taken into consideration, such as the cost of the water that comes from the treatment plant, which is estimated at R\$ 0.40, the cost to generate iced water (approximately R\$1.37), and, finally, the cost to dispose of water after use in the effluent treatment station (R\$ 1.70). Adding up these values, we get R\$ 3.47 spent per liter of water used in the process. The difference in water flow used before and after the implementation of the action plan

was approximately 0.7 L/kg for female and 0.16 L/kg for male turkeys. As such, R\$ 283 per days in savings were generated and taking into account that the average number of days worked in the month is 21 days, the savings added up to R\$ 6,079.92 per month and R\$ 72,959,04 per year. In addition, the most important gain was the contribution to the environment with the reduction of 83.435L/week and 1,001.220L/year.

Through these results, it can be said that the company was able to apply the principles of cleaner production, which is supported in the fact that the most effective way for the reduction of pollution is to analyze the process at the origin of the production and eliminate the problem at its source (MEDEIROS et al., 2007).

After the implementation of the actions, we pursued the maintenance of the improvements implemented in the process. This was possible through monitoring the water consumption used in the leg quarter chiller. The follow up was done with the previously mentioned data collection spreadsheets (Figure 2), as well as through the frequent employee trainings and the monitoring by the Eco-team.

IV. CONCLUDING REMARKS

The obtained results allow for the conclusion that the study has achieved its desired objectives. 83,435 L/week of water was saved and these savings directly impacted the company's bottom line. The statistical analyses reveal that a primary change of equipment can generate large energy savings in an entire process.

In particular, the study shows that it is possible to produce the same amount of products while respecting the allowed water consumption limits and collaborating in environmental preservation. Consequently, less effluents will be generated in the process. Thinking about environmental preservation and the reduction of expenses means always thinking about the future.

The implemented actions are therefore in alignment with the precepts of cleaner production, enabling the company to operate in a socially and environmentally responsible manner, consequently resulting in economic and technological improvements, applying a precautionary approach to Environmental Management (Medeiros et al., 2007).

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Importance of Municipal Solid Waste Management

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Abstract—Solid waste management is one among the fundamental and essential services provided by municipal authorities in the developed as well as developing countries to keep urban areas clean. In certain regions of our country, the free disposal facilities have reached their own capacity and even local governments are confronted with difficult decisions. Solid waste management is an integral element of modern society. There are many ways in which solid waste can be treated, and thanks to modernized practices and technological advancement, these methods are very safe and practical.

Keywords—Solid Waste Management, Intelligent technique.

I. INTRODUCTION

Solid waste management is one among the fundamental and essential services provided by municipal authorities in the country to keep urban centers clean. Solid waste management has always been a serious problem for cities throughout the world. It is not different in developing countries like India. In certain regions of our country, the free disposal facilities have reached their own capacity and even local governments are confronted with difficult decisions. Modern civilization has brought a lot of luxuries and conveniences to our lives. However, with all of the amenities that modern life brings us, they also cause us to contribute to producing a large quantity of trash that needs to be taken care of. Fortunately, there's the field of solid waste management, and it is with that Solid Waste Management that modern lives are enjoyable without the disturbance or refuse. Solid waste management is an integral element of modern society. Even if we don't get to see what goes on at the facilities and plants that process and dispose of garbage, it still contributes to the well-being of our lives. There are many ways in which solid waste can be treated, and thanks to modernized practices and technological advancement, these methods are very safe and practical. For example, in our previous research works, we have applied several intelligent techniques like graph theory, ant colony optimization, shortest path algorithm, image processing and other intelligent techniques [1,2,3,4,5,7,8,9,10,11,12,13,14,15,16]. In some cases the existing garbage collection pathways were considered and it was shown that if such intelligent

techniques are applied then the cost involved in collecting the garbage will be significantly decreased. Besides that we have also applied image processing technique for reorientation of garbage collection points in several municipal areas of West Bengal.

II. MATERIALS & METHODS

In our present study we mainly confine our views on importance of solid waste management. It is because this is now burning issues and most of the countries both developed and developing countries of the world concentrate on that. We have already studied solid waste management issue on several municipal areas of West Bengal, India of which some municipal areas belong to oldest city of India and some areas belong to most advanced i.e. satellite city of India. After that we have noticed the following:

- The poor quality of the services provided in terms of solid waste collection and disposal is the issues of concern.
- To provide a waste management service this can be acceptable on existing financial constraints.
- There is lack of action plan for proposing and implementing an efficient Management Information System (MIS) & Geographical Information System (GIS)
- The provision of planning and management such that there are possibilities of improvement in financial and institutional support.

