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FOREWORD

I am pleased to put into the hands of readers Volume-5; Issue-4: 2018 (April, 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.

Dr. Swapnesh Taterh
Editor-in-Chief
Date: April, 2018

Editorial/ Reviewer Board

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Virtual Environment, Digital Hypertext, Reading and Writing in Foreign Language

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Abstract**—** *This work intends to analyze – in an activity carried out with students from the third period of the Language (Spanish) undergraduate course of a college located in Itaperuna, a town in the State of Rio de Janeiro, Brazil - how the digital hypertextual reading can facilitate the selection of information in order to facilitate the writing process of texts in Spanish that can be broadcasted in the virtual environment, verifying how this may happen, so that these productions are shared, also allowing the interaction of the subjects with the language and with their peers. For this objective, we used the qualitative methodology (Erickson, 1986) with action research, seeking foundation in what theorists such as Lévy (1996, 1999), Coscarelli (2006, 2009), Gomes et al. (2015), Bannell et al. (2016), among others, investigate. As results, we emphasize that the subjects of the research actively participated in the construction of their own learning regarding the aspects covered in the foreign language class, and with this they were able to practice reading, writing, and the usage of the vocabulary and grammar studied. Finally, we conclude that the hypertext worked here as an inclusive device, facilitator of reading and propitiator of writing, making the participant students authors of digital texts that provided them with learning throughout all the process they have been through.*

Keywords**— Hypertextuality. Spanish Language, Virtual Environment.**

I. INTRODUCTION

According to Coscarelli (2009), there is no way to talk about technology and education without mentioning language, because the forms of reading and writing are different and the dispositions of texts are as well. Thus, as the researcher complements, dealing with a computer requires dealing with languages, both the verbal, "[…] like the other semiotic systems, and the icons and all programs non-verbal language (tools bars), programming languages, such as HTML, animations, video, radio, etc" (Dias & Corrêa, 2014, p. 3-4)[1].

In the context of foreign language teaching, it is not different, once they have "an important role in the entire development of the student and their teaching and learning Provide him with new experiences, skills development, understanding of cultures and new world understanding" (Fettermann, Silva & Paula, 2016)[2]. This, in the current days, has been largely made possible through the use of Digital Technologies of Information and Communication (DTIC), which have opened doors to

[1] "[...] *como os outros sistemas semióticos, como os ícones e toda linguagem não verbal dos programas (barras de ferramentas), as linguagens de programação, como HTML, animações, vídeo, rádio, etc*" (translated by the authors).

[2] "[...] *um importante papel no desenvolvimento integral do aluno e seu ensino e aprendizagem proporcionam a ele novas experiências, o desenvolvimento de habilidades, compreensão de culturas e novo entendimento de mundo*" (translated by the authors).

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new forms of communicating in the contemporary world.

Connected to that, the language teacher seeks strategies which allows a more significant and dynamic learning to the student, provided by the digital technologies. One we approached here is the new way of reading and searching, called digital hypertextual reading. According to researchers, it can help the reader to select the information needed, quickly. This reading approach can facilitate the writing process and allow the learning to be more interactive e connected to the current demands.

Thus, it is possible to assert that the digital technologies have been more and more used in the context language teaching, due to the advantages the internet can cause to the teaching and the learning process. One of the tools which, according to current researches, have demonstrated important results is the social network *Facebook*, and its use applied the language teaching can cover and make varied forms of reading and writing possible, besides entering the student in wider social and cultural contexts.

Considering that the virtual environment can be used as a resource to teach and learn, we intended to observe the potential of the digital hypertextual reading and, as a consequence, the text production in the classroom, as well as its post on *Facebook*, resulting in an interaction of students with their peers and the language, during the learning process.

We opted, in this perspective, for the application of the activity in a group of the third period of Languages (Spanish) of a college in Itaperuna/RJ, a town in the State of Rio de Janeiro, Brazil, supporting the study in theorists such as Lévy (1996, 1999), Coscarelli (2006, 2009), Gomes et al. (2015), Bannell et al. (2016), among others.

1 Hypertext, new readers and writers

In the last years, the modern Foreign language teaching has counted on the extra support made possible by the experience with the diverse technological tools. Thus, the hypertext became an element that contributes with the technologies, once the internet converted itself in a source of information Which help its users to surf in a not linear way, seeking new knowledge about the language studied, both grammatical and social cultural, confirming what Süssekind (2004, p. 107) defends, when she says that the hypertext is "[…] a cultural and social practice, allied to the technical instrument"[3], which we call here digital environments.

The hypertext in this paper is not the one found in a printed text, that is full of extra information like images, bottom page notes, among others that can lead the reader to a not linear reading. However, it is hosted in digital environments. Coscarelli (2009, p. 554)[4], clarifies that "[...] hypertexts are not linear texts that offer *links* or connection links to other texts, which can be images, graffics, videos, animations, sounds".

The internet as a digital support contributes to new types of reading and writing produced collectively (Lévy, 1996), taking the students to an interactive environment. As Dias and Corrêa (2014, p. 4) highlight, "Reading and writing ways are different today and the ways in which texts are available are as well"[5]. That can make hypertext a collaborator in the teaching and learning process of reading and writing in a foreign language.

In this sense, Lévy (1996) points out that the digital hypertext allows students to perform their research in a fast and intuitive way, facilitating the understanding and production of new meanings and making the reading more meaningful and dynamic. Therefore, if reading consists of selecting, schematizing, constructing a network of internal references to the text, associating other data, integrating words and images into a personal memory in permanent reconstruction, "Then the hypertextual devices constitute, indeed, a kind of objectification, exteriorization, virtualization of the reading processes" (Lévy, 1996, p. 43)[6].

From a hypertextual reading, the student ends up widening the cognitive, favoring a practice of writing both in digital and on paper, because "the hypertext as a new conception of writing finds the theories of text at this extreme point which is the intersection of semiotic heterogeneities" (Süssekind, 2004, p. 107)[7].

Thus, reading in digital environments provides the students with information which will be useful in their knowledge acquisition and language learning, besides allowing the reader to become also "a co-author, once he can add information to the text" (Coscarelli, 2009, p. 551)[8], and this hypertextual reading, powered and

[3] "*[…] uma prática cultural e social, aliada ao utensílio técnico*" (translated by the authors).

[4] "*[...] hipertextos são textos não lineares que oferecem links ou elos de ligação para outros textos, que podem inclusive ser imagens, gráficos, vídeos, animações, sons*" (translated by the authors).

[5] "*As formas de ler e escrever são diferentes hoje e as formas de disponibilização dos textos também são*" (translated by the authors).

[6] "*[...] então os dispositivos hipertextuais constituem de fato uma espécie de objetivação, de exteriorização, de virtualização dos processos de leitura*" (translated by the authors).

[7] "*[...] o hipertexto enquanto nova concepção de escrita encontra as teorias do texto nesse ponto extremo que é o cruzamento de heterogeneidades semióticas*" (translated by the authors).

[8] "*[...] um co-autor, uma vez que pode*

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interactive, will insert the learner in a significative textual production context. This way,

> When the hypertext structure system of visualization in real time (or its dynamic cartography) is well known, or when the search can be made in a natural and intuitive way, the open hyper documents, accessible through a network of computers, are powerful instruments of collective writing-reading (Lévy, 1999, p. 57).

Therefore, it is possible to conceive the hypertext as an accelerator tool to the foreign language teaching-learning process, for allowing the learner, after his reading with big scale information, get a wide vocabulary that will help him in the writing production, because "with the hypertext, all reading is a potential writing" (Lévy, 1999, p. 61)[9].

II. NEW READING AND WRITING PRACTICES

As already mentioned in this text, Lévy (1996) declares that the digital hypertext can facilitate the comprehension and production of new senses and make Reading more significative e dynamic, through rapid and intuitive searches. In this case, the reader/learner wides his cognitive skills, what can lead him to a writing practice, which can happen both in the digital environment and on paper.

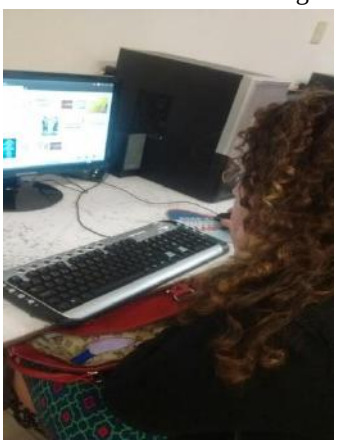
This possibility was verified in an activity performed with students of the third period of Languages (during the subject of Spanish I), in a private college in Itaperuna-RJ.

For the class, the students were sent to the informatics laboratory at the institution, and they were asked to search about two contents of grammar, *Reglas de acentuación* (Word stress rules) and *Palabras heterotónicas* (Heterotonic words), which had already been worked in previous classes, for, after the search, explaining it in a short text and posting it in the class' Facebook group.

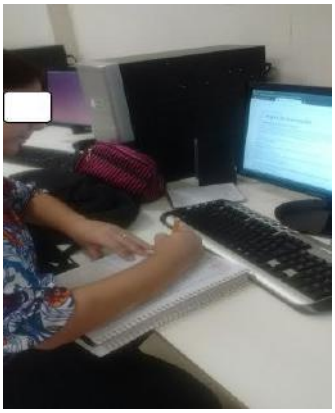
The activity happened in three steps, with the support of action research: 1. Hypertextual research; 2. Online Writing production; 3. Teacher mediation.

The first step consisted of the hypertextual search on the proposed contents, in Which the students searched on several web pages, having Google.com as a starting point, what took them to access various websites and links, choosing the most interesting ones for the task. It is worth mentioning, according to Coscarelli (2006, p. 8), that "Links do not carry meaning, but indicate a path for their construction"[10].

The second step was the written production by the students, happened after the readings. It was possible to note what Lévy (1996, p. 43) defends about hypertextual devices: they work as "[…] a kind of objectification, exteriorization, virtualization of reading processes"[11], because it allows the reader to select, schematize, integrate "[…] words and images to a personal memory in permanent reconstruction"[12] (Fettermann, Silva & Paula, 2016, p. 4). This can be observed in the figures below:



Photograph 1: Student during the hypertextual research
Source: Teacher's collection



Photograph 2: Student during the textual production
Source: Teacher's collection

Thus, the content searched in the hypertext search was used to produce the explanatory material that was then posted on the social network by the students. In

adicionar informações ao texto" (translated by the authors).

9 "*[...] com o hipertexto, toda leitura é uma escrita potencial*" (translated by the authors).

10 "*Links não carregam sentido, mas indicam um caminho para a construção deles*" (translated by the authors).

11 "*[...] uma espécie de objetivação, de exteriorização, de virtualização dos processos de leitura*" (translated by the authors).

12 "*[...] as palavras e as imagens a uma memória pessoal em reconstrução permanente*" (translated by the authors).

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agreement with what Bannell et al. (2016, p. 118) stands out,

> [...] the educational objective pursued is to stimulate the participants' active learning, with an emphasis on the sharing of knowledge and dialogue as a form of interaction.

In this perspective, the students were able to participate actively in their own learning related to the aspects covered in the Spanish class. With this, we highlight the skills that were practiced during the proposed task: reading, writing, vocabulary use and the practice of the grammar addressed.

The end of the activity was the third step, the teacher mediation, starting from the assumption that:

> [...] the exploitation of digital technologies in the space of the pedagogical relationship between teacher and student implies perceiving them as a space for dialogue: a place where words acquire new meanings, thanks to the experimentation of new ways of thinking, [...] based on the mutual exchange between teacher and student, on the collaborative work to solve problems, on the application of cognitive capacities to known and unknown situations and challenges (BANNELL et al., 2016, p. 121).

The following figure demonstrates teacher mediation in virtual space. We emphasize, however, that it happened throughout the teaching and learning process of the themes worked, from classes outside the computer lab until after the postings, through the teacher's interactions with the students using the Spanish language to explain the new content, clarification of the doubts, suggestion of the work and tutoring of all the activity in the group of the class on Facebook.

Fig.1: Written production
Source: Group "Español UniFSJ", on *Facebook*

Fig.2: Written production and teacher interference
Source: Group "Español UniFSJ", on *Facebook*

Thus, we could observe that the hypertextual readings in the digital context favored the practice of authorial writing and allowed the students to increase the capacity to choose the information researched and then produce their texts according to the proposition of the activity,

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since

> [...] in virtual environments users are no longer external observers and become active and interacting participants, and digital technologies provide opportunities for interaction, self-expression and authorship never before experienced (BANNELL et al., 2016, p. 115).

We emphasize that Facebook was chosen, once it has been the most used social network by the students, and it is also a space for information exchange, doubts explanations and interaction between them and the teacher, as well as an environment of study and incentive for the students to practice the teaching practice in the digital scope. "It is a space where all people can teach and learn from each other" (Bannell et al., 2016, p. 118)[13].

Therefore, we emphasize that the resources offered by the digital information and communication technologies, such as the hypertext that enables the search of information to perform tasks, and Facebook as a virtual environment for teaching and learning, favor the formation of new readers and authors, able to select and produce content that will enable them as future teachers.

III. FINAL CONSIDERATIONS

Through the use of digital technologies, it has been possible to insert new practices in the context of language teaching. The demands of the modern world lead us to seek alternatives that are more consistent with the realities of the students, who are often connected to several digital social networks in their daily lives.

In this way, this work fulfilled its objective, which was to analyze - in an activity carried out with students of the third period of the undergraduation of Languages (Spanish) of a college located in the municipality of Itaperuna/RJ – if it was possible and how the hypertextual reading in the digital environments could facilitate the selection of information and, later, the process of writing and posting of texts in Spanish in the virtual environment, in order to share their productions to interact with the language and with their peers.

Thus, we observed that through the hypertexts it was possible to select key information for the researches carried out by the participants, who, from then on, organized their writings in an objective way, including in them only what was proposed by the accomplished task.

Then, we consider that hypertext worked here as an inclusive device, facilitator of reading and propitiator of writing by students who became authors in this context. In this sense, we verified that this is one of the roles of this device, since the digital environment has been a place where they feel more fearless and interested in participating nowadays, taking advantage of the learning opportunities that arise.

Facebook, in this context, once again was verified as a virtual conducive place to the teaching and learning process, which favored reading and authorship of texts that can contribute to the training of future teachers, facilitators of knowledge exchange.

We believe, finally, that the practice reported on this paper can be applied in different contexts of language teaching and we emphasize that we do not intend to make generalizations on this subject, but we also try to propose that new experiences be carried out in this field so that relevant debates emerge from the practice shared here.

[13] "*Trata-se de um espaço em que todas as pessoas podem ensinar e aprender mutuamente*" (translated by the authors).

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A Case Study on Software Requirements Engineering using the FBI Virtual Case File Project Report

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Abstract*—Virtual Case File (VCF) was a case management software to be developed by the United States Federal Bureau of Investigation (FBI) to replace the existing Automated Case Support (ACS) software system. The goal of the project was to modernize FBI's suite of investigative software applications; the ACS system was developed in-house consisting of several layers of applications that were outdated and difficult to use. Based on the Goldstein's [1] report it was identified that the VCF system did not adhere to the requirements of the project and was fragmented. This case study identifies the critical problems from requirements engineering perspective that contributed to VCF project failure and discusses software engineering methods that would assist in requirements gathering.*

Keywords*— *Requirements engineering, software project management, requirement analysis

I. INTRODUCTION

The primary objective of the Virtual Case File (VCF) was to automate paper-based work environment and allow agents, analysts share vital investigative information and replace the obsolete Automated Case System (ACS). The Virtual Case File project spanned from 2000 to 2005 during which it experienced a series of software engineering failures. The goal of the project was to modernize FBI's suite of investigative software applications; the ACS system was developed in-house consisting of several layers of applications that were outdated and difficult to use. Based on the Post [1] and Goldstein's [2] report it was identified that the VCF system did not adhere to the requirements of the project and was fragmented. This case study identifies the critical problems from requirements engineering perspective that contributed to VCF project failure and discusses software engineering methods that would assist in requirements gathering.

II. REQUIREMENTS PROCESS ISSUES

The initial requirement was to upgrade the bureau's existing Automated Case Support system. The ACS system built by the bureau enabled the agents to search and analyze material between different cases, the system was deemed legacy as it was constructed using old tools like Natural [6], ADABAS [7], IBM terminals [8] from the 70's. Due to the limitations and legacy dependency of the ACS, the requirements were changed to create an entirely new application with a new database and graphical user interface. As per Goldstein [2] report, product requirements were discussed with more than forty domain experts rather than involving few crucially required domain experts, architects, developers, business analysts and the management team. There was no clear distinction between the project's stakeholder's, business analysts and developers. Ideas proposed by independent members in the meetings were added to the requirement list, and requirements were frequently modified without the focus on defining the mandatory core functionalities.

Short term goals, schedules, strategies, milestones, model to be adopted were not defined in the meetings. The project team focused on achieving the end goal, rather than identifying project milestones and clarifying/refining the requirements to meet the milestone. The herculean task of building the entire project first time around without clear milestones lead to vague requirements and ever-changing requirements. The VCF project adopted the Ad-hoc (Hobbyist) model [11] with new additions and modifications to the requirements, and there was no defined structure. It is stated that the lack of robust technical architecture is one of the leading reasons for the failure of the project [9]. The design document consisted of more than 800 pages specifying every detail of the project rather than portraying just the high-level design for better comprehension.

When a certain portion of the requirement was developed, stakeholders identified new issues or thought of new ideas and a new modified requirement was proposed. There was no final structure on what is to be delivered and what process model, and framework is to be adopted.

The entire project was to be deployed at once, and the old ACS system was to be discontinued immediately. No

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business risk management process was carried out; no backup business continuity plan was decided.

A well-documented requirement specification document is essential for building a detailed technical architecture. Below are two reasons that contributed to incomplete requirements and technical architecture:

1. Lack of planning and requirement analysis - As per SWEBOK [10], to design and build a product, it is essential to understand the requirements of the product, its functionalities and the users of the system. It is of primary importance to understand the requirements from the clients who will be using the system. With appropriate requirement elicitation techniques, a concise and clear requirement specification aids in the development of technical architecture and precise estimations related to time and resources. In the Virtual Case File project, requirements were gathered through group discussions from a wide array of members rather than elicitation from the customers alone. The lack of formal software engineering training among its members impacted the requirements gathering process. As the project adopted, ad-hoc software process requirements were routinely modified leading to additional un-expected downstream changes in other phases of the software development lifecycle. Changes in requirements led to constant changes in the product architecture and development, and with the lack of milestones and expectation to cutover to the new system without transition added to the projects agony.
2. Lack of Responsibility and Accountability - Lack of governance played a significant role in the failure of the VCF project as the management team lacked training in software project management, information technology, and computer science. In the project, the program managers did not duly evaluate the scope of project, schedule, effort, project plan, assign appropriate roles keeping in line with the goals of the project.
    a. A responsibility assignment matrix [4] (RACI matrix) is useful in identifying roles and responsibilities for a project. In short, the RACI matrix provides the following insight:
        - R – Responsibility: Who is responsible?
        - A – Accountability: Who is approver?
        - C – Consulted: Whose opinions are sought?
        - I – Informed: Who is to be updated about the activities?

Description	Responsible	Accountable	Consulted	Informed	Virtual Case File Project
Requirement Analysis	Analysts, Domain Experts	Customers and stakeholders	Management	Customers and Management	RACI - Group discussion, No clear separation of roles C – Attrition, Micromanagement I – Not adequately involved
Design	Analysts, Domain Experts, Developers	Customers	Customers	Customers and Management	R - Lack of precise design specification, Lacked formal training, Poor design choices ACI – Requirement changes
Implementation	Developers	Manager	Domain Experts, analysts	Customers and Management	AC- Ad-hoc Model R - Poor architecture blueprint
Testing	Developers, Testers	Customers and Management	Customers and Management	Customers and Management	RACI - Blame game among teams

It helps in improving governance and identifying problems at the various stages of software development lifecycle. Below is a RACI matrix built to identify issues in steps of the VCF project.

III. CONCLUSION

Below are two important attributes that can be adopted by similar projects -

1. Understanding requirements require thorough comprehension of the product to be designed; this can be achieved by iteratively discussing the requirement with the clients and defining project

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milestones. Clients should be involved in all stages of the software development lifecycle; this helps in gathering the requirements and obtaining immediate feedback at each step [3]. This would ensure that the product specification satisfies the client requirements. Various requirement elicitation techniques as defined in SWEBOK can be adopted.

In case of the VCF project, there was no clear distinction between the stakeholders and rest of the members, and requirements were discussed and added based on personal judgments and group discussions.

Requirement analysis is an iterative process and involving clients in each iteration would update the client with the current state of the project as well help in capturing important feedback.

It is imperative to have domain expertise based on the requirement to extract maximum information from the client, unlike in the VCF project the members lacked formal training software engineering and computer science as managers and engineers [9].

2. Adopt a suitable framework

To streamline the software development process SWEBOK [10] suggests the use of software processes as per the requirements of the project. A software process like Microsoft Solution Framework [5] would have been a good fit for the VCF project. Microsoft Solution Framework incorporates Agile practices and functions such as open communication, shared vision, empowering team members, shared responsibility, clear accountability, focus on business value, investment in quality and learning from experience. Phases of MSF such as the envisioning phase explores and identifies the scope of the project, and the planning phase discusses and approves project plans. MSF risk management phase recognizes the risks involved in specific steps of the software development and helps by providing the lessons which were captured in other projects for similar situations, and this would have been helpful as the VCF project did have any back-up for transitioning from the ACS system VCF.

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The Mathematical Connections Process of Junior High School Students with High and Low Logical Mathematical Intelligence in Solving Geometry Problems

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Abstract**—** *This study aimed to describe the mathematical connections process of students in solving geometry problems. The mathematical connections process was the students' steps in doing mathematical connections. The observed aspects were the internal connections (the interrelationships between mathematical concepts) and external connections (the mathematical interrelationships and outside of mathematics or daily life). The samples of this reasearch were the student with high and low mathematical logical intelligence. The results of the research showed that the students with high logical mathematical intelligence did the internal and external connections in solving geometry problems completely based on polya problem solving steps. Meanwhile, the students with low logical mathematical intelligence did the internal and external connections until the step of understanding the problems.*

Keywords**— External Connection, Internal Connection, Logical Mathematical Intelligence, Problem Solving.***

I. INTRODUCTION

Mathematics is one of the subjects taught in school. The objectives of mathematics learning in the Indonesian curriculum are to improve (1) the problem solving ability, (2) the reasoning ability, (3) the communication ability, (4) the making connections ability, and (5) the ability of representation (Harahap, 2015). Permana & Sumarmo (2007) state that in Indonesian curriculum, mathematical connection is one of the mathematics basic skills which must be mastered by the high school students.

Mathematical connections are relationships between concepts in mathematics; the relationship between mathematical concepts and other disciplines, and the relationships between mathematical concepts and the real world or in daily life. (NCTM, 2000: 274). Mathematical connections are occurred because mathematical science is not partitioned. Mathematical concepts are related between one another. Not only in mathematics itself, they are also related to other disciplines or to real life.

"When student can connect mathematical ideas, their understanding is deeper and more lasting" (NCTM, 2000: 64). If the students can connect mathematical concepts mathematically, so students will have a deeper understanding and can stay longer. The students' understanding of mathematics can be better if students can connect ideas, procedures and concepts from the subjects known to newly lessons received. Students can learn new things easier if it is based on the knowledge known. The importance of mathematical connections for the students is the relationship between mathematical concepts which are related to the mathematics itself (internal connection) and the relationship between mathematics and the outside of mathematics or daily life.

The scientists have done many researches on the importance of mathematical connections. According to Nordheimer (2010) states that the process of mathematical connections is a process of thinking in recognizing and using interrelationships between mathematical ideas. The process of mathematical connections needs to build and improve so that the students can connect mathematics and other sciences or the daily life.

The one of the Mathematical material is geometry. The importance of geometry studied by students is because many geometric concepts are used in real life. According to Soenarjadi (2012), geometry is one of the aspects in Mathematics which can improve logical thinking ability. Improving of logical thinking which is useful in problem solving related to daily life.

The ability of a person in digging information used to solve problems was related to geometry, such as being able to understand the interrelationship of information obtained from the problems so he has the steps in solving the problem appropriately. The ability can be done by

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people who have logical mathematical intelligence. It is with the proposed by Gunawan (2003: 111) that people who have well-developed logical-mathematical intelligence has the characteristic of being able to solve problems, thinking and arranging solutions in a logical sequence. In solving problems related to geometry, the students must be able to understand the problem firstly, then obtain the information from the problem given. The information obtained is translated into mathematical language. After that, the students arrange the plan what have to do to solve the problem. In solving the problem, the students may try to solve minor problems, then draw the generalization. The next step, the students is able to check the solution obtained. It is done in order to obtain a proper and correct solution. The process of solving problems requires the logical-mathematical intelligence. The indicators used in this study is presented in Table 1. below.

Table.1: The Mathematical Connections Indicators of Geometry Problem Solving Tests through Polya Problem Solving Steps

The Steps of Problem Solving	The aspects of mathematics connection	Indicators
Understanding the problem	Internal connection	• knowing the proportion of the lenght of both squares • knowing the average of the lenght of both squares • knowing the relationship of the area of shaded and no shaded region
	External connection	• connecting the problem given with mathematical concept known • being able to determine what known • being able to determine what asked
Drafting the Plan	Internal connection	• determining the lenght of each square side using statistical concept • determining the whole area (the addition of square 1 and 2) • determining whole area (the twice of area of no shaded region) • determining the area of no shaded region (addition of *VPR* and *TSW* right triangle) • detrmining the lenght of *WR* (*SR* side minus *SW* side) • determining the concept of comparison to find the lenght of *UX*
	External connection	• using a definition or symbol in drafting problem solving steps • understanding a definition or symbol in arranging arranging problems solving steps
Executing the plan	Internal connection	Solving the problems based on the problem solving steps made like finding out both of squares' side, finding out all area by adding the area of square 1 and 2, dividing two of all area, the area of triangle to find out the length of *WR*, and using the comparison concept of two triangle to find out the length of *UX*
	External connection	Solving the problems based on the strategy chosen: calculating the area of whole garden, the area of garden with flower planted, the area of garden no flower

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The Steps of Problem Solving	The aspects of mathematics connection	Indicators
		planted. Using the area and the length unit
Rechecking	Internal connection	The students recheck the result obtained. • what was it suitable with the first problem in the question? • what was it suitable with the mathematical procedure?
	External connection	Rechecking the result of calculation using the area and the length unit

In this research, researcher uses the samples of junior high students in knowing the process of mathematical connections. The students at this age have been able to provide arguments or explanations of their ability. Through the preliminary tests and recommendations from mathematics teacher of their communication skills. The research samples were selected one student with high mathematical logical intelligence, and one student with low logical mathematical intelligence. This research entitled "The Mathematical Connections Process of Junior High School Students with High and Low Mathematical Logical Intelligence in Solving Geometry Problems."

II. THE RESEARCH METHOD

This research was descriptive qualitative research which aimed to describe the process of mathematical connections of the students with high logical mathematical intelligence. The role of the researcher was as the main instrument in order to adapt to the class conditions easier so that obtained complete and quite deep data. The research was conducted in IXB class of MTs Fatihul Ulum Tanggul with 30 students in heterogeneous ability level. Researchers took 2 samples with the different categories of logical mathematical intelligence. The research samples were chosen based on logical mathematical intelligence test and consideration of IXB class mathematics teacher of MTs Fatihul Ulum about the fluency of students in communication. The samples chosen were initialized with LM1 for the student with high logical mathematical intelligence, and LM2 for the student with low mathematical logical intelligence.

The research instruments were used in the form of validation sheet. Logical mathematical intelligence tests previously tested were Tes Pemecahan Masalah Geometri/TPMG (Geometry Problem Solving Test) and interview guide. The instrument was validated by the three validators. One validator was a master's lecturer of mathematics education that qualified S3, and two other validators were the lecturers of mathematics education with S3 and S2 qualification. The problem in TPMG about geometry involved the ideas which had been obtained by the students previously, so it could be used to see the process of mathematical connections of the students in solving geometry problems. The aspects of connection included the internal connections (relationships between mathematical concepts) and the external connections (mathematical relationships with out of mathematics or daily life).

In this research, the data were (1) the data of logical mathematical intelligence test result, (2) the data of the connections test result, (3) the data of interview result of research samples. The data obtained were analyzed using flow model data analysis techniques proposed by Miles and Huberman (1992) with the steps (a) reducing, (b) presenting data, and (c) drawing conclusion.

III. THE RESEARCH RESULTS AND DISCUSSION

3.1 The Result of Data Analysis

a. Mathematical Connection Process of the Student with High Logical Mathematical Intelligence (LM1)

The process of mathematical connection of LM1 student in the step of understanding the problem in the answer sheet was by mentioning the information obtained from the problem, among which was known from the problem was the ratio of two sides of the square was 1: 3, the average of the side of both squares was 12 m, the area of shaded and the non-shaded region were same which the lengths of *WR* and *UX* sides asked. It meant that LM1 was able to apply the external connection (able to connect the flower garden problem as a two squares compound and determined what known and asked using his own language). In addition, LM1 was not only able to apply the external connection, he also applied the internal connection in understanding the problem. He knew the area of the shaded area equals to the area of the un-shaded area. The following was LM1 expression during the interview on the step of understanding the problem.

P : *Try to retell the meaning of the question number 1!*

LM1 : *So Mr. Andi had a square-shaped garden combining of two squares, the proportion of squares' sides was 1: 3, the average of two squares' sides was 12 m, the area of unplanted*

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flowers or shaded region was similar with the area of planted flowers regionor un-shaded region. The question was the length of WR and UX side.

The next step, LM1 arranged the plan. He made an internal connection in arranging a plan to find the length of two squares' sides. After knowing the length of squares' sides, then the step taken was to find the whole area of two squares and divided it into two because the shaded area equals the un-shaded area. The un-shaded area was equal to the sum of two right triangles. The following was LM1 expression during the interview.

P : *How were the strategies or steps you used to solve this problem?*
LM1 : *Finding the length of both sides of the squares first.*
P : *After the sides of the two squares found, what was step done?*
LM1 : *Finding the area, mam.*
P : *Which was area?*
LM1 : *Whole area mam, the area of big square plus the area of small square, after that divided by two.*
P : *Why was it divided by two?*
LM1 : *Because the area of garden have been not planted was equal with the area have already planted with flowers.*

LM1 not only did the internal connection, he also applied the external connection when arranging the plan to define a small square area with *Lpk* and the area of big square area with *Lpb*. In addition, he defined that the area of *VPR* triangle with *LΔI* and the area of *TSW* triangle with *LΔII*.

To find the length of *UX* side, LM1 planned to use the concept of proportion of two triangles as expressed by him during the following interview.

LM1 : *Looking for the length of UX*
P : *What did the concept do you use in finding the length of UX?*
LM1 : *The proportion of two triangles*
P : *Which were triangles?*
LM1 : *XQR triangle and VPR triangle*

At the step of doing the completion plan, LM1 worked based on the chosen strategy in solving the problem. First, finding the sides of the two squares. Then, calculating the area of each square and summing it up to obtain the whole area. After that, dividing the whole area into two to find the area of unshaded region. He stated that the area of unshaded region was the sum of the area of triangle I and the area of the triangle II, so that the length of *WR* obtained. The following was LM1's written answer.

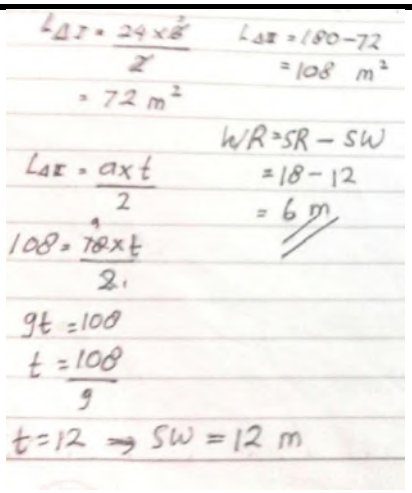

Fig. 1 : The process of mathematical connection in finding the length of WR

It was accordance with what LM1 expressed during the interview.

P : *Try to retell your steps in solving number 1 problem!*
LM1 : *UX Finding the sides of the big and small squares, finding the whole area then summed and divided by two, finding the area of TSW triangle, finding the length of WR, and finding the length of UX.*
P : *Try to explain how you found the length of WR!*
LM1 : *That was the whole area if it is divided by two equals 180 m^2, 180 m^2 for unplanted flowers, 180 m^2 for planted flowers. The garden planted with flowers is a combination of triangle 1 and triangle 2, so 180 equals to the area of triangle 1 plus triangle II, using the right triangle square formula, the area of triangle 1 is obtained 72 m^2. The area of triangle 2 equals to 180 minus 72 equals 108 m^2. Using the area of triangle 2, t found 12, t is the length of SW. To find WR = SR - SW = 18 - 12 = 6 m.*

LM1 kemudian mencari panjang *UX* menggunakan konsep perbandingan yang sudah dipelajari sebelumnya. Berikut adalah ungkapan LM1 pada saat wawancara. Furthermore, LM1 found the length of *UX* using the concept of proportion which was studied previously. The following was LM1's expression during the interview.

P : *Now, Try to retell your way in obtaining the length of UX.*
LM1 : *Finding the length of QX first using the proportion concept of XQR and VPR triangles.* $\frac{18}{QX} = \frac{24}{6}$ *QX equals 4,5 m. So, UX = 6 – 4,5 = 1,5 m*

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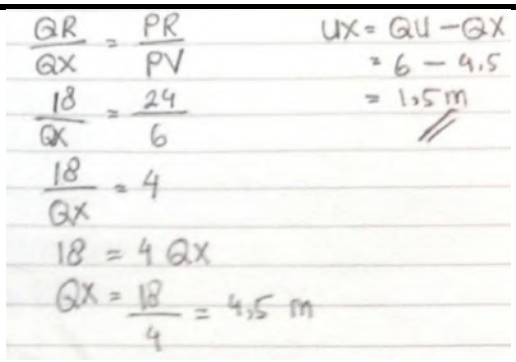

Fig. 2: The process of mathematics connection to find the length of UX

It indicated that during implemented the plan LM1 has done an internal connection by applying the concept of triangle area, square area, and proportion. Moreover, he also used the length unit which meant he able to connect mathematics and beyond mathematics. It meant that LM1 did the external connection.

He also re-checked the result of *WR* length by summing the length of WR and SW so that the length of *SR* obtained. For the length of *SR* and *UQ*, he re-checked using the length of *UQ* plus the length of *SR*. Moreover, he also did the external connection when re-checking using the length unit on both sides.

The following was LM1's expressions in rechecking.

P : *Were you sure of the answers you got? Was it appropriate with the initial problem in the question?*

LM1 : *Yes, I was. Mam.*

P :*How were you sure that your answer appropriate with the initial problem in the question?*

LM1 : *Well mam, the length of WR 6 m, 6 plus 12 equals 18 m, 18 m is the length of the big square's sides. The length of UX is 1.5 m, 1.5 plus 4.5 equals 6 m, 6 m is the length of the small square's sides*

P :*Was your result appropriate with the initial problem in the question?*

LM1 : *It was appropriate mam, so the average of square is 12 m, 12 times 2 equals 24 m. If the big square's sides added a small square side is equal to 24 m.*

The process of mathematical connection of the student with high logical mathematical intelligence (LM1) in completing TPMG was presented in Table 2 below.

Table.2: The Process of Mathematical Connection of LMI

The Steps of Problem Solving	The Aspects of mathematical connection	Students' Activities
Understanding the problem	Internal connection	• Understanding the proportion of both squares 1:3 • Understanding the average of sides of both squares 12 m • understanding the area of the shaded region equals to the area of unshaded region
	External connection	Being able to determine what known and what asked
Drafting the plan	Internal connection	• Being able to determine the lenght of sides of both squares using mean formula • Being able to determine the whole area (the addition of the area of the big square plus the area of the small square • Being able to determine the area of unshaded region (a half of the whole area) • Being able to determine the area of unshaded region (the addition of two right triangles, right triangle I and II) • Being able to determine the length of *WR* side (the length of *SR* side minus the length of *SW* side) • Being able to determine the proportion concept

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The Steps of Problem Solving	The Aspects of mathematical connection	Students' Activities
		of *XQR* and *VPR* triangle to find the length of *UX*
	External connection	• Defining the area of square 1 using *Lpk* and the area of square 2 using *Lpb*. • Defining the area of *VPR* triangle using *LΔI* and *TSW* using *LΔII* • Defining the whole area using *Lsemua*
Executing the plan	Internal connection	Solving using the strategy chosen
	External connection	Using the unit of area and length
Rechecking	Internal connection	Believing the answer obtained and rechecking the result obtained
	External connection	Using the length unit

b. Process of the Mathematical Connection of the Student with Low Logical Mathematical Intelligence (LM2)

In the step of understanding the problem, LM2 firstly got difficulties in understanding the problem. However, after reading several times, he could understand the problem. He mentioned the information from the question of a rectangle-shaped garden. The proportion of the both squares' sides, and the average of the sides of the both squares. Although, it was not written on the answer sheet, He mentioned that the planted flowers garden was the same as the garden unplanted flowers, the unplanted flowers garden was the shaded area in the picture. This indicated that he had the internal connection. He not only mentioned what known, but also mentioned what asked in the question. It meant LM2 also had the external connection. The following was LM2's expression during the interview.

P : *How were your opinion about the question number 1 which you did?*
LM2 : *Difficult*
P : *Did you get the difficulties in doing it?*
LM2 : *Yes*
P : *What were the difficulties?*
LM2 : *I didn't understand what the purpose, mam. I reread mam.*
P : *So, did you understand by doing it in understanding the question?*
LM2 : *Pretty fair*
P : *What the information did you get from the problem?*
LM2 : *The garden shaped of two squares, the proportion of two squares 1:3 and the average of two squares 12*
P : *Any else?*
LM2 : *Iya bu. Eh ada bu, luas taman yang belum ditanami bunga sama dengan luas taman yang sudah ditanami bunga. Luas taman yang belum ditanami bunga itu daerah yang diarsir Yes, mam. The area of unplanted flower garden equals to the planted flower garden. The area of unplanted flower garden was the shaded region.*
P : *What were asked in the question?*
LM2 : *The length of WR and UX sides*

Furthermore, when He was making the plan, finding the lengths of the sides of the both squares by giving *x* for the sides of square 1, and *3x* for the sides of square 2. The following was LM2's written answer.

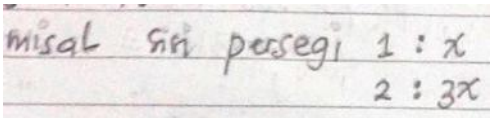

Fig. 3: The Process of the Mathematical Connections Koneksi in Drafting a Plan of Finding the Lenght of the Both Squares' Sides

When LM2 drafting the plan, he planned to find the length of the *WR* using the length of *SR* divided by two. He did not understand that the whole area was 2 times the shaded region. Moreover, he did not understand that the area of unshaded region was a combination of two triangles *VPR* and *TSW*. He also did not understand that through the area of *TSW* triangle the length of *WR* could be found. The following was LM2's expressions during the interview.

LM2 : *Because I want to find the length of WR, the length of WR equals to SW, so divided by 2*
P : *Were you sure that the length of WR equals to SW?*
LM2 : *Emm…actually, I wasn't sure mam, because I didn't know its way.*
P : *Try to find the whole area first, then find the area of the unshaded region. The length of the unshaded region was the combination of two triangles VPR and TSW. The area of TSW triangle used to find the length of SW, after that the length*

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of SW found you could find the length of WR using SR minus SW. Have you understand?

LM2 : *Not yet.*

In drafting the plan, LM2 did not understand in finding the length of *UX* could use the proportion of two triangles. It showed that in drafting a plan, he did not do the internal connection and external connection at once. The following was LM2's expressions during the interview.

P : *Why was the length of UQ divided by 2?*

LM2 : *Because the length of UX equals to QX*

P : *Are you sure UX equals to QX?*

LM2 : *Emmm...*

P : *Try to find the length of QX first using the proportion concept of two triangles VPR and XQR. Then, find the length of UX.*

LM2 : *I didn't understand mam.*

In executing the plan, LM2 used the chosen strategy in finding the length of sides of th both squares. However, he used the wrong step in finding the length of *WR* and *UX*. It indicated that he did not do the internal connection. Moreover, he also did not do the external connection by not using the lenght unit when executing the plan. The following was LM2's written answer.

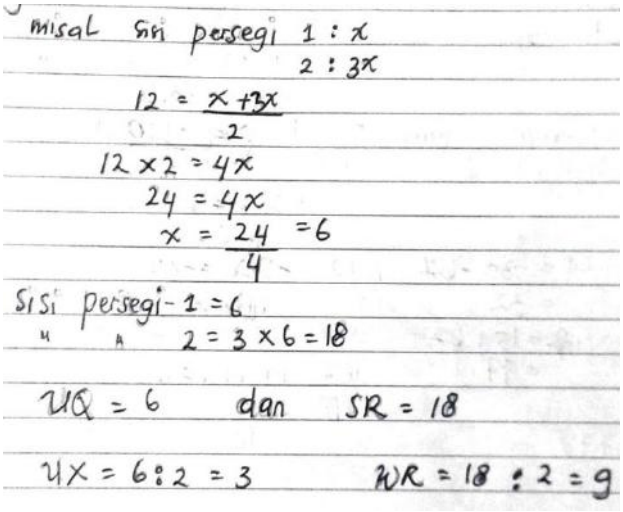

Fig. 4: The process of mathematics connections in executing the plan in finding the length of UX and WR

In solving it, LM2 did not recheck. The mathematical connection process of students with low mathematical logical intelligence (LM2) in completing the geometry problem solving test was presented in the following table.

Table.3: LM2's Process of Mathematical Connections

The steps of problem solving	The Aspects of Mathematical Connection	Students' Activities
Understanding the problem	Internal Connection	• Understanding the proportion of the sides of two squares 1:3 • Understanding the average of the sides of squares 12 • understanding the shaded region equals to the shaded region
	External Connection	Being able to determine what known and asked
Draf-ting the plan	Internal Connection	• Being able to determine the sides of two squares using the average formula • Determining the wrong step in finding the length of *WR* • Determining the wrong step in finding the length of *UX*
	External Connection	• Defining the sides of the fisrt square using *x* and the sides of the second square using *3x* • Not defining the whole area, the area of triangle, the length of unshaded region/ shaded region
Executing the plan	Internal Connection	• Completing the chosen strategy to find the sides of the both squares • Wrong in executing the plan to find the lenght of *WR* • Wrong in executing to find the lenght of *UX*

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The steps of problem solving	The Aspects of Mathematical Connection	Students' Activities
	External Connection	Not using the length unit
Rechecking	Internal Connection	Not rechecking
	External Connection	Not rechecking

3.2 Discussion

Based on the research result data the written answer sheet and the result of interview with research samples showed that the connections process between mathematical concept (internal connection) of the student with high logical mathematical intelligence category (LM1) and the students with low logical mathematical intelligence (LM2) in understanding step could understand the proportion of the sides of two squares, the average of the two square sides, and the area of the shaded region equals to the area of the un-shaded region. Moreover, both LM1 and LM2 also use the external connection in the step of understanding the problem by mentioning what known and asked from the problem given.

Furthermore, LM1 drafted a plan to find the length of *WR* side using the whole area divided by two then using the area of the right triangle, and found the length of the *UX* side using the concept of proportion of two right triangles. In executing the, LM1 planned using his capabilities and skills in applying operations and procedures to find the answers of the problems faced by finding the length of *WR* side and *UX* side. This is in line with the opinion of Hudojo (2003) that in solving problem, the students understand the process of solving the problem and become skilled in choosing and identifying relevant concepts, finding generalization, formulating, planning for completion and organizing the skills had.

The Students with high logical mathematical intelligence category were able to solve the problem of geometry by doing the internal connection, the connections between mathematical topics completely in each step of geometry problems solving. This is in line with the opinion of Bosse (2003) that if the student did the internal connection between mathematical topics then it will make easier for the student to integrate some mathematical concepts into a connected idea and will facilitate students in building knowledge, so that the student with high logical mathematical intelligence was able to solve the problem of the question number 1 correctly because he did the internal connection in the problem solving step.

The Student with high logical mathematical intelligence did the external connection completely in geometry solving problem step. LM1 was able to determine the information obtained from the problem mentioning what known and asked from the problem of number 1. LM1 defined the information obtained using symbols to facilitate the process. This was in line with Orhan's (2008) opinion that students can communicate ideas with symbols, tables, diagrams or other media to explain mathematics and beyond mathematics. In this research, the mathematics and beyond mathematical relationship was intended to the external connection.

LM1 also understood and used the unit for area and length which in Khomariyah's opinion (2014) the student who could use the unit of length and area meant he was able to relate mathematics and beyond mathematics.

The student with low logical mathematical intelligence did not do the internal connection when drafting the plan or executing the plan so that LM2 could not find the lenght of WR and UX sides. This was in line the opinion of Hodgson (1995) that the mathematical connection is problem solving tool. If the student is unable to establish a connection so the connection do not play a role in solving the problem. In line with that opinion Bosse (2003) that the internal connection between mathematical topics can help students to integrate some mathematical concepts into a connected idea. LM2 is unable to work on geometric problems to find the lengths of *WR* and *UX* because LM2 is unable to connect concepts between mathematical topics. Moreover, LM2 did not use the unit of length meter when determining the length of the both square's sides. It showed that LM2 did not do the external connection. Based on the opinion of Khomariyah (2014) student who can use the unit of length and area meant the student has been able to connect mathematics and beyond mathematics.