Due to the financial constrains it was suggested to incorporate those options which can promote the improvement in the system without a major capital investment. So it is proposed to create the MIS and GIS information. According to Ogra, A, 2003 [6], "Municipal bodies are unable to prove a 100% efficient system and even are not able to reach the efficiency of 60%". This is not because the municipality is not doing their work properly or due to work negligence, but it is due to the old conventional working methods which need to be upgraded with the advanced system like GIS and a better management system. The data should be managed in an integrated way to reduce the complexity of different issues related to the function of the work involved in the waste management system. We have noticed that the solid waste

management in several municipal areas appears to be inadequate and needs up gradation. The solid waste has to be disposed off scientifically through sanitary landfill and recyclable portion of the waste should be salvaged. Segregation of recyclable material would also lead to reduction in quantity of solid waste for final disposal. Higher priority needs to be assigned to the management of municipal solid waste by the local authority and a system approach needs to be adopted for optimizing the entire operation of SWM encompassing segregation at source, timely and proper collection, transportation routes and types of vehicles and development and proper operation of sanitary landfill site. The density of population along with number of offices and institutions are continuously increasing thus there should be effective management activity for managing the solid waste which is generated daily in these municipal areas. On the other side the municipal authorities had their reasons for this mismanaged of the waste maintenance as follows:

- The citizens do not throw the waste inside the bins so it often lies outside and around the bins, making the area around the bin look dirty.
- The waste lifting capacity is quite less in comparison with the amount of waste generated in the city.
- There is also a shortage of manpower, equipment and machinery.
- Other problems due to poor SWM Now the situation was such that there were several drawbacks of this garbage accumulation and even worse were its consequences, some of them are:
 - (i) Bad odour is created around the garbage area, making an unbearable environment.
 - (ii) Poor waste pickers pose a serious threat to public health.
 - (iii) Animals like cats, dogs, goats and cows come to the garbage in search of food and end up in spreading the garbage around the bins.
 - (iv) The economic factor is also affected, the market value of a particular area decreases if there is a badly maintained waste area near by as it poses a bad aesthetics.
 - (v) It overall leaves a bad impression and poses a threat to the environment
 - (vi) Waste bins are not properly distributed; the waste bins of several areas of all municipal areas considered in this study are not uniformly distributed. Moreover some wards or blocks share the waste bins of adjacent wards/blocks.
 - (vii) Distance between waste bins varies in great extent; it is found that generally in each block/ward only one dustbin is present. The area of each block/ward varies greatly. Thus in several cases it is found that the distance

between waste bins located in adjacent blocks/wards considerably large.

- (viii) There is no proper justification regarding waste generation and number of waste bin in a particular area; it is because huge garbage production areas contain few numbers of waste bins.
- (ix) For effective SWM, both GIS & MIS data should be implemented; by applying this concept the waste generation map can be constructed which is essential for justifying existing waste bins locations and optimizing the garbage collection pathways.

III. CONCLUSION

In the conclusion it has been discussed about the reformation in the concepts of the data management and the analysis carried with the help of GIS. Once the waste management department is aware of the total function of the GIS system, it will get acquainted with its effectiveness. Then there will be an entire record of all the things related to the waste management and suitable logistic management and spatial planning can be achieved. This can be done with the help of GIS analysis on the different layers for practical implementations. By applying the functions like overlaying, applying buffer for proximity analysis or by applying queries through a structured query language (SQL) the required information can be extracted.

- Demographic map can be used to know the more waste generating areas.
- The category of waste like domestic, industrial, commercial etc. can be found out easily with the help of the land use map.
- Existing location of the waste bins and the street maps will provide the proximity of the bins to the waste collection service routes. In case of any inconveniency for the waste collecting crew the bins can be re located.
- A map showing the current waste generated and the waste generated in different wards, sectors and along the roads, streets and junctions. These above enlisted points are said to be an important exercise to begin with. The points overall covers many waste management issues, but they are very generalize and require a lot of data and proper analysis using the GIS software. There will be a requirement to develop several models to apply all those points on the real time data.

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