IV. CONCLUSION

Based on the results of data analysis and discussion of mathematical connection process of the student with high logical mathematical intelligence and the student with low logical mathematical intelligence, it coul be seen that the student with high logical mathematical intelligence able to complete the test of geometry problem solving completely based on the steps of Polya problem solving; understanding the problem , drafting the plan, executing the plan, and rechecking. The Student with high logical mathematical intelligence performed both the internal connection and external connections at each problem solving step. Meanwhile the student with low logical mathematical intelligence did the internal connection and external connections only until the understanding the problem step.

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Student Critical thinking in Solving Two Dimensional Armetics Problems Based on 21th Century Skills

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Abstract— *Critical thinking has a very important role in constructing the improvement of students' ability to face the 21st century, especially in generalizing the pattern of the two dimensional arithmetic series. Since critical thinking is necessary when we try to understand and process information, put forward ideas or ideas objectively, and develop deeper insights. The purpose of this study is to analyse students' critical thinking skills based on P21. This study is a combination method in which this method is a combination of quantitative and qualitative methods. Research subjects are high school students. This subject is expected to provide an overview of critical thinking based on P21. Data collection techniques in this study are: (1) test, this technique is used to measure the ability of students in mastering the arithmetic array of two dimensions; (2) interview; it is based on the students work in solving the problem of two dimensional arithmetic series. The data result showed that in the experimental class had increased 40.85% on the indicator of effective reasoning, 37,44% on indicator of thinking system, 47,53% on decision indicator, and 42,55% on problem solving indicator. While the control class experienced a 19.5% increase in the effective reasoning indicator, 0.07% on the indicator of the thinking system, 0.02% on the decision making indicator, and 0.02% on the problem solving indicator.*

Keywords—Critical Thinking on 21st Century Skill, Problem Solving, Problem-based Learning.

I. INTRODUCTION

Critical thinking is an important aspect in mathematics is the ability to think critically. Critical thinking has a very important role in constructing the improvement of students' ability to face the globalization era. This is in line with 21st century learning (P21), which is learning that requires learners to have competence in critical thinking, creative thinking, communicative, and collaborative [1].

According to the book P21, critical thinking consists of (1) reasoning effectively, (2) thinking systems, (3) making decisions, and (4) problem-solving skills [1]. Zetriuslita (2016) defines to argue from facts that see the lack of an argument, evaluate evidence and determine cause and effect [2]. The critical thinking that is intended in this study includes the activities of analyzing, evaluating, and providing solutions in every problem. Mason (in Lunenburg, 2011) states that the concept of critical thinking is one of the most significant trends in education and has a dynamic relationship in the learning process. Lunenburg added after understanding the thought content that produces, organizes, analyses, synthesis, evaluates, and transforms it [3]. Further, Facione (2011) argue that the basic concept of critical thinking is interpretation, analysis, evaluation, concluding, explanation and confidence [4]. Therefore, critical thinking is needed when we try to understand and process information, put forward ideas or ideas objectively, and develops deeper insights. Thus, critical mathematical thinking skills have an important role for students in constructing student abilities and finding the best alternative in solving problems.

According to Sharif, 2017, students need critical thinking skills when they face challenges by considering information received, making plans, deciding the right decisions, making decisions, and evaluating. Although critical thinking is very important, in fact, Indonesian students have not been able to develop their skills well [5]. This is evidenced by the achievement of Indonesian students' mathematics score in the PESA system is still relatively low compared to the average value of OEDC (Organization for Economic Co-operation and Development) in 2015 (Kemendikbud, 2016) [6]. Therefore, the researcher identifies that students' critical thinking skills need to be developed especially in solving arithmetic series problems since they affect the purpose and achievement of education in Indonesia.

Based on Fajarwati & Manoy (2017), giving a problem is one of the efforts that can be done to improve students' critical thinking ability of mathematical, since they will try to think to solve the problem by looking for the problem solution. One of the learning models that can improve the critical thinking skills of mathematics in learning mathematics is a model of problem-based learning [7].

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As mentioned previously, the need for certain research is on critical thinking to face the 21st century. Thus, the researchers apply problem-based Learning to improve the students' abilities. The research results conducted by Oktavia Filda (2017), the goal of problem-based learning are to train students to be more independent in order to develop the ability to solve problems [6]. Nur Izzati Abdullah, Rohani Ahmad Tarmizi, Rosini Abu (2010) elaborate that the purpose of problem based learning focused on collaboration, communication, and problem solving skills [8]. While the objective of the research is to analyse the students' ability in solving the problem of the two dimensional arithmetic series based on P21st Century Skill through Problem Based Learning, in which the students will be able to reason effectively, use the thinking system well, make the right decision / argumentation, and arrange strategy / generalize in solving the problem.

Michael Angelo B. Promentilla, Rochelle Irene G. Lucas, Kathleen B. Aviso, Raymond R. Tan (2017)state that PBL is one way of developing students' learning skills in solving problems [9]. In line with Hobri's perspective (2009), students can develop thinking processes that include inductive, deductive, semiotic, analysing, criticizing, and making concurrent decisions and conclusions [10]. In the process of developing thinking skills through problem-based learning models, students are not only given a general knowledge, but rather bring them to a higher level of critical thinking and solve problems. The attainment of this level in learning theory is known as Higher Order Thinking Skills (HOTS) (Dafik, 2015) [11].

Many researches investigate in the mathematics education area, as well as arithmetic series. A two dimensional arithmetic array can be used to measure students' critical thinking skills since they require high-level mathematical skills especially in generalizing partition patterns. The two dimensional arithmetic array is the development of the arithmetic $Un = a + (n - 1)$ d into the following table, *i* denotes the position of the term in the horizontal row, whereas j denotes the position of the term in the vertical row.

i / *j*	1	2	3	...
1				
2				
...				

The two dimensional arithmetic series (i, j) is on partitioning techniques. The symbol used is: (P_ (m, d) ^ n) where P is the partition, n is the number of columns, m is the number of rows, and d is the difference among the column rows called P_ (m, d) ^ n (i , j), which means table / partition (i, j) with many n and m particular, and has a difference d in its sequence [12].

II. METHOD

This study is mix-method. Mix-method is a combination of quantitative and qualitative methods. Quantitative method is the collection of data whose data are numerical that can be quantified. Qualitative methods are used to understand and explore in-depth and process empathy, procedural, assessment, and evaluation activities. This triangulation approach is selected to provide an idea of the critical thinking skills level of students based on 21st century learning (P21) [13].

The subjects of this study were experimental class and control class in class of XI SMA consisting of 17 students. The subject of this study is expected to provide an overview of the ability to think critically based on P21. Then, the data is analysed, presented, and verified using triangulation approach in order to obtain valid data.

Data collection techniques used in this study were: (1) test, this technique is used to measure the students ability in mastering the arithmetic array of two dimensions; (2) interview, it is based on the students work in solving the problem of two dimensional arithmetic series. This technique is used to find out the reasons for the steps students used in problem-solving on the test.

The data presentation in this research covered classification activities and identification data to draw conclusions. In this study, the data exposure is the classification and identification of students' critical thinking skills. The indicator of critical thinking ability (CTA) that is reason effectively, use systems thinking, make judgments and decisions, and solve problems. The characteristic level of critical thinking is as follows:

Table.1: The Level of Critical Thinking Skill

Level	Characteristics
Level 4 (Very Critic)	Students are able to clarify, evaluate the results of completion and interpret the result, and arrange the strategies to generalize each problem.
Tingkat 3 (Critical)	Students are able to clarify, evaluate the results of completion and interpret, but they have not been able to formulate strategies to generalize every problem.
Tingkat 2 (quite critical)	Students are able to clarify, but they have not been able to evaluate the results of

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	completion and interpretation, and develop strategies to generalize each problem.
Tingkat 1 (less critical)	Students are only able to clarify problems but they have not been able to evaluate and interpret it, and formulate strategies to generalize every problem.
Tingkat 0 (not critical)	Students are unable to show all aspects of critical thinking in solving problems

III. FINDINGS

The first step in this study is to provide student worksheets and interview instruments which are validated by 2 validators, to be precise the first vaidator is Undergraduate lecturer and the second validator is Graduate lecturer. The researchers border the subject into a two dimensional arithmetic array (*i*, *j*) with partitioning techniques. In the second dimension table, *i* depend on the number of n, whereas *j* depends on the number of *m* that has been determined. Next, the students try to fill the table with numbers to find out the pattern of the series. Then, it is summing the numbers in each column that the sum of the numbers in each column must form an arithmetic sequence. P_ (m, d) ^ n used in this study includes 〖P〗_ (m, m) ^ n, P_ (m, m ^ 2) ^ n, and P_ (m, m / 2) ^ n [12].

3.1 Determining the two dimensional arithmetic patterns

The first stage in this process, students are given the task to complete the table contained in the student worksheet and make the pattern *n* and *m* differently.

3.2 Summing up some two dimensional arithmetic patterns

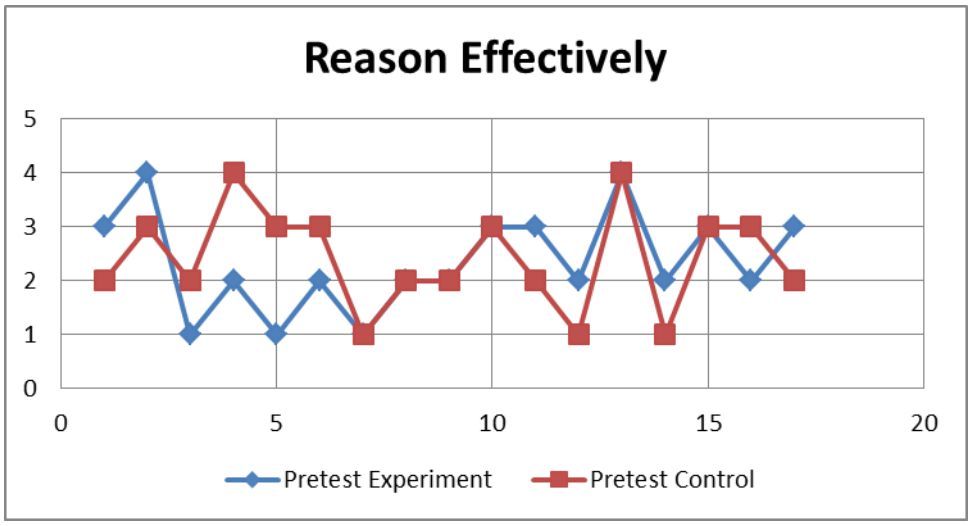
The second stage, students are given the summing task of some patterns that have been presented precisely the first pattern and the second pattern, the second pattern andthe third pattern, and so on.

3.3 The analysis of research results based on pre-test and post-test

3.3.1 The experimental pre-test and control class results

The student result of pre-test problem solving, then, analysed to know the student level of critical thinking and problem solving based on P21 indicator on experiment class and control class so that it can be used as the basis of this study. The indicators are reason effectively, use systems thinking, make judgments and decisions, and solve problems. This following is the pre-test results based on the four indicators in question:

a) Indicator of reason effectively



According to the previous diagram, it can be seen that there are 2 students from the experimental class and 2 students are in very critical category, 5 students of experimental class and 6 students of control class are critical, 7 students of experiment class and 6 students of control class are quite critical, and 3 students of experiment class and 3 control class students are less critical.

b) Indicator on systems thinking

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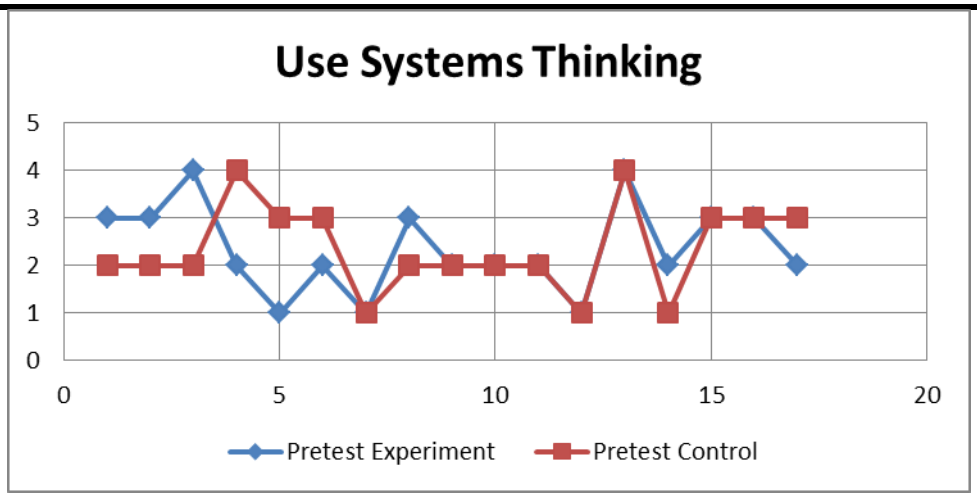
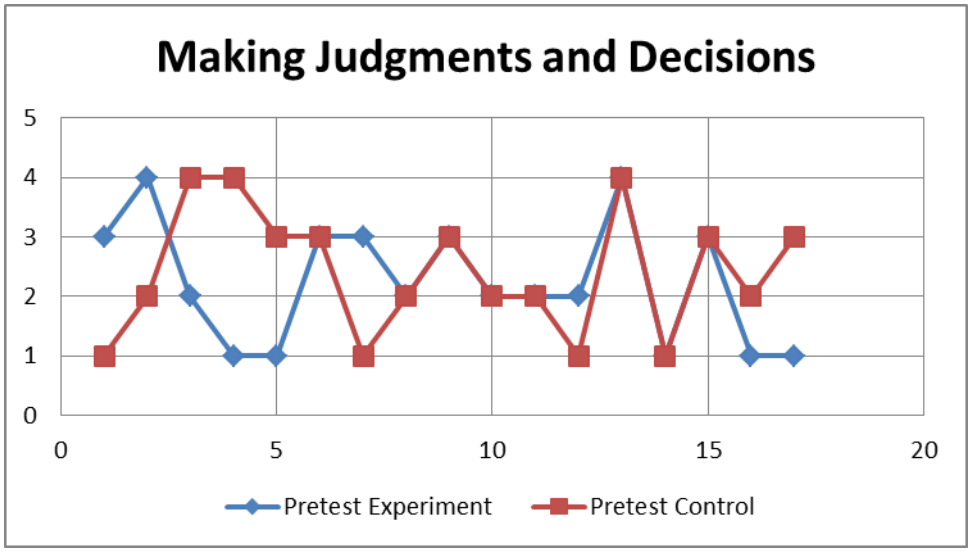


The previous diagram can be seen that there are 2 students from the experimental class and 2 students are in category of very critical, 5 students of experimental class and 5 students of control class are critical, 7 students of experiment class and 7 students of control class are critical, and 3 students of experiment class and 3 control class students are on less critical categories.

c) Indicator on making judgments and decisions



The previous diagram can be seen that there are 2 students from the experimental class and 3 students are in very critical category, 5 students of experiment class and 5 students of control class are in category of critical, 5 students of experiment class and 5 students of control class are critical, and 5 students of experiment class and 4 control class students are in less critical categories.

d) Indicator on problem-solving

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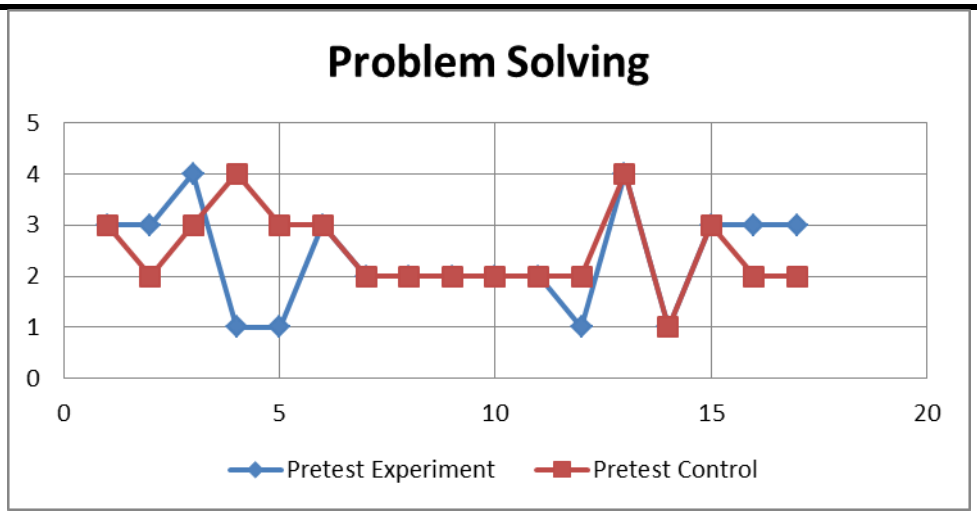

It can be seen in the previous diagram that there are 2 students from the experimental class and they are in very critical category, 6 students of the experimental class and 5 students of control class are critical, 5 students of experimental class and 9 students of control class are critical, and 4 students of experiment class and 1 student of control class are in less critical categories.

Based on the results, it can be concluded that among the experimental class and the control class has no significant difference. It was also proved by different test of both pre-test results on the following paired samples test:

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Exp_1 - Ctrl_1	-,11765	,99262	,24075	-,62801	,39271	-,489	16	,632
Pair 2	Exp_2 - Ctrl_2	,00000	,86603	,21004	-,44527	,44527	,000	16	1,000
Pair 3	Exp_3 - Ctrl_3	-,17647	1,46779	,35599	-,93114	,57820	-,496	16	,627
Pair 4	Exp_4 - Ctrl_4	,00000	,61237	,14852	-,31485	,31485	,000	16	1,000

From the different of test results, it can be seen that each indicator of the pretest has Sig (2-tailed)> 0, 05.It is concluded that there is no significant difference between the experimental class and the control class [14].

3.3.2. Post-test result of experiment class and control class

The result of the students' post-test on the experimental class and the control class in solving the problem was analysed to find out the critical thinking ability based on P21 indicators referring to some indicators that have been formulated. This following is the post-test result based on the indicator in question:

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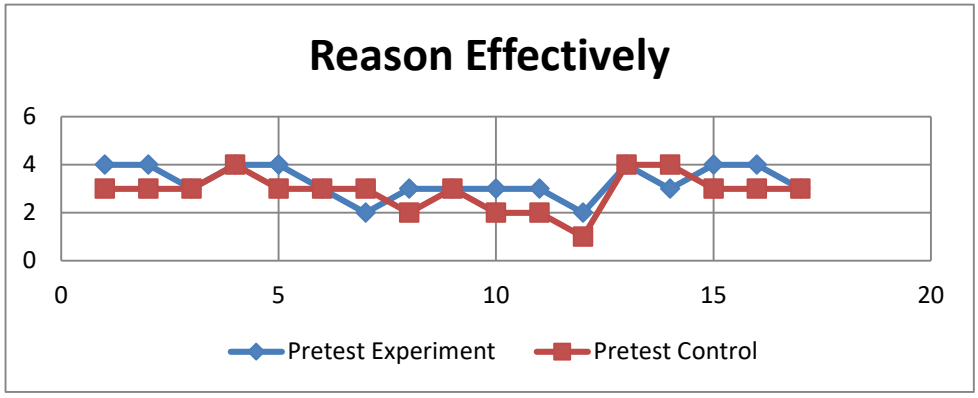
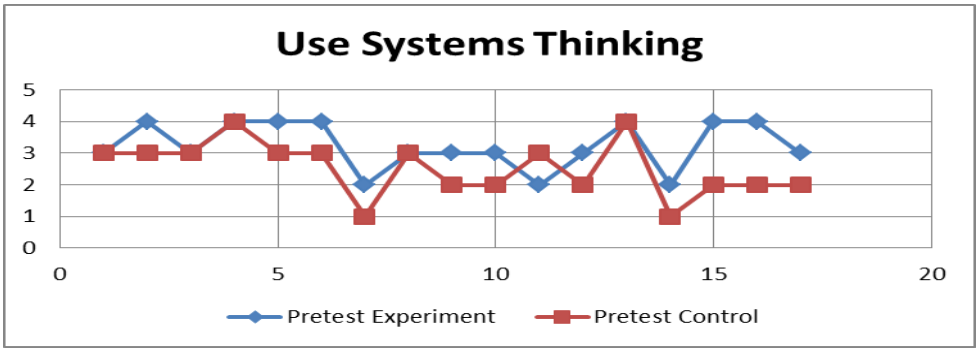
a. Indicator of reason effectively



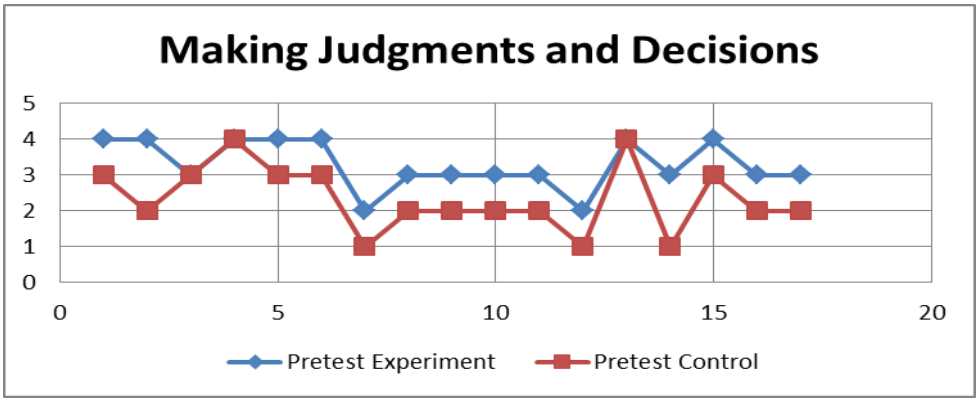
According to the previous diagram, it can be seen that there are 7 students from the experimental class and 3 students are in the category of very critical, 8 students of experimental class and 10 students of control class are critical, 2 students of experiment class and 3 students of control class is critical, while only 1 student in control class are less critical categories.

b) Indicator on systems thinking



The diagram presents that there are 6 students of the experimental class and 2 students are in very critical category, 7 students of experimental class and 7 students of control class are critical, 3 students of experiment class and 6 students of control class is quite critical, while 2 students only in control class are in the category of less critical.

c) Indicator on making judgments and decisions



The diagram shows that there are 7 students of the experimental class and 2 students are in very critical category, 8 students of the experimental class and 5 students of control class are critical, 2 students of the experimental class and 6 students of the control class are quite critical, while the 3 students are only in the control class are in the category of less critical.

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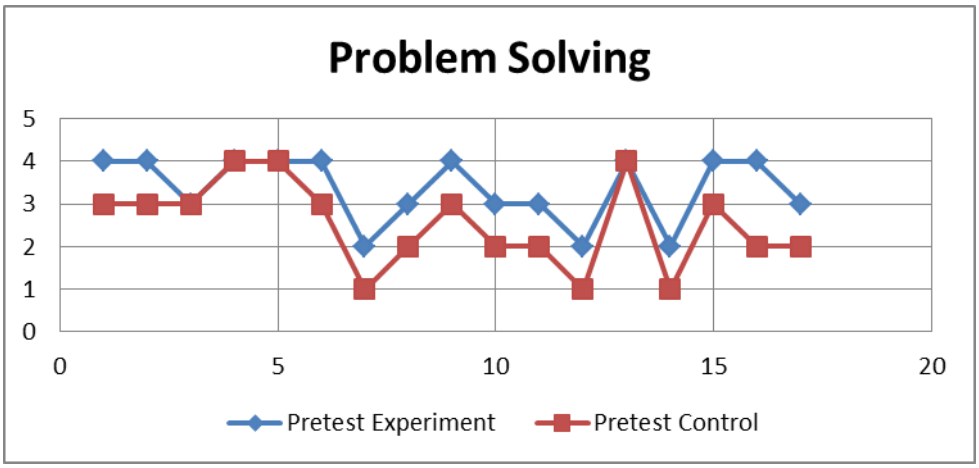
d) Indicator on problem-solving



The diagram indicates that there are 9 students of the experimental class and 3 students are in very critical category, 5 students of experiment class and 6 students of control class are critical, 3 students of experiment class and 5 students of control class is quite critical, while 3 students only in control class are in the category of less critical.

Based on the results, it can be concluded that the experimental class has significant differences. However, the control class does not have the difference among pre-test and post-tes. It is also proven by the test on paired samples test as follows:

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Exp_1 - Exp_post1	-,88235	,99262	,24075	-1,39271	-,37199	-3,665	16	,002
Pair 2	Ctrl_1 - Ctrl_post1	-,47059	,94324	,22877	-,95556	,01438	-2,057	16	,056
Pair 3	Exp_2 - Exp_post2	-,76471	,90342	,21911	-1,22920	-,30021	-3,490	16	,003
Pair 4	Ctrl_2 - Ctrl_post2	-,11765	,69663	,16896	-,47582	,24053	-,696	16	,496
Pair 5	Exp_3 - Exp_post3	-1,00000	1,22474	,29704	-1,62971	-,37029	-3,367	16	,004
Pair 6	Ctrl_3 - Ctrl_post3	,05882	,65865	,15975	-1,39271	,39747	,368	16	,718
Pair 7	Exp_4 - Exp_post4	-,88235	,99262	,24075	-,95556	-,37199	-3,665	16	,002
Pair 8	Ctrl_4 - Ctrl_post4	-,23529	1,09141	,26471	-1,22920	,32586	-,889	16	,387

IV. DISCUSSION

The followings are student results in problem solving on summing several series of two dimensional aritmetics.

1. Subject on Experiement Class, Irfan Odiawan

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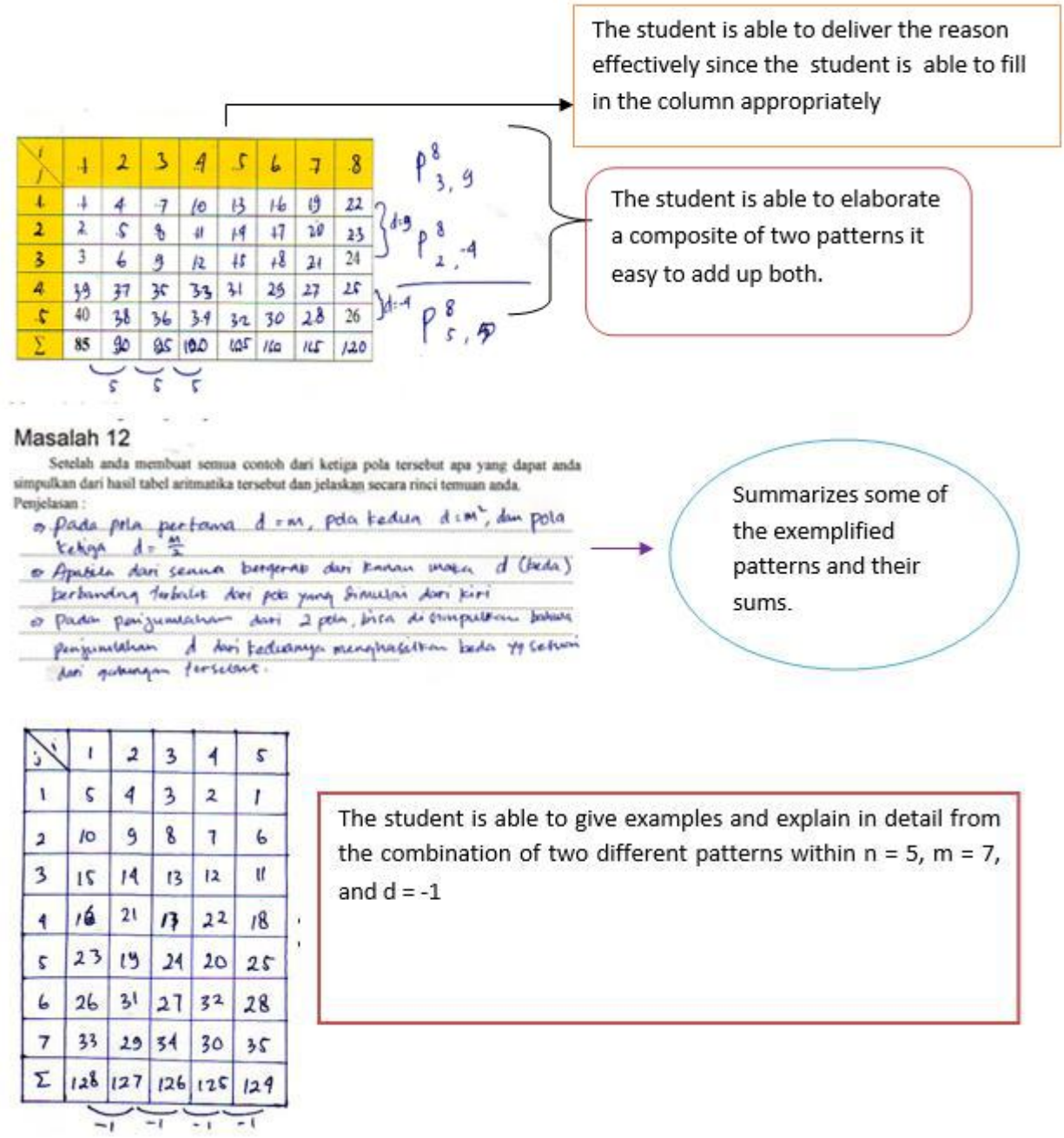

Fig.1: The result of Problem Solving in Experiment Class

Meanwhile, the student interview results on the experimental class during the process of summing two arithmetic patterns that are categorized are able to achieve the overall critical thinking indicator:

Teacher : Did you face the difficulties on summing the problems?

Student 1 : No

Teacher : What pattern that you take on summing the problems?

Student 1 : The second pattern, *m* 1-3 and *m* 4-5 patterns on the second one but it starts from the right.

Teacher : From the combination of the two patterns, which partition do you add up?

Student 1 : I only add up *m* and *n*.

Teacher : Why so?

Student 1 : because the summation rule of arithmetic is down.

Teacher : what can you conclude from the sum of the partitions?

Student 1 : before adding the two partitions, first, I must determine the pattern and know the value *d* of the two patterns. From the summation, the summation result of m and *d* are both corresponding that m and d are combined.

Teacher : can you create a new summation pattern with d = -1? Then explain!

Student 1 : for m 1 to 3 I take the first pattern that moves from right to left so that d = -3 and m 4 to 7, I take

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the third pattern so d = 2. If both add up the result to d = -1.

Based on Figure 1 and the interview results, it can be concluded that the problem solving from one of the students in the experimental class is very critical. It is evident from the way students fill columns, summarize, and create a different partition sum with the previous example. According to Ary Woro, the students having critical skills are students who are active in analysing their thinking, forming systematic planning in problem solving, using intuitive high in searching for information [15].

This followings are the student results in problem solving in summing several series of two dimensional arithmetic.

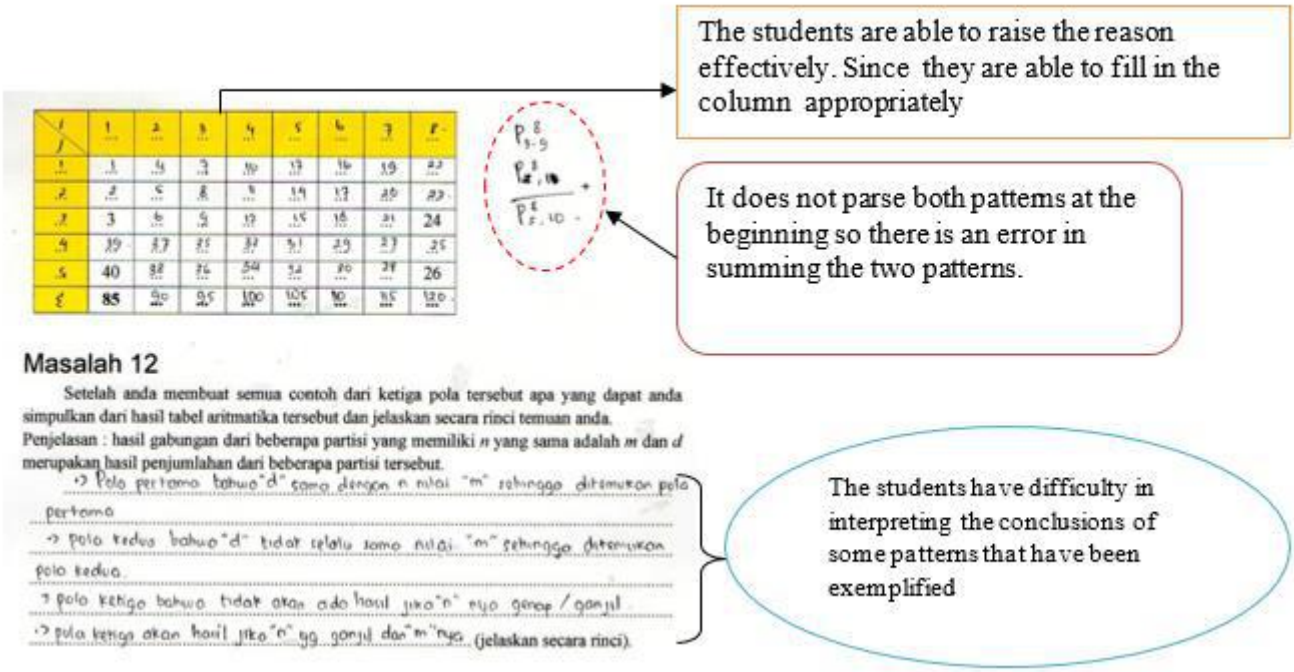

Fig.2: The result of Problem Solving on Control Class

Meanwhile, the interviews results for the students in the control class during the process of summing two arithmetical array patterns categorized as capable of meeting the overall critical thinking indicator:

Teacher : Did you face difficulties in summing the two patterns?
Student 2 : No
Teacher : Which pattern did you take fot solving the problem?
Student 2 : The second pattern
Teacher : According to the two patterns, which partition did you sum up?
Student 2 : I only sum up m and d
Teacher : Why?
Student 2 : Because it cannot sum up.
Teacher : What can you conclude from the partition?
Student 2 : d in the second summation is different from d in table.
Teacher : Can you create a new sum pattern with d = -1? Then explain it!
Student 2 : Not yet, because I am still confused to determine from some patterns

Based on Figure 1 and the interview results, it can be concluded that the problem solving from one of the students in the experimental class is less critical. It is proved by the way students solve problems. Since students in this category have developed thinking skills. However, the ability to think is still limited to dig information that meets the standards of intellectual reasoning, digging and developing awareness of concepts and ideas that meet the standards clearly.

V. CONCLUSIONS

Based on the results, it can be concluded that the experimental class has increased as much as 40.85% on the indicator of effective reasoning, 37.44% on indicators using thinking systems, 47.53% on decision-making indicators, and 42.55% solve the problem indicator. While the control class experienced 19.5% increase in the effective reasoning indicator, 0.07% on the indicator of using the thinking system, 0.02% on the decision making indicator, and 0.02% on the problem solving indicator. Mathematically, the experimental class is higher in achievement than the control class.

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Appendix: Tasks

Completing the Partition Pattern

Observe the following arithmetic pattern and find the first pattern through the pattern examples.

i \ *j*	**1**	**2**	**3**	**4**
1	1	...	...	...
2	...	6	...	8
3	9	...	11	...
∑	**15**	**...**	**...**	**...**

$n = 4$ dan $m = 3$

$$p^{n}_{m,d} = p^{\dots}_{3,3}$$

i \ *j*	**1**	**2**	**3**
1	...	...	...
2	...	...	6
3	...	...	...
4	...	...	...
∑	...	...	...

$n = 3$ dan $m = 4$

$$p^{n}_{m,d} = p^{3}_{\dots,\dots}$$

$n = 6$ dan $m = 5$

Observe the arithmetic pattern below and find the second pattern through the pattern examples

i \ *j*	**1**	**2**	**3**	**4**
1	1	...	...	...
2	...	6	...	8
3	9	...	11	...
∑	**15**	**...**	**...**	**...**

Observe the following arithmetic patterns and find the second pattern through the pattern examples:

i \ *j*	**1**	**2**	**3**
1	1	4	2
2	5	3	6
∑	**...**	**...**	**...**

i \ *j*	**1**	**2**	**3**	**4**	**5**
1	1	...	2	...	...
2	...	...	...	5	...
3	...	...	...	...	...
4	...	...	...	...	20
∑	**...**	**...**	**...**	**...**	**...**

$n = 5$ dan $m = 6$

$$p^{n}_{m,d} = p^{\dots}_{\dots,\ \dots}$$

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Determining the Partition

Look at the following table:

i \ *j*	**1**	**2**	**3**	**4**	**5**
1	1	11	2	12	3
2	13	4	14	5	15
3	6	16	7	17	8
4	18	9	19	10	20
∑	**38**	**40**	**42**	**44**	**46**

i \ *j*	**1**	**2**	**3**	**4**
1	1	2	3	4
2	8	7	6	5
3	9	10	11	12
4	16	15	14	13
∑	**34**	**34**	**34**	**34**

i \ *j*	**1**	**2**	**3**
1	1	5	7
2	8	6	2
3	3	4	10
4	12	11	9
∑	**24**	**26**	**28**

Are the three tables partitions? Explain it in detail!

Summing Up From Two Partition Patterns

i \ *j*	1	2	3
1	…	2	…
2	…	…	6
3	7	…	…
4	…	…	12
∑	**20**	**26**	**32**

$P^{\cdots}_{\cdots,\cdots}$

$P^{\cdots}_{\cdots,\cdots} +$

$P^{\cdots}_{\cdots,\cdots}$

i \ *j*	1	2	3
1	…	2	…
2	…	…	6
3	7	…	…
4	…	…	…
5	…	…	15
∑	**…**	**…**	**…**

$P^{\cdots}_{\cdots,\cdots}$

$P^{\cdots}_{\cdots,\cdots} +$

$P^{\cdots}_{\cdots,\cdots}$

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After you have created all the examples of the three patterns what you can conclude from the results of the arithmetic table and explain in detail your findings.

Explanation:

Applying Patterns and Joint Partitions

To better understand the three types of patterns, the arithmetic sequence pattern starts from the right (last column), and the combination of patterns, let's try to solve the following problems:

1. Create some two-dimensional arithmetic tables that yield d = 4!
2. Apply the combined method of the patterns to the following problem. Give some combined examples of:
   a) 2 patterns that yield d = 2
   b) 3 patterns that yield d = -1

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Numerical Simulation of Compression Ignition Diesel Injection (CIDI) to investigate Performance parameters.

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***Abstract*—** *This paper describes the requirement of the Numerical simulation of compression ignition diesel injection by the use of computer language and it also compares the performance parameter for the biodiesel such as jatropha and karanja. The Engine test was carried out in 512 Army base workshops for the experimental validations. It was carried out on SAJ dynamometer which was installed in Engine test house for testing of Engines. Performance parameters such as Brake power, Brake Torque, Mechanical efficiency, Thermal Efficiency, Pressure vs Crank angle and Heat release Rate vs Crank Angle was taken from the Engine test house. The Program code for the Performance parameter of Engine was developed in C++ language. Then the simulation was carried out. The simulation results were compared and analyzed with the experimental results.*

The final results was effective for compression ignition diesel injection. As we know that today's world is approaching towards computer simulated results, so the numerically simulated results will save time and money for engine testing house. Likewise we can approach towards numerical simulation for various types of Engines.

***Keywords*— Performance parameter, Compression Ignition Diesel Injection, Karanja biodiesel, and Numerical Simulation.**

I. INTRODUCTION

Today world is totally depends on Natural Resources which is limited, so it is necessary to find alternatives to the natural resources. Bio-diesel can we produced from various naturally grown plants which can be alternative to diesel for producing high energy for heavy vehicles and machinery. This paper describes the production of karanja plant and extraction of karanja bio-diesel from it. Karanja plant can be grown on the land which has water scarcity. This plant once cultivated can produce the karanja oil for 15 years. During the latest study of karanja bio-diesel, it was found that the properties of the bio-diesel have similar physical properties to the diesel. Physical properties such as density, calorific value, cetane number and acid value was satisfactory similar to the diesel, when karanja bio-diesel produced by chemical reaction with the methyl ester. Performance parameters of Compression ignition Diesel injection (CIDI) of karanja bio-diesel was compared to the diesel while experimentally using both the diesel used in diesel engine during workshop period.

Mathematical model has been developed for the Numerical simulation of the performance parameter of Compression Ignition Diesel Injection (CIDI). Performance parameters such as Brake Torque, Brake horse power, Specific fuel consumption, Mechanical efficiency and Thermal efficiency. A program was developed in C++ language with the help of Mathematical model. Program developed was then simulated to obtain the result. The result obtained was then compared and analyzed with the experimental result.

The input to the program was Engine geometry, Fuel property and inlet- outlet condition. Outcome of the program will be Torque, Brake power, Specific fuel consumption, and Mechanical and Thermal efficiency.

II. LITERATURE RIVIEW

C McCartan, P McEntee, and R Blair has developed a model for turbocharged direct injection engine to simulate the performance parameters. That software also tested instaneous gas and thermodynamic behavior in the engine cylinder [1].A Pandey, P Sivakumar, M Nandgaonkar, and S Suresh studied the comparison of diesel, karanja biodiesel and jatropha biodiesel. In that they compared the exhaust gases emission and material wear and tear. Engine performance of biodiesel was slightly lower than diesel. And Emissions performance was slightly better than diesel [2]. M Nandgaonkar and A Pandey evaluated the performance parameter of biodiesel where they tested the wear and tear, and Emission gases. They result was good and effective as compare to diesel [3]. J Gupta and A Agarwal has studied the macroscopic and microscopic

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spray characteristics of diesel and karanja biodiesel blends. Effect of pressure on macroscopic spray characteristics such as spray penetration, spray area and cone angle were investigated in a constant volume spray chamber .Microscopic spray characteristics such as velocity distribution of droplets and spray droplet size were measured using PDI (phase Doppler interferometry) [4].

J Lahuerta, and S Samuel developed a simulation model to improve thermal efficiency of IC Engine for operating engine in various range such as cold start etc. This was formulated based on the thermal management strategy in an engine can allow the engine to work at different operating temperature in order to reduce heat transfer loss by ensuring optimum volumetric efficiency, efficient combustion and adequate safety margin durability of mechanical components [5].

L Li, Y Luan, Z Wang and J Deng develop a simulation model for free piston engine alternator integrative power system. the key design parameters such as reciprocating mass of the piston assembly, compression ratio, the ignition timing, the engine fuel consumption rate and power output. It predict the performance parameter using free piston engine [6]. V Jadhav, S kanchan, K Kavathekar and S Thipse optimized the IC Engine by varying the compression ratio, valve lift profile, intake plenium volume, runner length, spark-advance timing, fuel injection location, exhaust pipe length and catalytic converter selection. The simulation was developed and the performance parameter was simulated and compared with experimental [7].W Zottin, P Bacchin and A Gracia developed a numerical simulation model for carbon build –up and oil consumption in a heavy duty diesel engine. It was develop to optimize the engine and components behaviours which are mainly responsible for emission and wear and tear [8]. F Millio , E Pautasso, P Pasero and S Barbero studied and developed a numerical simulation model for Advanced EGR control system for Automotive diesel engine. The result of simulation and experimental was compared and was found to be satisfactory [9]. E Shoukry, S Taylor, N Clarke and P Famouri has developed a simulation model for parametric study of a two stroke Direct Injection Linear engine . Parameters such as rate of combustion, convection heat transferred inside the cylinders, friction forces, external loads, acceleration, velocity profile, compression ratio, and in cylinder pressures were modeled [10]. G Morin, E Nicouleau-Bourles, F Simon and O Prince has developed an methodology that allows to validate and optimize field reliability during development and before start of production. These was developed based on the environmental issues, reliability and developement time reduction [11]. J Arias, E Varela, R Perez and E Navarro has developed simulation model of scavenging process in a two stroke tourbocharged diesel engine [12].

E Benavides, J Perez, R Herrero and E Arroyo developed a numerical simulation model for injection process in a two stroke diesel engine and later validated [13]. Jae Soon Lee, Hee Gag Lee, and Nak Won Sung has developed numerical simulation model for prediction of volumetric efficiency of diesel engine. Simulation model contains factors such as fluid flow in intake and exhaust manifolds[14].T Minagawa, H Kosaka and T Kamimoto has developed a numerical simulation model for Ignition delay of diesel fuel spray. This includes factors such asspray axis and spray periphery [15].

III. SIMULATION APPROACH

Indicated mean effective pressure (IMEP):

Indicated mean effective mean pressure is hypothetical pressure generated inside the cylinder. It is calculated from the indicator's diagram. Indicators diagram is plotted with P-V variation inside the cylinder of Diesel engine throughout the cycle. The average pressure generated in the combustion chamber during the power stroke is considered.

It is work done during power stroke divided by displacement volume.

IMEP= (P2*V2-P1*V1)/Vs;

Friction Mean Effective pressure (FMEP):

FMEP is defined as the power loss in the Engine during Diesel cycle process. All the losses are mention below.

(i) Mean effective pressure (MEP) lost to overcome friction due to gas pressure behind the rings.

(ii) Mean effective pressure absorbed in friction due to wall tension of rings.

(iii) MEP absorbed in friction due to piston and rings.

(iv) Blow-by loss.

(v) MEP lost in overcoming inlet and throttling losses.

(vi) MEP absorbed to overcome friction due to the valve gear.

(vii) MEP lost in pumping.

(viii) MEP absorbed in bearing friction.

(ix) MEP absorbed in overcoming the combustion chamber and wall pumping losses.

Brake Mean effective pressure (BMEP):

Brake Mean effective pressure is the average power output produced due to the pressure imposed uniformly on piston from the top to bottom of each power stroke.

As we know that Indicated mean effective pressure is the sum of Brake mean effective pressure and Friction mean effective pressure.

IMEP=BMEP+FMEP;

So from above relation we can find out the Brake mean effective pressure.

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Brake Mean effective pressure= Indicated Mean effective pressure-friction mean effective pressure.
BMEP=IMEP-FMEP;

Torque (T):

The tendency of a force to cause the rotational motion of a body. It is a twist turning force on an object.
Torque can be calculated from BMEP as follows.
T= (BMEP*A*L*K)/2*3.14;

Mechanical Efficiency (nv);

Mechanical Efficiency measures the performance of a engine in transforming the energy and power that is input to the engine into an output force.
nv=(BMEP)/(IMEP);

Thermal Efficiency (nt);

The efficiency of a engine measured by the ratio of work done by it to the heat supplied to it.
nt=W/Qh;
Qh=mf*CV.
mf=mass fuel flow rate.
CV=calorific value of fuel.

Brake Specific Fuel Consumption:

BSFC is a measure of the fuel efficiency of a engine which burns fuel and produce shaft power.
BSFC is the rate of fuel consumption to the power produced.
BSFC= mf/bp;
mf= fuel mass flow rate;
bp=brake power;

Pressure vs Crank angle (P vs CA):

We have to Measure Pressure inside the cylinder throughout diesel cycle.
Two-zone model views the entire combustion in to burned zone and unburned zone.
After amount of mass fraction burned inside the combustion chamber was found out, the next important parameter to find out is instantaneous Volume of the cylinder. This volume can be obtained by the equation in relation with the crank angle as:
Volume at any instant can be calculated by below given formula.

$$V_\theta = V_{disp} * \left[\frac{r}{r-1} - \frac{1-\cos\theta}{2} + \frac{L}{S} - \frac{1}{2}\sqrt{\left(\frac{2L}{s}\right)^2 - \sin^2\theta} \right]$$

Mass of burned fuel at any instant is given by:

$$x_b(\theta) = 1 - \exp\left[-a\left(\frac{\theta - \theta_0}{\Delta\theta} \right)^{m+1} \right] \quad 7$$

a. Compression process
During Compression process the pressure developed in cylinder is calculated by relating the instant volume to instant pressure. Same applies for Temperatures. Relation is shown below.

$$P_c(\theta) = P_{ivc}\left(\frac{V_{ivc}}{V(\theta)} \right)^{\gamma c} \quad 1$$

$$T_c(\theta) = T_{ivc}\left(\frac{V_{ivc}}{V(\theta)} \right)^{\gamma c - 1} \quad 2$$

b. Expansion process
During Expansion process the pressure developed in cylinder is calculated by relating the instant volume to instant pressure. Same applies for Temperatures. Relation is shown below.

$$P_e(\theta) = P_3\left(\frac{V_3}{V(\theta)} \right)^{\gamma e} \quad 4$$

$$T_e(\theta) = T_3\left(\frac{V_3}{V(\theta)} \right)^{\gamma e - 1} \quad 5$$

c. Combustion process
Pressure during the combustion process is calculated by using interpolating Compression and Expansion process.

$$P_{comb}(\theta) = (1 - x_b(\theta)).P_c(\theta) + x_b(\theta).P_e(\theta) \quad 8$$

d. And finally the pressure and temp outlet is calculated.

$$P_3 = P_2\left(\frac{T_3}{T_2} \right) \quad 6$$

IV. EXPERIMENTAL APPROACH

a. Dynamometer
b. Pressure Transducer
c. Crank angle encoder
d. DAQ
e. Speed acquisition

a. Dynamometer:

A dynamometer is a machine used for measuring the brake power and torque required to operate a drive engine.
Hydraulic dynamometer works on the principle of dissipating the power in fluid friction.
Hydraulic dynamometer consists of an impeller or rotating members coupled to the output shaft.

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The impeller in this dynamometer rotates in a casing filled with the fluid. Due to the centrifugal force developed in the outer casing, tends to revolve with the outer casing but it is resisted by a torque arm supporting the balance pressure developed.

The pressure difference developed is used measure the torque developed in engine. Then with the help of torque brake power is calculated.

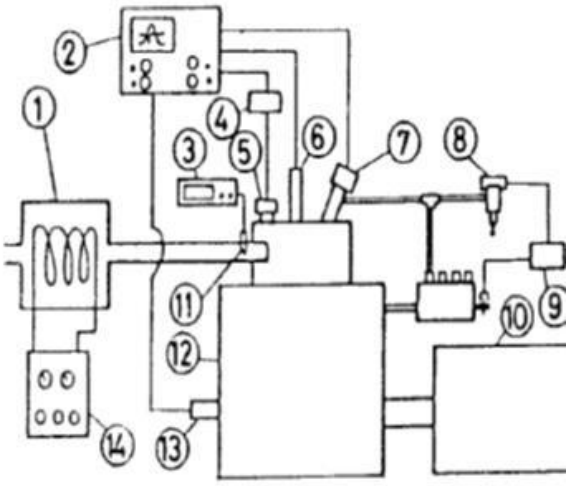

Fig.1: Schematic Diagram of Experimental Apparatus

b. Pressure Transducer:

To measure the pressure inside the cylinder, we have to place the pressure transducer in drilled hole near inlet valve. Then pressure transducer sends electrical signal to the amplifier which is then converted into digital form. The measure pressure is then correlated with the crank angle.

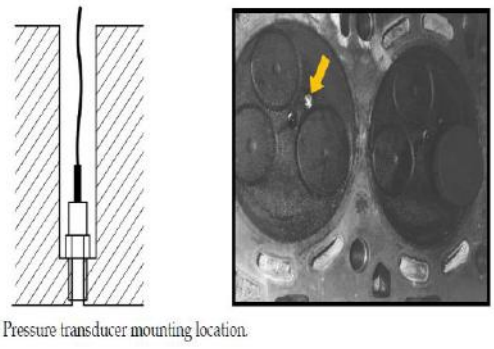

Fig.2: Pressure transducer mounting location

c. Crank angle encoder:

The crankshaft angle was measured with a resolution of 1 degree that is 720 data points per engine cycle. The sensor was mounted at the free end of the crankshaft. The crank angle data was sampled and converted to angle domain. Reference mark is marked on the one of the teeth. The position of crank is measured by passing rays on the incremental mark and the difference between the marked and rays deflected are calculated. Thus the position is found out.

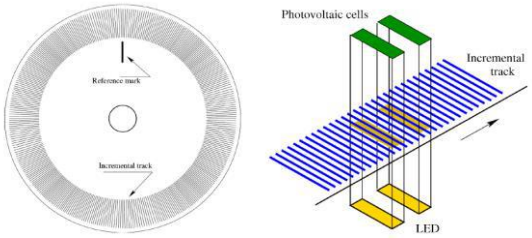

Fig.3: Optical Crank angle encoder.

d. Data Acquisition System:

A data acquisition system could be a device designed to live numerous parameters. the information acquisition system is often natural philosophy primarily based and it's fabricated from hardware and code. The hardware half encompass sensors, signal conditioners and information code.

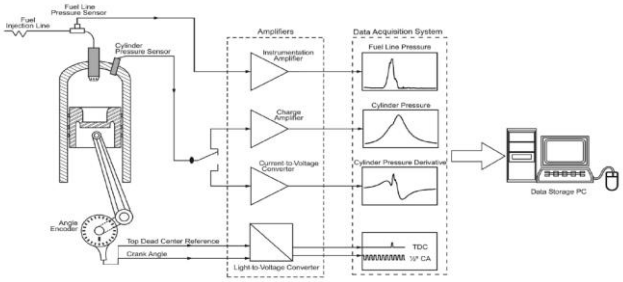

Fig.4: data acquisition system.

e. Speed Acquisition:

The speed is measured digitally at the shaft of the dynamometer by the use of a toothed wheel and a pulse generator. eg Tachometer, Eddy current.

The unit consists of a small permanent magnet with a coil round it. This magnetic pick up is placed near a metallic toothed rotor whose speed is to be measured. As the shaft rotates, the teeth pass in front of the pick-up and produce a change in the reluctance of the magnetic circuit. The field expands or collapses and a voltage is induced in the coil. The frequency of the pulses depends upon the number of teeth on the wheel and its speed of rotation. Since the number of teeth is known, the speed of rotation can be determined by measuring the pulse frequency. To accomplish this task, pulse is amplified and squared, and fed into a counter of frequency measuring unit.

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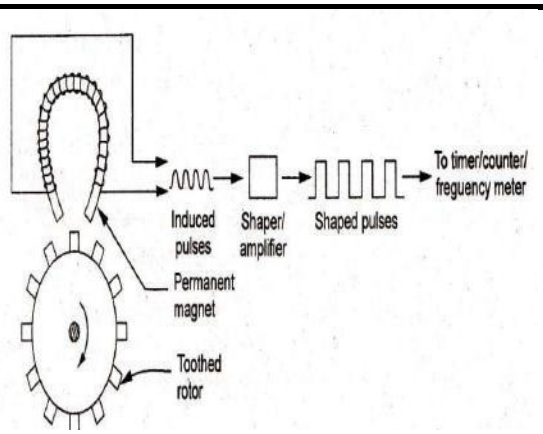

Fig.5: Magnetic RPM measuring instrument.

The following parameters will be determine by the Experimental setup step by step.

I. Measurement of N-(RPM).
II. Measurement of Brake Torque
III. Measurement of Brake Power.
IV. Measurement of Cylinder Pressure.
V. Measurement of Crank angle.
VI. Measurement of Brake specific Fuel Consumption.
VII. Measurement of Thermal Efficiency.
VIII. Measurement of Mechanical efficiency.

KARANJA BIO-DIESEL

An ever increasing demand of fuels has been a challenge for today's scientific employees. The fuel resources square measure dwindling day by day. Biodiesel appear to be an answer for future.

Pongamia pinnata is an exact supply of material as a result of its straightforward convenience in wild. Genus Pongamia pinnata is drought resistant, semi-deciduous, gas fixing herbaceous plant tree. Its height is regarding 16-20 meters with an oversized portion on top of the bottom that spreads equally wide. When trans-esterification of fossil fuel shows wonderful properties like hot worth, iodine range, cetane range and definite quantity etc.

A thick yellow – orange to brown oil is extracted from seed. Regarding pure gold of yield is obtained by mechanical expeller. The oil has bitter check and disagreeable aroma, thus it's thought of as a non-edible one. In our country this oil is used as a fuel for preparation and lamps. Additionally oil is employed as material, chemical and in soap creating industries. The oil has meditative worth within the treatment of rheumatism and in skin diseases.

Table.1: Physical and Chemical properties of karanja oil.

Physico-chemical Properties of Pongamia pinnata -crude oil

Property	Unit	Value
Color	-	Yellowish red
Odor	-	Characteristic odd odor
Density	gm/cc	0.924
Viscosity	mm^2/sec	40.2
Acid Value	mg/KOH	5.40
Iodine Value	-	87
Saponification Value	-	184
Calorific Value	Kcal/KG	8742
Specific Gravity	-	0.925
Unsaponifiable matter	-	2.9
Flash Point	^0C	225
Fire Point	^0C	230
Cloud Point	^0C	3.5
Pour Point	^0C	-3
Boiling Point	^0C	316
Cetane Number	-	42
Copper strip Corrosion	-	No Corrosion observed
Ash Content	in %	0.07

Table.2: Properties of karanja bio-diesel.

Properties of Karanja Methyl Ester-

Property	Unit	ASTM Test Method	Karanja Biodiesel	Diesel
Density	gm/cc	D1498	0.860	0.824
Calorific value	Kcal/KG	D240/ D 4868	3700	4285
Cetane Number	Number	D613	41.7	49
Acid Value	mg/KOH	D664	0.46	0.36
Iodine Value	Number	D1510	91	-
Water and sediments	% vol, max	D2709	0.005	-

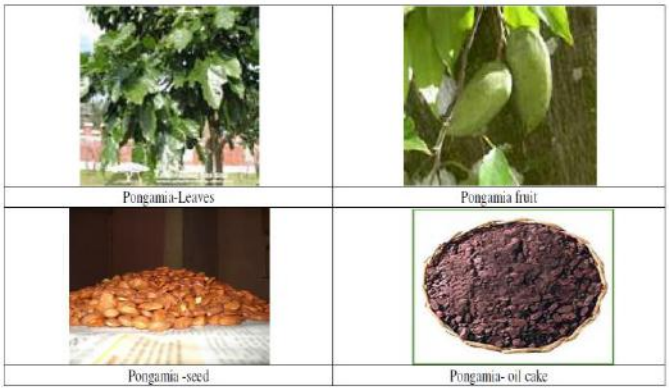

Fig.6: karanja leaves, pongamia fruit, seeds and oil cake.

V. RESULTS AND DISCUSSION

The result of numerical simulation and its validation are discussed below.

In study the performance parameter of CIDI engine is investigated with diesel and karanja bio-diesel. Performance parameter such as Torque, Brake horse power, Specific fuel consumption, Mech effic and Ther effic. Numerically simulated data is validated with the experimental data as shown below.

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a. Experimental data of CIDI Engine for diesel fuel.

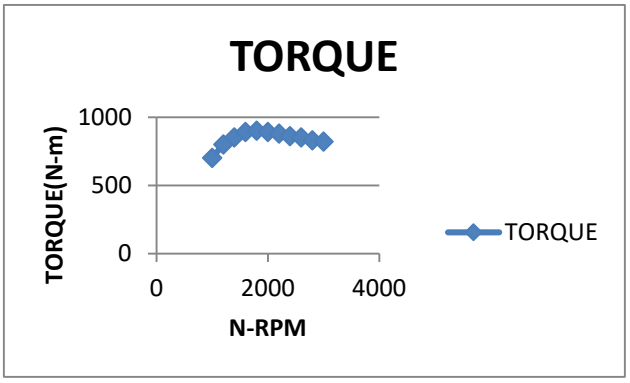

Fig.a:Torque vs RPM.

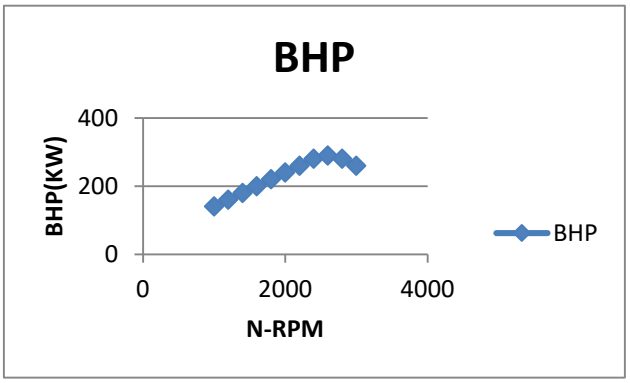

Fig.b: Brake Horse Power vs RPM.

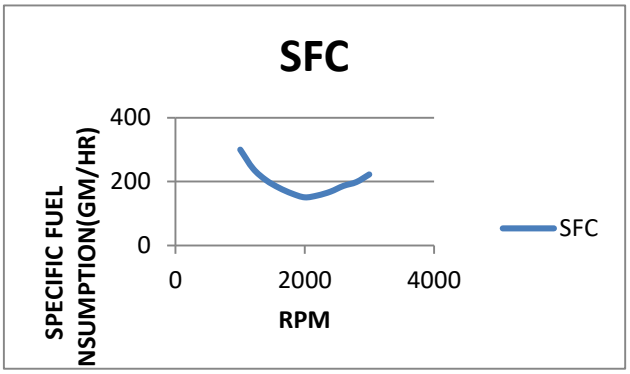

Fig.c: Specific fuel consumption vs RPM.

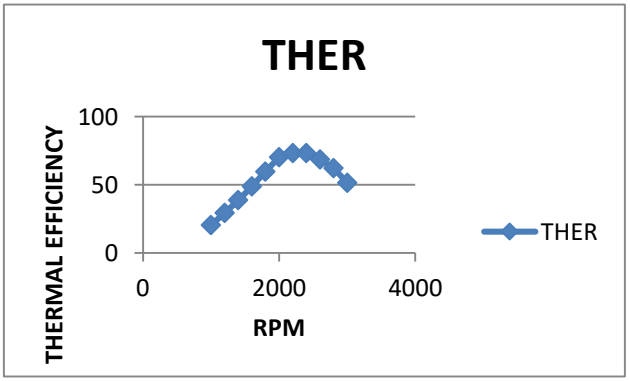

Fig.d:Thermal efficiency vs RPM.

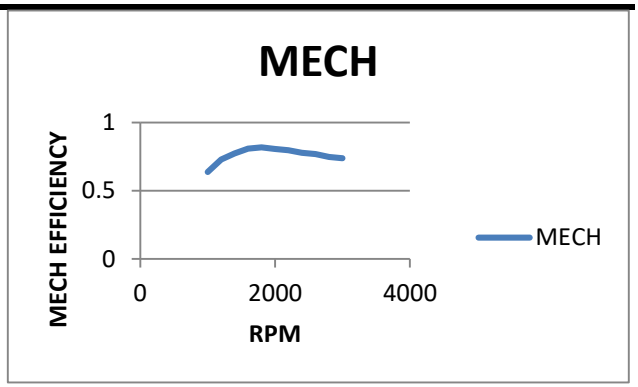

Fig.e:Mechanical efficiency vs RPM.

b. Comparison of Experimental and Simulated data for Diesel fuel.

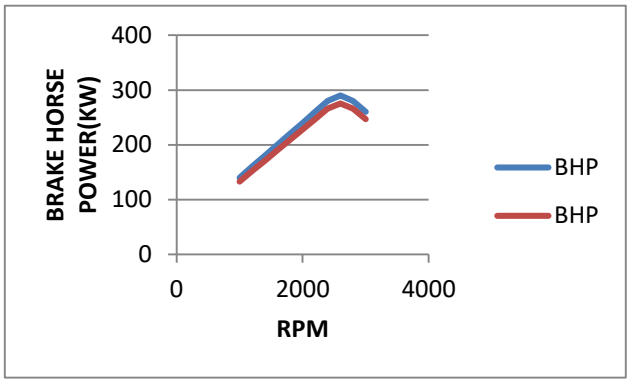

Fig.f: Brake Horse Power vs RPM.

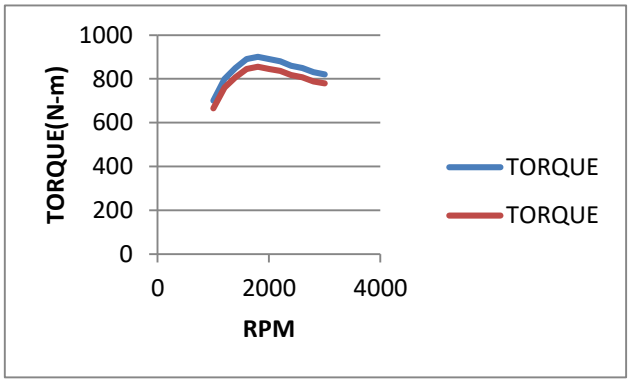

Fig.g:Torque vs RPM.

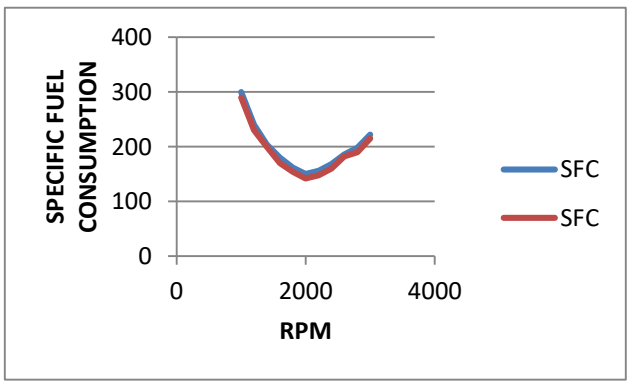

Fig.h: Specific fuel consumption vs RPM.

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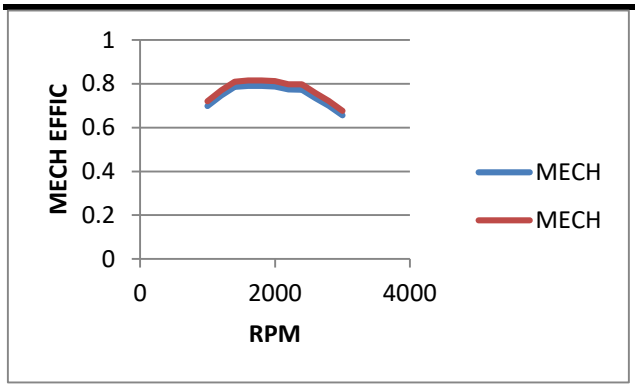

Fig.i:Mechanical efficiency vs RPM.

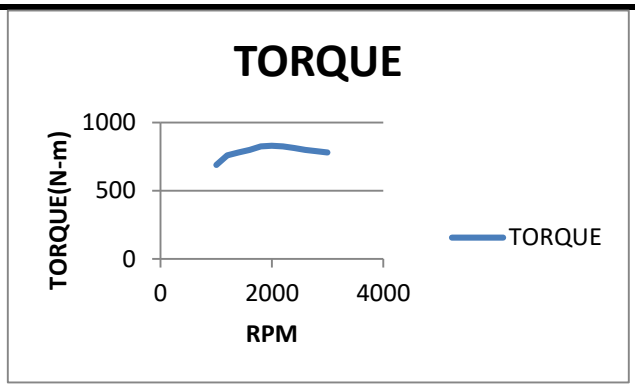

Fig.l:Torque vs RPM.

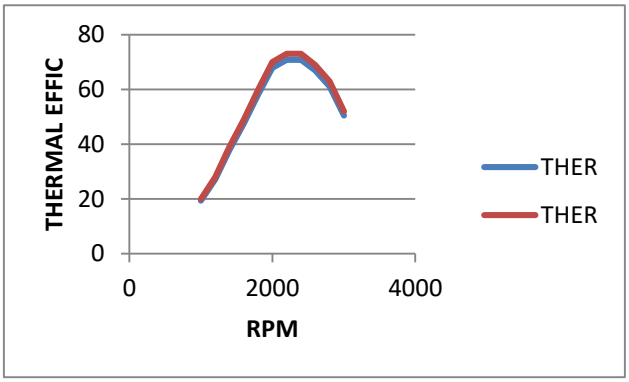

Fig.j:Thermal efficiency vs RPM.

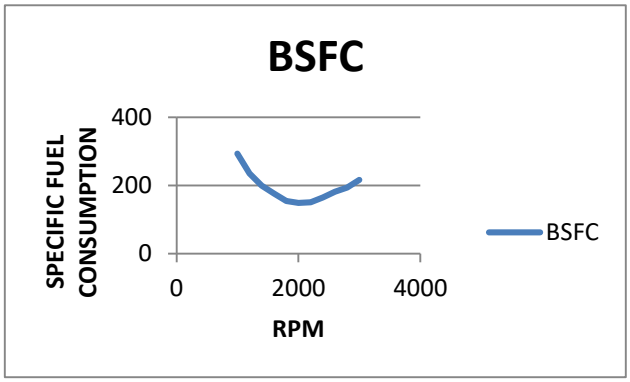

Fig.m: Specific fuel consumption vs RPM.

The numerically simulated data is plotted with the experimental data for performance parameter. The graph shows the effective result. The error between them is typically less than 5% which is good indication.

c. Experimental data of CIDI Engine for Karanja Bio-diesel.

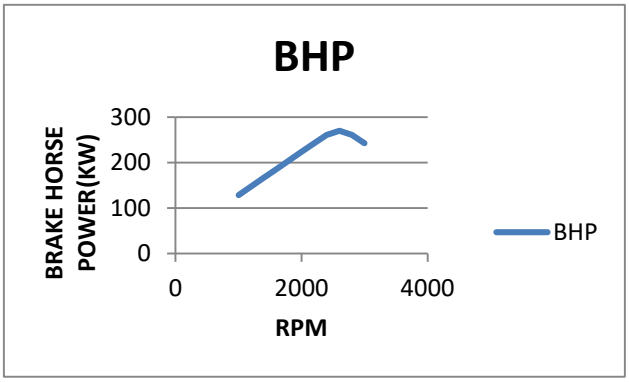

Fig.k: Brake Horse Power vs RPM.

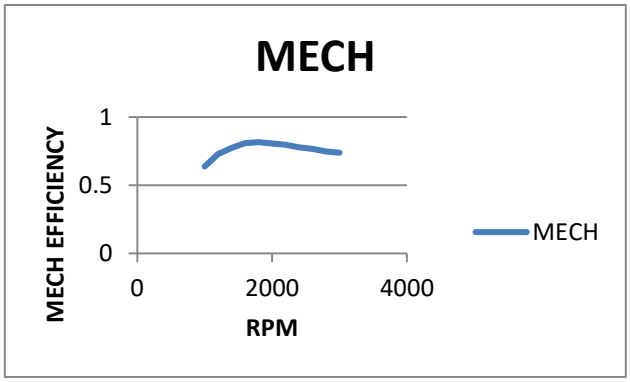

Fig.n:Mechanical efficiency vs RPM.

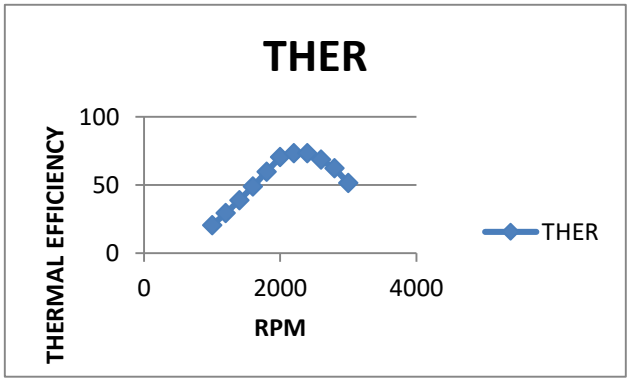

Fig.o:Thermal efficiency vs RPM.

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d. Comparison of Experimental and Simulated data

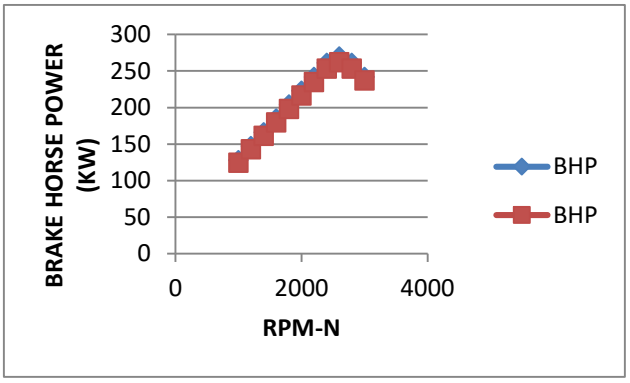

Fig.p: Brake Horse Power vs RPM.

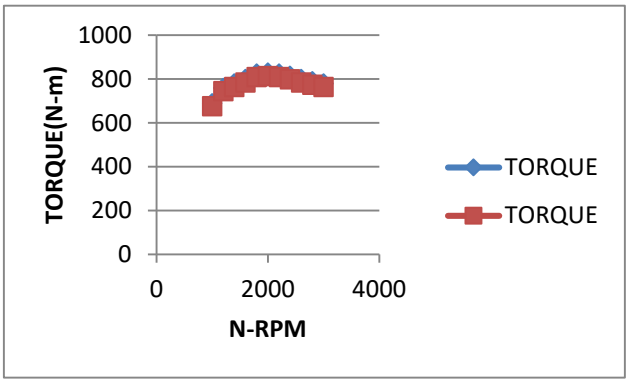

Fig.q:Torque vs RPM.

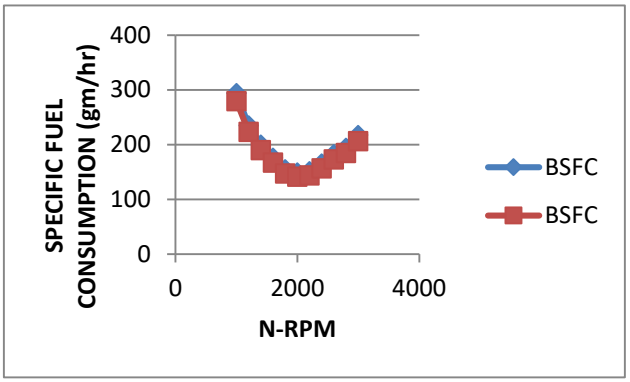

Fig.r: Specific fuel consumption vs RPM.

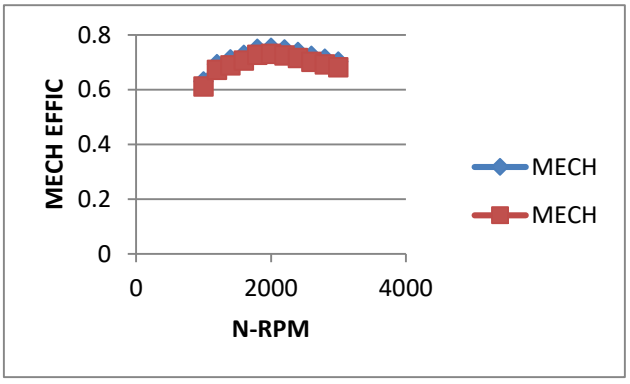

Fig.s:Mechanical efficiency vs RPM.

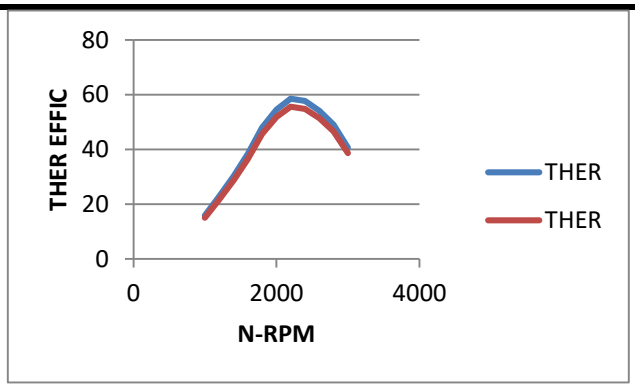

Fig.t:Thermal efficiency vs RPM.

The numerically simulated data is plotted with the experimental data for performance parameter. The graph shows the effective result. The error between them is typically less than 5% which is good indication.

VI. CONCLUSION

A Numerical simulation model was developed to investigate the performance parameter of Compression Ignition Diesel Injection (CIDI). Performance parameter such as Torque, brake horse power, specific fuel consumption, etc is formulated in the form of mathematical model. The model predicts the effective results, which has error percentage less than 5.

Karanja bio-diesel has slightly lower calorific value as compare to diesel.The comparison of biodiesel and karanja bio-diesel shows the comparative similar performance parameter, which shows that karanja bio-diesel can be a best alternative.

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Algebraic Learning through Caring Community Based On Lesson Study for Learning Community

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Abstract— *Algebraic material is still considered difficult by many students, especially for those in junior high schools. They still find it difficult to understand and solve algebraiv problems. This happens because their level of understanding for algebraic material is still low, therefore it takes the participation of many parties, including peers and parents, to overcome this problem (caring community based learning). This study aims to improve the students' understanding of the algebraic concept and to minimize the errors that occur in solving algebra problems. The study was conducted in 3 cycles, each cycle consisted of 3 phases, ie plan - do - see, in accordance with the learning cycle in the lesson study. The subjects of this research were 32 students of VII G class of MTs Negeri 2 Jember in the 2017/2018 academic year. Data collection techniques used were observation, tests and documentation. The data were analyzed using descriptive qualitative method through three steps: data reduction, data presentation and conclusion. The results showed that there was a high confidence increase in learning among the students and the "care" occured in the learning process. The students' understanding and mastery of algebraic material were also improved through caring community based lesson study for learning community.*

Keywords— Algebra, lesson study, learning community, and caring community.

I. INTRODUCTION

Mathematics plays an important role in education. Hence, it was given to students since primary school to equip them with logical, analytical and systematic thinking skills. One of the competencies that students must master when learning mathematics is algebra. Algebraic form is one of the mandatory requirements that must be mastered in order to be able to solve math problems. Generally, math problems can not be separated from this particular material. The algebraic form is a mathematical form in which it contains variables or constants.

Whether we realize it or not, everyone must have used the concept of algebra in their lives, especially for those who have gone through education, but the facts on the ground show alarming results in algebra learning. Many students ask their teacher to repeat the explanation in every algebra learning process and many students still often make mistakes in working on issues related to algebra.

Many previous studies have suggested that students find it difficult to understand the concept of algebra that leads to the errors of the basic concept of algebra. Irwitadia Hasibuan (2015), in her journal, mentions that students have not mastered algebraic material since the students who mastered algebraic material only get score below 85% that is only 3.7% and individually, students have not mastered algebraic material because only 19 students (70.4%) who achieved the minimum standard score. Ramadhani (2015) also points out that the most common mistake in the concept of addition and subtraction of algebraic form is 63%. This shows that students' mastery of algebraic material is still low so that the algebra learning strategy that brings the students into more understanding is needed. One of the learning strategy that can be applied in algebraic material is caring community, as it has been applied in Japan.

Caring community is one of the three lessons learnt in lesson study (the two others were collaborative learning and and jump task). The LS was first developed in Japan more than 100 years ago and has been applying it ever since. In Indonesia, Lesson Study activities have been initiated since around 2004/2005 along with IMSTEP program implementation (1998-2005). Based on the survey results of the implementation and impact of Lesson Study in 2012 and BIMTEK outcomes in 2013, it was concluded that the Lesson Study activities in general have been able to increase the quality of lecturing and competence processes.

Caring community based learning is based on the Vygotsky-Bruner theory (meaning of knowledge), active, collaborative, and reflection. High quality learning, namely: (1) authentic learning, (2) collaborative learning

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(listening), Zone of Proximal Development (ZPD) - collaborative - jumping (not a book assignment). In practice, caring communities do not question educational inputs and outputs, but rather the process called illumination models, therefore there is no need to assess the learning outcomes of each learning activity (Hobri: 2016). Caring Community vision are: in learning students should not be left alone or "none of the students are neglected". Teachers should know, care to, and educate the students by facilitating them to learn in collaborative form. Three philosophies of learning community are: (1) public philosophy, meaning that all parties are school reformers; teachers do "open class" more than 1 times a year; (2) democratic philosophy, meaning that the purpose of school education is how students learn and live cooperatively with others, (3) excellent philosophy, that is by doing the best for learning and teaching.

Caring community implementation will bring up and build a *caring* community in a class. Students in one class are divided into several small groups of 3-4 students, where they build a sense of care for other students in the group, and finally for other students in other groups so that there is a sense of *caring* among all students in one class. The teacher also participates in the community so that the care between teachers, teachers with students, and students with students will be intertwined.

Jennifer Stepanek (2000) mentions in her book that there are two ways that the caring concept can be applied to learning. First, there is a sense that students should be noticed, and the second the students' care for each other. This is important in building the trust, security, and collaboration needed to pursue math and science problems. The *caring* also involves relationships between students with the disciplines of mathematics and science. Since the students cares about the content and ideas they are learning, they create an emotional investment that brings energy and joy to pursue a knowledge.

In addition to the formation of *caring* among students and teachers-students, there is also a need for involvement and care of other people such as parents or guardians. According to Sue Bredekamp (2014), caring community is a group or class in which children and adults engage in a positive relationship, treating each other with respect; and learn from and with each other.

In the caring community based learning on the subject of algebraic form, students in a group are required to ask or express opinions in terms of reflecting on their thoughts on the understanding of the concept of variables, constants, and algebraic terms. All students in one group will communicate with each other about the algebraic form and then write them on a piece of paper. The *caring* that are built not only occur among students in one group, but also between one group with another group, so that the so-called "mathematical communication" will also occur among students in one class.

The *caring* built will encourage the communication both students-students and teacher-students, so that the students will be motivated to learn and finally make the learning process more fun. The students will often reveal all their ideas in learning algebra and will interpret them in an answer on the issues of algebraic incomprehension. In addition, the student will often respond to a statement/problem in the form of a convincing argument. Therefore, the research problem of this research is whether there is an increase in the students' achievement in the mathematics lesson of algebra materials in VII class of MTs Negeri 2 Jember through caring community based learning. The objective is to improve understanding of algebra concept and to improve the students' achievement in the basic concept of algebraic form and its operation. In addition, to minimize errors in solving algebra problems..

II. METHODOLOGY

The research was conducted using qualitative approach with classroom action research design. The study was conducted in 3 cycles, each cycle consisted of 3 phases, ie *plan - do - see*, in accordance with the learning cycle in the lesson study. The material in cycle 1 was about the introduction to algebraic forms, cycle 2 was about addition and subtraction operations of algebra, and in cycle 3 the students learnt about multiplication and division operations of algebra. This research was conducted in MTs Negeri 2 Jember in the 2017/2018 academic year, with 32 students of VII G class as the subjects. Data collection methods used were observation, test and documentation. This observation was carried out using direct observation of the teaching and learning activities of the students especially in terms of performing the *plan*, *do* and *see* stages. The activities in the *plan* stage consisted of the making of lesson plan (Indonesian: *Rencana Proses Pembelajaran*, RPP) and Student Worksheet (Indonesian: *Lembar Kerja Siswa*, LKS) with other experienced math teachers. In the *do* stage, learning activities were carried out in accordance with the plan in the *plan* phase. While the *see* phase reflected the learning process that had been implemented related to the students' activities, *caring* among students and learning outcomes. Collection of test data was used to determine the students' achievement, while documentation was used to record all learning processes. Instruments were in the form of observation guidelines and achievement test. The validity of the data was obtained by triangulation of source and method. Data analysis was done descriptive qualitatively through data reduction, data presentation, and conclusion or verification.

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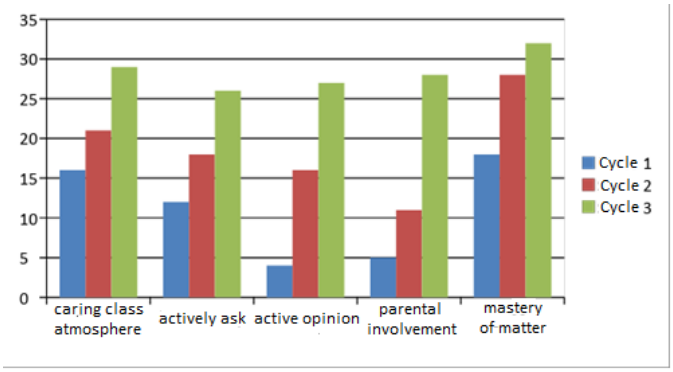
III. RESULTS

The study was conducted in VII G class with 32 students. The result was presented as follows:

No	Indicators	Number of Students		
		Cycle 1	Cycle 2	Cycle 3
1	Caring to the class situation and condition	16	21	29
2	Actively asking during the teaching and learning process	12	18	26
3	Actively expressing opinions	4	16	27
4	Involving the parents/guardians in the home in learning algebra	5	11	28
5	Mastering algebraic material	18	28	32

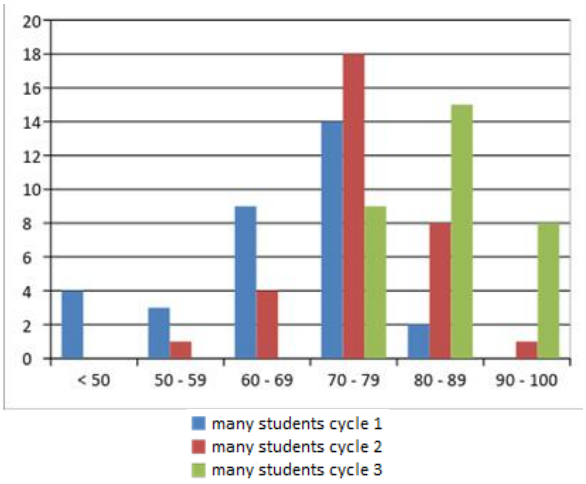


Picture 1. Caring community based learning diagram

The students' sense of careness towards the classroom increased, in cycle 1: 16 students, 2: 21 students, 31.25% and 3: 29 students, increased to 38.09%. The students' level of activeness in asking either to friends in the same group or the others, or ask teachers in cycle 1: 12 students, cycle 2: 18 students increased to 50%, and cycle 3 26 students increased to 44.44%. The students' level of activeness in expressing opinion or helping friends in the group or outside the group who have not understood the material, in cycle 1: 4 students, cycle 2: 16 students increased fourfold or 300%, cycle 3: 11 students rose 68, 75%. Parents / guardians involved in learning their children at home in cycle 1: 5 students cycle, cycle 2: 11 students up 120%, cycle 3: 28 students up 154.5%. Mastery of material achieved in cycle 1: 18 students, cycle 2: 28 students rose 55.56%, and cycle 3: 32 students rose 14.28%.

Meanwhile, the results of achievement test were presented below:

NO	Score Range	Number of Students		
		Cycle 1	Cycle 2	Cycle 3
1	< 50	4	0	0
2	50 – 59	3	1	0
3	60 – 69	9	4	0
4	70 – 79	14	18	9
5	80 – 89	2	8	15
6	90 – 100	0	1	8
TOTAL		32	32	32



Picture 2. The result of achievement test after the implementation of caring community based learning

In cycle 1, the students who achieved score 70 or greater were 16 students and those who did not achieve were 16 students. Therefore, half of the students did not achieve the minimum standard score. The average score in cycle 1 was 65.1. In cycle 2, the students who achieved score 70 or greater were 27 students and those who did not achieve were 5 students. The average score in cycle 2 was 75.1. In cycle 3, the students who achieved score 70 or greater were 32 students and the average score in cycle 3 was 83.5. From cycle 1 to cycle 2 there was an increase by 15.36%, and from cycle 2 to cycle 3 there was an increase by 11.19%.

IV. DISCUSSION

Cycle 1

Cycle 1 began with a *plan* conducted by researchers together with other mathematics teachers, Arif Setyo Purnomo, S.Pd., M.Si. and Rika Nurul Barokah, S.Si. This stage started with the making of Lesson Plan (RPP), Student Worksheet (LKS) and the test. The activities in this stage included the designing of the steps to learn algebra through caring community based learning in accordance with the Curriculum 2013, preparing the

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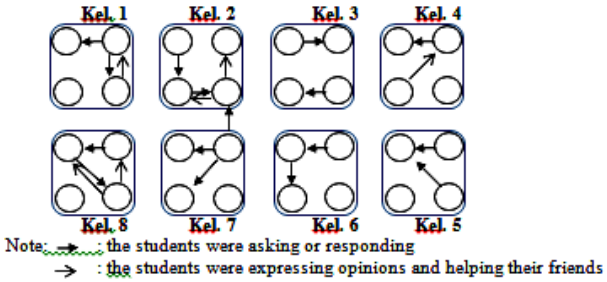
supporting media, and determining the number of possible meetings. After the *plan* was conducted, *do* stage in cycle 1 was held on September 19th, 2017, at 08.50-10.10 WIB in VII G class. As usual, the teacher conditioned the class and conducted pre-learning. The students were divided into 8 groups, each group consisted of 4 students. The teacher provided initial material stimulus for algebra in the form of a sheet containing algebraic table and things that needed to be filled related to learning algebra based on caring community, whether related to group discussion, inter-group, discussion with teacher or stuff related to parent involvement in home learning.

After the *do* was conducted, then the next was the *see*/reflection stage. Some of the results obtained from the discussion of reflection on this cycle were: the learning conducted did not run properly with the plan, for example in the caring community based learning, the students still felt embarrassed in discussing, asking and giving opinions, so that the *caring* did not work optimally.

According to the results of the observations and test results above, the *care* of students towards the classroom atmosphere had not yet emerged. Similarly, the *caring* among students, whether asking or even expressing opinions, was still far from the word *care* itself. When they returned to their homes, the parents/guardians who really *cared* about the lessons their children have learnt in school were few. This resulted in low level of understanding and mastery of algebraic material among these students and many of their scores were under the minimum standard score (70), i.e 16 out of 32 students. The average score obtained from the test result was 65.1, which was below 70 (the minimum standard score).



Picture 3. Illustration chart of learning process in cycle 1

In relation to the problems found in cycle 1, cycle 2 therefore was conducted.

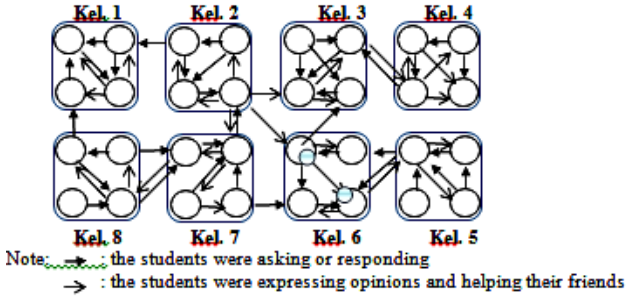
Cycle 2

Cycle 2 began with the plan to solve problems found in cycle 1. This *plan* phase began by revising the RPP that had been made in accordance with the results of cycle 1, as well as the making of RPP and LKS material about algebra addition and subtraction operations through caring community based learning and Curriculum 2013.

Cycle 2's *do* was held on 21th September 2017, at 07.30-08.50 WIB in VII G class. The implementation of the stage did better than the implementation in cycle 1. The *caring* among the students had started to appear although not all of them were affected by it. Group discussions both inside and outside their own groups had begun to appear, they also started to ask or express their opinions.

After *do*, the next stage was the *see*/reflection stage. Some of the things that came out from the discussion of reflection in this cycle are: learning had been carried out in accordance with the plan. The learning done has been executed by the teacher coherently, the organizing time was good, the students' conditioning in the group and in the class was also very good. The improvement plan from cycle 1 for cycle 2 had been implemented. The process of the students' action was better as well, but the students' achievement had not seen optimal results because there were 5 students whose scores were still under the minimum standard score.

The *caring* sense of the students toward the atmosphere of the class had begun to emerge. Similarly, the *caring* among students, either when asking or even expressing an opinion, was already there. Those who actively asked on cycle 2 were 18 students, which saw an increase from cycle 1 (12 students), while those who actively expressed their opinions and helped their friends were 18 students (4 students in cycle 1). The *caring* parents/guardians who paid attention to what their children had done in the school has increased from 5 to 11 students. This resulted in the increase of the number of the students who achieved the minimum standard score (70), which was 27 students. The average score obtained in cycle 2 was 75.1, which was better than cycle 1 that was 65.1. This meant that there was an increase around 15.36% from cycle 1 to cycle 2



Picture 4. Illustration chart of learning process in cycle 2

Since there were some students who still had not achieve the minimum standard score in cycle 2, cycle 3 was badly needed to be applied so that the algebraic teaching and learning process using caring community based learning showed optimal results.

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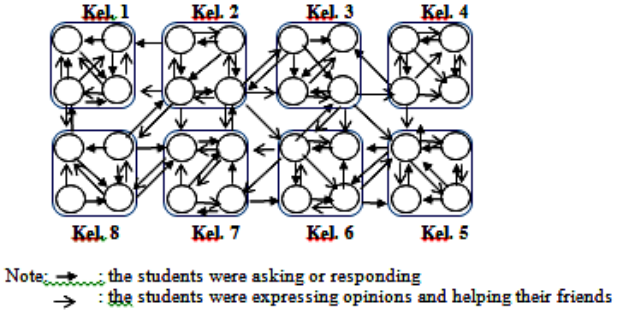
Cycle 3

Similar to previous cycles, cycle 3 began with a plan conducted by researchers and other mathematics teacher to solve any problems found in cycle 2. This *plan* phase began by revising the previous RPP, and made RPP and LKS for algebra multiplication and division which was adjusted to the results of reflection in cycle 2. Preparation of RPP included the steps for applying the caring community based learning through the Curriculum 2013.

After the *do* was conducted, the next step was the *see* / reflection stage. Some of the things obtained from the results of reflection discussion on this cycle were: In this third cycle, the students' self-confidence increased which resulted in the positive communication among the students. A total of 32 students in the class also understood and mastered the algebraic material. In addition, the learning achievement had increased compared to before the caring community based learning action was applied. This is in accordance with the results of the observations and the tests above, there were 29 students who showed the *caring* sense for the classroom atmosphere and 26 students who actively asked among students either in one group or another group. There were a total of 27 students who had the confidence to express ideas and opinions in the process of learning algebra. When the students returned home, there were 28 *caring* parents/guardians who cared what their child had done at school. This resulted in the good mastery of the algebraic learning among the students and all of them achieved 70 (the minimum standard score) or greater. The average score obtained from the test result was 83.5, which saw an increase from the previous cycles (from cycle 2 to 11.19% and from cycle 1 of 28.26%).



Picture 5. Illustration chart of learning process in cycle 3

Based on the results in cycle 3, the algebra learning using the caring community based learning showed satisfactory results. A learning that emphasizes the careness between the students is badly needed, because the careness among the students and the careness from the teachers and parents/guardians will trigger the enthusiasm of learning and communication so that the students have a sense of empathy, care and confidence in asking and learning algebra in particular, and learning mathematics in general.

A groups that actively asked questions, expressed opinions, responded to opinions of other students were Group 2 (Kel. 2 in the pictures). There was one particular student who *cared* very much about his friends either the same group or friends in other groups. In Group 8 (Kel. 8 in the pictures), there was one particular student who did not *care* about the learning. After his house was surveyed, it was found out that the parents of the student have been divorced, the father married again and the mother work abroad. He is now living with his grandmother. Maybe that is one of the reasons why the student did not *care* in the process of learning algebra.

The uniqueness of caring community based learning is shown in Picture 5. The careness was not dominated only between the members of the same group, but also between the closest groups. In one group, the students ask other students who have understood and mastered the material; the students guided other students who did not understand and then expressed their opinions. There were also students who responded to opinions that had been expressed. So there was a discussion among students in one group by promoting the *careness*. Similarly, the interaction between groups caused a sense of *careness* while asking, guiding, and responding. This is why the algebra learning became more active and the students' understanding of algebra also increased, the communication between them related to algebra during the teaching learning process also increased.

V. CONCLUSION AND SUGGESTIONS

The conclusion of this research is that caring community based learning is very effective, not only it can improve students' understanding and achievement, but also improve their confidence in communicating. Viewed from the observation about the learning process that had been done, there was always an improvement from cycle 1 to cycle 2, and from cycle 2 to cycle 3. Meanwhile, the results of the students' achievement also increased, from cycle 1 to cycle 2 it increased by 15.36%, while in cycle 2 to cycle 3 it increased by 11.19%.

The implementation of caring community based learning research can be continued with different material, or the same material (about algebra) but with different subjects, so that the sense of *careness*, self-confidence and the students' communication appear in the learning.

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Support Vector Machine based Image Classification for Deaf and Mute People

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Abstract—*A hand gesture recognition system provides a natural, innovative and modern way of nonverbal communication. It has a wide area of application in human computer interaction and sign language. The whole system consists of three components: hand detection, gesture recognition and human-computer interaction (HCI) based on recognition; in the existing technique, ANFIS(adaptive neuro-fuzzy interface system) to recognize gestures and makes it attainable to identify relatively complex gestures were used. But the complexity is high and performance is low. To achieve high accuracy and high performance with less complexity, a gray illumination technique is introduced in the proposed Hand gesture recognition. Here, live video is converted into frames and resize the frame, then apply gray illumination algorithm for color balancing in order to separate the skin separately. Then morphological feature extraction operation is carried out. After that support vector machine (SVM) train and testing process are carried out for gesture recognition. Finally, the character sound is played as audio output.*

Keywords—-Sign language, SVM (support vector machine), gesture recognition, feature extraction, gray illumination algorithm.

I. INTRODUCTION

There are only about 250 certified sign languages interpreters in India, translating for a deaf population of between 1.8 million and 7 million.(the wide range in population estimates exist because the Indian in 2017 census does not track the member of deaf people instead, it documents an aggregate member of people in disabilities)[1].There are about 70million deaf people who use sign languages as the first language and mother tongue to many hearing people and some deaf blind people (tactile sign language).Each country has one or sometimes two or more sign language, although different sign language can share the same linguistic root in the same way as the spoken languages do[2]. As per the research done in sign languages, data glove using sensor and vision based these are the common primary approach which has been used to recognize sign languages. In this sensor based approach, the user has to put on the gloves on the hand which contain the load of cables that is connected to the system. These gloves are found with high-price and this glove is difficult to get everywhere. Thus, vision based approach basically works on dataset containing the sign hand gestures images that are captured by camera. This vision based method gives a basic environment to the user and this reduces the problems as such in the glove based method. The pre-eminent feature of persons hand gesture has been summarized by their dynamic property and multi-attribute property [3].

The previous method used was the ANFIS (adaptive neuro-fuzzy interface system), this provides the high complexity and their performance is low. Thus we have used the new technique called gray illumination method and in this method we reduce the complexity and increase the performance. This consist of skin filtering, morphological feature extraction method, suitable vector machine and the trained hand gestures in order to strongly develop the hand gesture recognition for the physically challenged people (deaf and dumb).As we know that the way of living for the normal person and physically challenged person has become arduous and the only reason for this is the language understanding between two person. This physically challenged people's one of the most difficult way for surviving is that they cannot work with the normal society people because the proper communication between them is strenuous. These inability people are not able to do their basic schooling properly along with the normal people. Thus this becomes the main reason to have a different world for them and they are not able to mingle with the normal society people so can happily promise them an independent and happy life without the help of human translator to translate between the normal and physically challenged person.

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II. LITERATURE SURVEY

The formation of sign language is by the combination of hand gesture, facial expression and body language together, the performance of the sign gesture mostly depends on the hand and henceforth most of the research work is working on extracting the hand gestures [4]. But, when compared to other sign language immensely less research work has been done on our Indian sign language and this is because of lack of standard dataset.

Jyoeeta Singha [5] propounded a method for ceaseless video string of the signs. In this they have used segmentation, in which first skin filtering is used that gives the skin terrain i.e. it will take the only skin image of the hand from the image and then they have used histogram matching algorithm. For the future feature extraction Eigen values and the Eigen vectors technique is used. Thus in order to classify the signs properly this Eigen value weighted Euclidean distance technique is been used. This system gives 86.25% recollection rate for the future use.

P. V. V. kishore [6] has proposed a Discrete Wavelet transform which is based on the fusion algorithm. In this the edges of the hand province has been detected from video surge and for this they took the fusion of discrete wavelet transform method and prudent edge detection technique. Further the hand and head shape features are been extricate from the videos by using Elliptical Fourier descriptors. In the end, the fuzzy inference system was used to train the network that gives 84% accuracy.

Anup Nandy [7] posit a real time categorization of Indian Sign Language. Here in this paper, they have straightly used segmented frames, then they have used extracted features of hand region by using direction histogram and these features are used for classification stretch. Using feature vector in enactment phase they have used two classifiers- Euclidean distance and K nearest neighbor for gesture recognition. They have achieved superior results from K nearest neighbor metrics. The posit system [8], uses ANFIS (Adaptive neuro inference system), PDIST (Pair wise distance) and Neural networks are used for classification. ANFIS gives more appropriate outcome as juxtaposed to other two techniques. The propound system [9], transforms the RGB image into gray scale image and apply thresholding algorithm on gray scale image. Image accommodate black color for backdrop and white for forepart that culmination the wanted features. They performed on edge detection. For recognition, they used if-then law.

To attempt to break the obstacle of communication blockade between normal and deaf-mute people; the system proffer a communication application which helps both normal and deaf-mute people explicitly commune with each other without any help of other human transcriber. This paper is further constructed into the following segments.

III. EXISTING SYSTEM

In the existing work, develop a real-time gesture-based HCI system that recognizes gestures only using one monocular camera and extend the system to the HRI case. The developed system relies on a ANFIS classifier to learn features and to recognize gestures. We employ a series of steps to process the image and to segment the hand region before feeding it to the ANFIS classifier in order to improve the performance of the classifier. Gesture images are collected to test and demonstrate that the ANFIS classifier combined with our image processing steps can recognize gestures with low accuracy. The usage of the ANFIS frees us from extracting the gesture features manually and improves the recognition accuracy. Besides, the Kalman filter is used to smooth the motion of the mouse cursor controlled by the hand[9].

Disadvantages:

- High complexity
- Low performance
- Low accuracy

IV. PROPOSED SYSTEM

Live video is given as input for both training and testing phases. After that the video is converted into frames and resized the frame individually. After that filter the skin by using gray illumination algorithm. Then Morphological feature extraction is performed for both train and test frames. The matching between train and test features are find to recognize the gesture. Support vector machine is used for gesture recognition. Finally, the character sound (gesture recognition output) is given as audio output.

Advantages:

- Low complexity
- High performance
- High accuracy
- False recognition rate is low

A. SOFTWARE REQUIREMENT

1. Mat lab R2015b

B. HARDWARE SYSTEM CONFIGURATION

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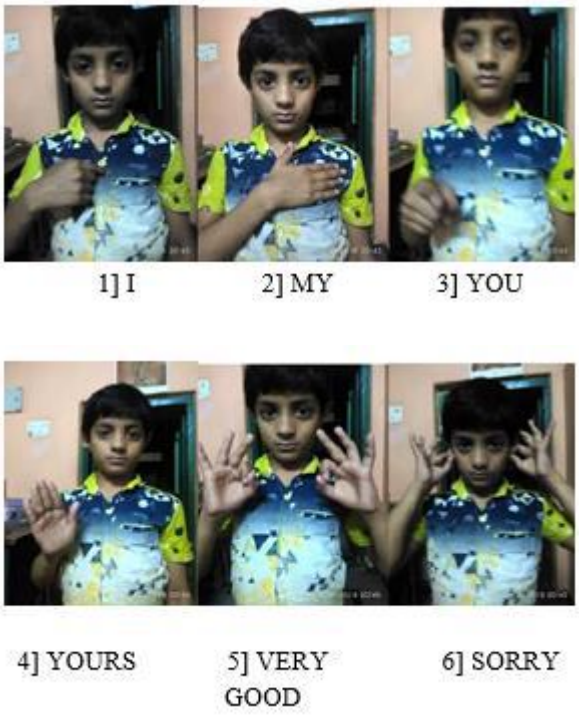
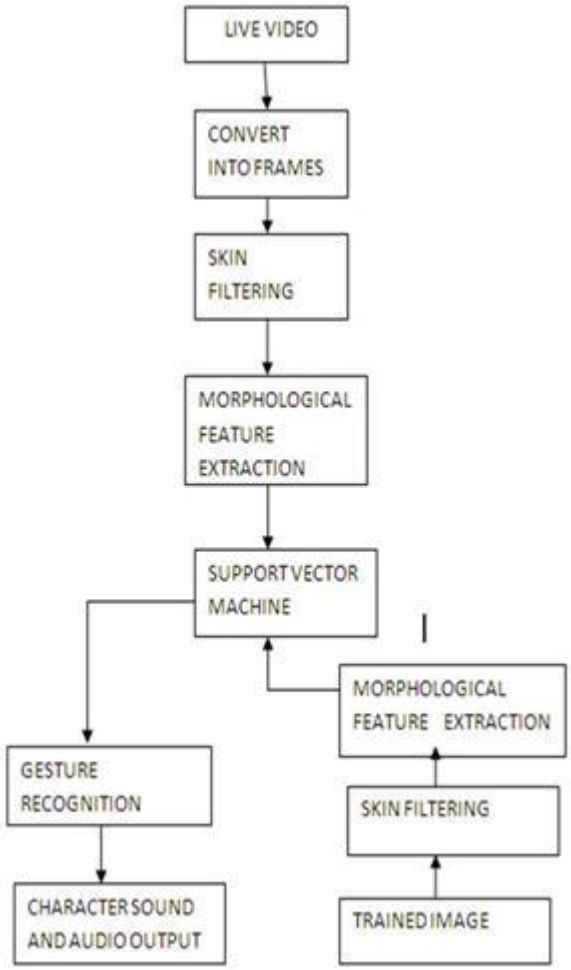
1. Processor - Pentium –III
2. Speed - 1.1 GHz
3. RAM - 256 MB (min)
4. Hard Disk - 20 GB
5. Floppy Drive - 1.44 MB
6. Key Board - Standard Windows

Keyboard

For showing particular gesture as given below diagram



Dia.1: Different sign language using one or both of the hands



Dia.2: Block Diagram

I. SYSTEM DESCRIPTION

The Indian Sign Language is very essential for deaf and dumb people because using these gesture language impaired people can convey their feelings and thinking as like normal people, and for this reason the posit system delivered a pre-recorded video frames of Indian Sign Language words by using one or both of the hands

A. SYSTEM DESCRIPTION

As shown in below diagram 2 here the Posit system delivers four main pace- Video pre-processing, Segmentation, Morphological feature extraction, and Support vector machine.

B. VIDEO PRE PROCESSING

Preprocessing is not a obligatory step. This process is used only when the image is distorted.it consists of a number of

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strides to make the raw features which is used for recognizer.

It is mainly used for eviction of noise, deblurr, reshape and resize the image.

In this preprocessing stage, each frame are given as the input and this each frames come from the convertion of video. Now the pre-processing technique has been applied to this frames which are further parted into two divisions which are named as segmentation and filtering. In order to filter the skin we have used a technique called gray illumission algorithm. Generally, skin filtering technique has applied in input video frames in order to detect the gesture from the framework of the image. Therefore, skin color filtering technique segregate skin color sector from non-skin color sector [10].

C. SEGMENTATION

In computer vision, image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels, also known as super-pixels). The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics [11]

D. MORPHOLOGICAL FEATURE

The arithmetic morphological analysis has been performed to reduce noise signal. However, the improper selection of length of the structure element (SE) will have considerable influence on effectiveness of fault feature extraction. Besides, the classification of fault type is a remarkable step in intelligent unsatisfactory diagnosis, and many approaches have already been prospered, such as support vector machine (SVM). This study prefers an intelligent fault diagnosis plan that unites the extraction of morphological feature and support vector regression (SVR) classifier. The vibration signal is first performed using variant scales of morphological analysis, where the size of SE is determined robustly. Thence, nine statistical features are extracted from the progressed signal [12].

E. MORPHOLOGICAL ANALYSIS

Serra initially established morphological analysis in 1982 and used SEs to accumulate the information or disfigure the shape of an image. Morphological analysis has been endorsed to exhibit a superlative execution in denoising. This method performs with two basic operators as given below:

Erosion

$$(f\Theta g)(n) = \min\left[f(n+m) - g(m)\right],\ m = 0,1,2,\ldots,M-1,\ n = 0,1,2,\ldots,N-1$$

Dilation

$$(f \oplus g)(n) = \max\left[f(n-m) + g(m)\right],\ m = 0,1,2,\ldots,M-1,\ n = 0,1,2,\ldots,N-1,$$

Where(n) is the original one-dimensional vibration signal, and g(n) is the SE, are the operators of erosion and dilation, separately Erosion computation is used to smooth and suppress the negative and positive impacts, respectively. By contrast, dilation calculation is used to flatten and suppress the positive and negative impacts, respectively.

Opening

$$(f \circ g)(n) = (f\Theta g \oplus g)(n),\quad n = 0,1,2,\ldots,N-1$$

Closing

$$(f \bullet g)(n) = (f \oplus g\Theta g)(n),\quad n = 0,1,2,\ldots,N-1,$$

of which all gadgets are GREEN and to the left part where all the objects are RED. Any new object like the white circle which falls to the right side which is labeled as GREEN (or classified as RED should it fall to the left of the separating line) [13] .

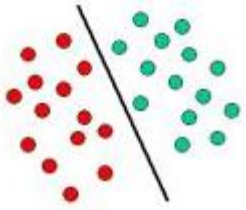

Fig: 3

The above is a classic example of a linear classifier, i.e., a classifier that separates a set of objects into their respective groups (GREEN and RED in this case) with a line. Most classification tasks, however, are not that simple, and often more complex structures are needed in order to make an

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optimal separation, i.e., correctly classify new objects (test cases) on the basis of the examples that are available(Dia: 4) (train cases). This situation is depicted in the illustration below. Compared to the previous schematic, it is clear that a full separation of the GREEN and RED objects would require a curve (which is more complex than a line). Classification tasks based on drawing separating lines to distinguish between objects of different class memberships are known as hyper plane classifiers. Support Vector Machines are particularly suited to handle such tasks.

Where and represent the opening and closing functions, respectively. The opening operator suppresses and preserves the positive and negative impacts, respectively. By contrast, the closing operator suppresses and preserves the negative and positive impacts, respectively.

F. SUPPORT VECTOR MACHINE

Support Vector Machines (SVM) is based on the abstraction of decision planes those interpret decision boundaries. The resolution plane is one that separates the set of objects which have non identical class memberships. A formulaic example is shown in the illustration below. This example (Dig: 3), describes the objects belonging either to category RED or GREEN. The partition line defines the frontier on the right part

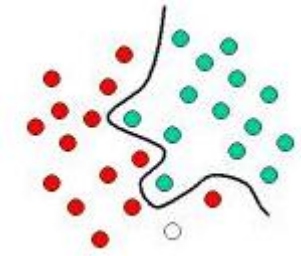

Fig: 4

Application:

- SVMs can be used to solve various real world problems:
- SVMs are helpful in text and hypertext categorization as their application can significantly reduce the need for labeled training instances in both the standard inductive and transductive settings.
- Classification of images can also be performed using SVMs. Experimental results show that SVMs achieve significantly higher search accuracy than traditional query refinement schemes after just three to four rounds of relevance feedback.
- This is also true of image segmentation systems, including those using a modified version SVM that uses the privileged approach as suggested by Vapnik.
- Hand-written characters can be recognized using SVM.
- The SVM algorithm has been widely applied in the biological and other sciences. They have been used to classify proteins with up to 90% of the compounds classified correctly.
- Permutation tests based on SVM weights have been suggested as a mechanism for interpretation of SVM models. Support vector machine weights have also been used to interpret SVM models in the past. Posthoc interpretation of support vector machine models in order to identify features used by the model to make predictions is a relatively new area research with special significance in the biological sciences.

V. SYSTEM SPECIFICATION

A. IMAGE PROCESSING

Digital image processing is the use of computer algorithms to perform image processing on digital images. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing. Since images are defined over two dimensions (perhaps more) digital image processing may be modeled in the form of multidimensional systems.

Digital image processing allows the use of much more complex algorithms, and hence, can offer both more sophisticated performance at simple tasks, and the implementation of methods which would be impossible by analog means [15].

- Multi-scale signal analysis
- Pattern recognition
- Projection

Some techniques which are used in digital image processing include:

- Anisotropic diffusion
- Hidden Markov models
- Image editing
- Image restoration
- Independent component analysis

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- Linear filtering
- Neural networks
- Partial differential equations
- Pixilation
- Principal components analysis
- Self-organizing maps
- Wavelets

B. MATLAB SYSTEM

The MATLAB system consists of five main parts:

1. The MATLAB language.

This is a high-level matrix/array language with control flow statements, functions, data structures, input/output, and object- oriented programming features. It allows both "programming in the small" to rapidly create quick and dirty throw-away programs, and "programming in the large" to create complete large and complex application programs.

2. The MATLAB working environment.

This is the set of tools and facilities that you work with as the MATLAB user or programmer. It includes facilities for managing the variables in your workspace and importing and exporting data. It also includes tools for developing, managing, debugging, and profiling M-files, MATLAB's applications.

3. Handle Graphics.

This is the MATLAB graphics system. It includes high-level commands for two-dimensional and three-dimensional data visualization, image processing, animation, and presentation graphics. It also includes low-level commands that allow you to fully customize the appearance of graphics as well as to build complete Graphical User Interfaces on your MATLAB applications.

4. The MATLAB mathematical function library.

This is a vast collection of computational algorithms ranging from elementary functions like sum, sine, cosine, and complex arithmetic, to more sophisticated functions like matrix inverse, matrix eigenvalues, Bessel functions, and fast Fourier transforms.

5. The MATLAB Application Program Interface (API).

This is a library that allows you to write C and Fortran programs that interact with MATLAB. It include facilities for calling routines from MATLAB (dynamic linking), calling MATLAB as a computational engine, and for reading and writing MAT-files.

VI. CONCLUSION AND FUTURE WORK

In this paper, we have proposed a live video which is given as input for both training and testing phases. After that this video is converted into frames and the frame is resized individually. After that the skin is filtered by using gray illumination algorithm. Then Morphological feature extraction is performed for both train and test frames. The matching between train and test features are find to recognize the gesture. Support vector machine is used for gesture recognition. Finally, the character sound (gesture recognition output) is given as audio output.

In future, we would like to put our efforts in order to extend our work in creating more number of words and sentences of our Indian sign language. And hope to have a hardware system as a compact one make use of this project as a real time usage for the deaf and dumb people.

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Improving the Students' Critical thinking ability through Problem-Based Learning Model of Scientific Approach on "Linear Equation System of Two Variables" Learning Material

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Abstract*—The quality of education today is still a relatively prominent problem in efforts to improve the quality of the national education system. One of the things needs to be improved is the ability to think critically. Critical thinking ability is an important ability to have by students in order to solve the problems faced in changing world. Learning Mathematics by using problem-based learning model of scientific approach is one alternative approach that aims to improve the ability of critical thinking to be trained properly. This study aimed to examine the improvement of students' critical thinking skills, especially on the learning material "Linear Equation System of Two Variables", both reviewed in whole and in groups of students (upper and lower groups). This research was conducted in junior high school at middle level. The data were collected through tests and questionnaires. The results of the study showed that there was an improvement of critical thinking of 35.29%. The improvement was considered as very low due to the researcher's lack of attention on the level of difficulty among the test items. The level of difficulty was very important to pay attention in order to know how the students' critical thinking skills improvement was. The Student Activities Observation Result showed that the average improvement of the students' active participation every meeting was 83.74% which meant that the students were actively joining every lesson. Furthermore, the data analysis of the students' response questionnaire revealed that students showed a positive attitude toward learning mathematics by using problem-based learning of scientific approach.*

Keywords*— C*ritical thinking, Improvement, Problem-based learning, Scientific approach.

I. INTRODUCTION

The quality of education today is still a relatively prominent problem in efforts to improve the quality of the national education system. However, many efforts have been done to overcome the education problem. Those efforts cover all of the education components like a renewal of curriculum, improvement of teachers' quality as well as the other efforts related to the improvement of education quality.

Constitution No. 20 in 2003 about National Education System that:

> Education is a conscious and well-planned effort to create an atmosphere of learning and learning process so that learners actively develop their potential to have spiritual / religious power, self-control, personality, intelligence, noble character, as well as skills owned by themselves, society, nation and state.

The statement above indicates that it is expected that through education the state is capable to prepare human resources who are ready to face any demands of the times. Qualified human resources can only be achieved by improving the quality of education in Indonesia. Improving the quality of education can be done by changing the learning system from teacher-centered learning which has been implemented for many years into student-centered learning. Student-centered learning system would be able to grow and develop creativity and train the students' critical thinking ability in both learning and solving problems faced in daily life. It is strengthened by Muhfaroyin (2009) who stated that student-centered learning paradigm is more appropriately used to develop self-regulated learners who are capable to empower critical thinking ability. To deal with the world which is rapidly changing is a mean of creating critical thinking ability in society (Sadeli dan Wati, 2013). The priority of an education system is to educate students about how to learn and to think.

In relation to the demands of the quality improvement of intellectual and critical thinking human resources, the mastery of every learning subjects needs to be improved in all education levels, one of them is Mathematics education level.

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Along with the development of science and technology, the role of Mathematics as one of basic science knowledge which has many essential values in various fields in life becomes very important especially in science knowledge and technology mastery. The low quality of every level of education is still an unsolved problem. Yet, students' skills in thinking and solving problems have not been so entrenched in the society. Students used to learn by memorizing everything without any development of thinking and solving problems. Teacher as the informant is also often dominate the learning activities in classroom. There, teacher usually just writes the formulas, gives examples and asks to do the tasks. These ways of teaching make the students less active in learning activities.

By looking at above condition, a teacher indeed is required to be always creative and innovative in planning and implementing the teaching and learning process. To meet this demand, teacher needs a tool which can improve the students' critical thinking ability. The learning outcomes will be more meaningful if there is a change of students' attitude and behavior to be more critical, active, creative and innovative. Learning Mathematics should be presented in a certain context which is more actual and appropriate with the students' daily real experiences.

For those reasons, the learning approach that is appropriate to be used is scientific approach. Scientific approach is closely related to scientific method. Generally, scientific method involves observation activity which is used to formulate hypothesis or collect data. It is also based on the exposure of data obtained through observation or experiment. In this case, experiment activity is changed to the activity of obtaining information from various resources.

One of learning models that notice about the students' critical thinking ability and require students' creativity is Problem-Based Learning (PBL). PBL is based on the theory of cognitive psychology, mainly based on Piaget and Vigotsky (constructivism theory). According to constructivism theory, students learn to construct knowledge through an interaction with their environment. PBL facilitates students to learn through structured real world problems to construct their knowledge. This learning model requires students to actively conduct investigation in solving problems and teacher roles as facilitator or consultant. It can build high order thinking ability and improve students' ability to think critically.

The lack of the learning tool examples of mathematics that appropriate with problem-based learning makes teachers have not implemented this learning model. PBL is a learning approach that uses problems in real life as a context for students to learn about how to think critically, have the ability to solve problems and gain knowledge and concepts from learning materials.

Linear Equation System of Two Variables (LESTV) is one of Mathematics learning materials which is considered as difficult material by most of students especially for the test items in the form of story. The difficulties faced by the students in understanding the concept of LESTV causes the learning process hampered. The number of LESTV applications in daily life becomes one significant reason for students to master the material. Therefore, in learning LESTV, the students are required to be active and creative in solving the problems either served by the teacher or faced in daily life.

Linear Equation System of Two Variables (LESTV) is chosen as the learning material of this research because there are a number of its applications which are faced by students that make them difficult to understand LESTV contextually. When students are given exercises of LESTV in the form of story, most of them solve the exercises by memorizing the solution from the examples so that they cannot do the different exercises well. In addition, in teaching LESTV, most teachers just rewrite the existing formulas from the students' textbook, give examples and assist tasks. Students are less actively involved in solving problems related to LESTV. For these reasons, LESTV learning material is more appropriate with the implementation of Problem-Based Learning (PBL) because in this learning model the students are required to identify the problems by themselves, so that they are not only memorizing but also finding. By implementing PBL, students are expected to have no difficulties when they are given different types of exercises or even with high difficulty level.

Based on the explanation above, the researcher intends to improve the eighth grade students' critical thinking ability by using Problem-Based Learning of scientific approach on "Linear Equation System of Two Variables" learning material.

II. RESEARCH METHODS

This research used Classroom Action Research (CAR) as the design. The subjects of the research were Class VIIIA students of SMPN 2 Balung Jember in 2016/2017 academic year. The object of this research was the students' critical thinking ability and their responses.

Considering to the data needed, there were three kinds of instrument used in this research: 1) Mathematics Critical Thinking Ability Test to know the improvement of the students' critical thinking ability. This test was administered to the students before and after the teaching and learning process with some test items related to the learning material LESTV; 2) Students' Activities Observation Sheet which contained the types of students' activities observed as well as the columns that indicated the categories of their active participation. The observation sheet is filled by giving check mark in

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provided columns based on what is observed; 3) Students' Responses Questionnaires which consisted of 11 written questions with some alternative options namely "Happy", "Quite Happy" and "Not Happy" that aims to collect the data from all of Class VIIIA students as the samples or responses. The responses are given and filled by the students after the teaching and learning process.

To obtain research instruments which fulfilled standard measurement, the instruments compiled had been tested first and the validity of each item had been calculated. The focus of this research was the improvement of the students' critical thinking ability.

The data analysis of the research result of Critical Thinking Ability can be described as follows:

The results of students' works are analyzed to determine the level required by each of the students with criteria:

Level 3: Critical

In this level, the students met all of the characteristics of critical thinking or met at least characteristics of it with a note that K_1 and K_2 are met**.**

Level 2: Quite Critical

Students said to be in this level if they met three or two characteristics of critical thinking with a note that if they met three characteristics, K_1 or K_2 will be not met, if they met two characteristics, they only met K_1 and K_2.

Level 1: Not Critical

Students said to be in this level if they met two or one or even did not met any characteristics of critical thinking provided. Note that if they met two characteristics, either K_1 or K_2 was not met.

For further details, take a look on Table 1 below.

Table.1: Critical Thinking Characteristics

Criteria	Critical Thinking Characteristics
Critical	1. K_1, K_2, K_3 and K_4
	2. K_1, K_2 and K_3
	3. K_1, K_2 and K_4
Quite Critical	1. K_1, K_3 and K_4
	2. K_2, K_3 and K_4
	3. K_1 and K_2
Not Critical	1. K_1 and K_3
	2. K_2 and K_3
	3. K_3 and K_4
	4. K_1
	5. K_2
	6. K_3
	7. K_4
	8. -

III. INDENTATIONS AND EQUATIONS

The action of this research was carried out in the implementation. However, the development of learning tools and materials was done before implementation and they are validated by education experts.

In details, the activities done in implementation stage were as follows:

a. The observation of Lesson Plan Implementation
   During the lesson, teacher acted as the facilitator that only accompanied students solving the problems on their worksheets. It aimed to make students accustomed solving problems by themselves in group. In this case, the researcher did not directly give the answers but gave guidance in solving the problems by doing experiment based on the students' worksheet developed by the researcher.
b. The result of Critical Thinking Ability
   The result of critical thinking ability test could be showed as follows:

Table.2: The Analysis of Critical Thinking Ability Test Result

No	PRETEST		POSTTEST	
	Result	Cri	Result	Cri
1	K_1, K_2, K_3 & K_4	C	K_1, K_3 & K_4	QC
2	K_1, K_2 & K_4	C	K_1, K_2 & K_4	C
3	K_1, K_2, K_3 & K_4	C	K_2, K_3 & K_4	QC
4	-	NC	K_2, K_3 & K_4	QC
5	K_4	NC	K_1, K_3 & K_4	QC
6	K_1, K_2 & K_3	C	K_1, K_3 & K_4	QC
7	K_1, K_2 & K_3	C	K_1, K_2 & K_3	C
8	K_1, K_2 & K_4	C	K_1, K_2 & K_4	C
9	-	NC	K_2, K_3 & K_4	QC
10	K_1, K_2, K_3 & K_4	C	K_1, K_3 & K_4	QC
11	K_1, K_2 & K_4	C	K_1, K_2 & K_4	C
12	-	NC	K_2, K_3 & K_4	QC
13	K_1 & K_4	NC	K_2, K_3 & K_4	QC
14	K_1, K_2 & K_3	C	K_1, K_2 & K_3	C
15	K_2 & K_3	NC	K_2, K_3 & K_4	QC
16	K_1, K_2 & K_3	C	K_1, K_2 & K_3	C
17	K_1, K_2 & K_4	C	K_2, K_3 & K_4	QC
18	K_1	NC	K_4	NC
19	K_1, K_2, K_3 & K_4	C	K_1, K_2, K_3 & K_4	C
20	K_1, K_2, K_3 & K_4	C	K_2, K_3 & K_4	QC
21	K_2	NC	K_1, K_2 & K_3	C
22	K_1, K_2, K_3 & K_4	C	K_2, K_3 & K_4	QC
23	K_2	NC	K_2, K_3 & K_4	QC
24	K_1 & K_4	NC	K_1, K_3 & K_4	QC
25	K_1, K_3 & K_4	QC	K_1, K_2, K_3 & K_4	C
26	K_1, K_2 & K_4	C	K_1, K_2 & K_4	C
27	K_1 & K_3	NC	K_1, K_2 & K_4	C
28	K_1, K_2 & K_4	C	K_2, K_3 & K_4	QC
29	K_2 & K_3	NC	K_2, K_3 & K_4	QC
30	K_1, K_3 & K_4	QC	K_1, K_3 & K_4	QC
31	K_1, K_3 & K_4	QC	K_1, K_2 & K_4	C

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No	PRETEST		POSTTEST	
	Result	Cri	Result	Cri
32	K_1, K_2 & K_4	C	K_1, K_2 & K_4	C
33	K_1, K_2, K_3 & K_4	C	K_2, K_3 & K_4	QC
34	K_1 & K_2	C	K_2, K_3 & K_4	QC

Notes: C = Critical
QC = Quite Critical
NC = Not Critical

Based on the data as the result of critical thinking ability test in Table 2, it can be summarized into a diagram in Picture 1 below.

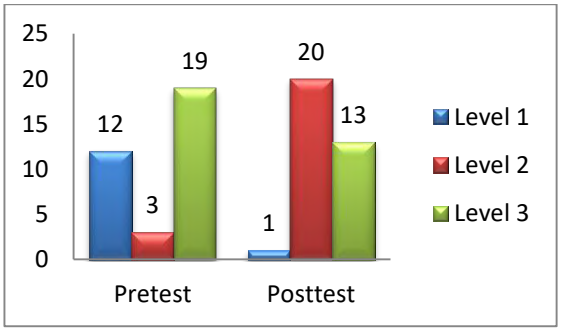

Fig.1: Diagram of Critical Thinking Ability

From the diagram above, it was known that there was a significant decline since the number of the students who still in level 1 was reduced from 12 students to 1 student. It indicated that there was an improvement of the students' critical thinking ability.

However, another concern focused on the decline of the number of the students in level 3 from 19 students to 13 students. According to the result of interview with those students, it was known that they thought that the test items in Posttest were more difficult than the test items in Pretest. This thing was not noted by the researcher. The researcher should pay more attention to the equality of the test items.

The researcher's less attention to the equality between Pretest and Posttest resulted in very low improvement of the students' critical thinking ability, that was 35.29% with Very Low (VL) category. Yet, the researcher predicted that these learning tools could improve the students' critical thinking ability because of the learning tools' validation (valid, practical and effective).

Based on the result of students observation, it was obtained that:

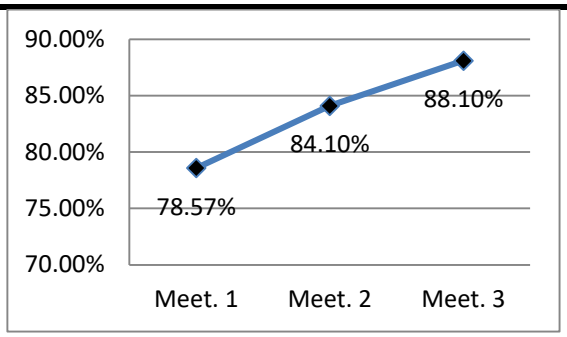

Fig.2: Diagram of Students' Activities Observation

From the diagram of Students' Activities Observation above, it was known that there was an improvement of the students' active participation in every meeting. The improvement was about 83.74% which meant that the students were active every joining the lesson.

From the Students' Responses Questionnaire, it was gained a result that 75.13% of the students were "Happy" with the lesson, 20.05% of the students were "Quite Happy" and 4.82% of them were "Not Happy" with the lesson. Based on the result, it could be said that the learning tools were effective with good category based on students' responses.

Based on the analysis, it could be summarized that there was an improvement of the students' critical thinking ability by using Mathematics learning tools taught with problem-based learning model of scientific approach. This alternative way could be used to help solving the problems faced by the eighth grade students on "Linear Equation System of Two Variables" learning material. Moreover, it should be tested on the other schools with different condition to obtain more qualified learning tools.

IV. CONCLUSION

Based on the results of the research, it can be concluded that teaching and learning Mathematics "Linear Equation System of Two Variable" material by using problem-based learning model of scientific approach can improve the eighth grade students' critical thinking ability in SMPN 2 Balung. It increased as much as 35.29% with Very Low (VL) category. This low improvement was due to the researcher's less attention of the test items equality. This condition can be an opportunity for the further researchers to extend the research. Therefore, the other researchers can give contribution to this classroom action research.

V. SUGGESTION

In relation to the result which has been reviewed, the researcher wants to give some suggestions for the readers and the further researchers who want to conduct a similar research as follows:

a) The learning tools in this research can be used as an alternative learning in classroom, especially for the

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learning material "Linear Equation System of Two Variables" for eighth grade students who have similar problem with the eighth grade students of SMPN 2 Balung.

b) The learning tools still should be tested to the other schools with different conditions to obtain the more qualified learning tools which are developed by using problem-based learning model of scientific approach to improve the students' critical thinking ability on the learning material "Linear Equation System of Two Variables" for the eighth grade students.
c) Teachers can use the learning tools as an alternative way to make students not bored and more motivated than the usual activities.
d) The other researchers who want to extend this research are suggested to pay more attention to the equality among the test items so that the improvement of the students' critical thinking ability can be measured accurately.

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A Detailed Study of Channel Estimation and BER Optimization in presence of AWGN and Rayleigh Channel of OFDM System

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Abstract*—Orthogonal Frequency Division Multiplexing is an important one field communication and that uses parallel information series. Contrast and single carrier adjustment are basic aspects of this technique where OFDM has many favourable circumstances are risky to work on this technique. It is robust, easy to use, and strength to safe the processing channel from distortions. It provides safety from multipath, much lesser computational many-sided characteristic. OFDM has some significant to execute it in commonly using media transmission frameworks. OFDM standard tolerate Packet misfortune, Bit trouble, Bit Error Rate (BER), Signal to Noise Ratio (SNR), Calculation of PAPR, Power Spectrum estimation. This dissertation is targeted to show the comparison of AWGN and Rayleigh channel by using fading process for particularity in superior performance with individual values of spectrums as well as by their scattering plots. In this dissertation each and every signal of these terms are examined and all the four parameters are thought about utilizing AWGN and Rayleigh fading channel by changing the period of a portion of the subcarriers utilizing QPSK in OFDM regulation. The representation of outputs is finished through MATLAB programming.*

Keywords—OFDM System, Channel Estimation, Fading, BER.

I. INTRODUCTION

OFDM is a strategy for encoding advanced data on multiple messenger frequencies. COFDM remains for Coded orthogonal frequency division multiplexing. It difference from OFDM on the grounds that in COFDM, forward blunder redress is attach to the flag before transmission. This is done to conquer mistakes. OFDM is orthogonal frequency division multiplexing (OFDM) method employ as a further multi-transporter adjustment strategy. An expansive number of firmly separated orthogonal sub-transporter signals are utilized to convey data on a few parallel information streams or channels. The essential preferred standpoint of OFDM over single-transporter plans is its capacity to adapt to serious channel conditions without complex evening out channels. The low image rate makes the utilization of a watch interim between images moderate, making it conceivable to dispose of inter symbol impedance (ISI) and use echoes.

II. RELATED WORK

A. Zhong Fan, GeorgiosKalogridis, Costas Efthymiou, Mahesh Sooriyabandara, Mutsumu,2016

This paper informs around a part of the problem and possibility of interchanges explore in the territory of shrewd frameworks and brilliant metering. Unmistakably the correspondences inquire about group has been currently looking for the „next huge thing" after interests in late hotly debated issues, for example, subjective radio, agreeable interchanges, and MIMO have pretty much topped. I view that the new activity on keen framework overall gives a perfect possibility to correspondence and systems administration scientists to apply unique existing advances and also imagining new ones in this energizing region [12].

B. PAN Pei-sheng, ZHENG Bao-yu, 2015

Different information several yield (MIMO) frameworks can be combine with orthogonal recurrence division multiplexing (OFDM) frameworks to enhance the restricted and nature of remote interchanges. In this article, a direct estimation procedure in both space and recurrence area for MIMO-OFDM frameworks is proposed. It is indicate that the proposed conspire with space-recurrence pilot tones accomplish ideal least mean square mistake (MMSE) channel evaluation. Reproduction comes about show that the proposed strategy accomplishes great execution related to their input data streams [13].

C. Muquet and M. de Courville, 2014

This paper shows two new visually impaired channel recognizable proof strategies suited to multicarrier

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framework (OFDM) misusing the excess presented by the adjunction of a cyclic prefix at the producer and depending on the assessment of the desired flag autocorrelation network are displayed. The proposed calculations can recognize any channel with no requirement on their zeroes area (counting non-least stage channels) and are hearty to the expansion of repetitive sound. Additionally a further improvement of the estimation exactness can undoubtedly be accomplished by exploiting officially introduce preparing images in current frameworks working in a semi-dazzle setting. Moreover one of the two recognizable proof methodologies has a low arithmetical many-sided quality which makes it especially alluring by and by. Notice that these strategies are not restricted to accepted DFT-type modulators and still employ with any immaculate recreation modulator [14].

III. PROBLEM STATEMENT AND PROPOSED METHODOLOGY

A Problem Statement

Interference and fading are the superior performance depreciate factors in wireless communications. To enhance and affirm the framework's viability to oppose fading, displaying and reproduction of correspondence framework under fading channel is of incredible importance in the outline of correspondence framework. The normal for fading channel for various proliferation conditions is different and complex. Another complication lies in the viability of hostile to obstruction innovations. OFDM is multi-carrier scheme for remote correspondence because of its tendency of strong immunity from impedance and high spectra productivity, high information rate transmission. Channel analysis process can be separate into two parts: daze channel analysis and pilot-helped channel analysis. The station assessment strategies contemplated in the exposition are all pilot-helped, for pilot-supported station assessment are more appropriate in quick fading recurrence specific radio spread channel. A diverse pilot addition design brings about discrete BER exhibitions. 2-D pilot channel estimation is demonstrated to have better execution looking at than 1-D pilot channel estimation.

B Proposed Methodology

- Characterize the basic standard of OFDM system and ability to decrease ISI and ICI caused by single base band signal way. Change designs is similarly familiar and examined with more Right off the bat depict typical for darkening in remote correspondence especially Rayleigh clouding and AWGN channel amplify the achievement of OFDM system.
- Right off the bat depict typical for darkening in remote correspondence especially Rayleigh clouding and AWGN channel.
- Prompt Pilot-bolstered channel estimation frameworks to address little scale clouding issue in remote exchanges. Two 1-D pilot configuration, piece sort and brush sort, are look. Rectangular 2-D pilot outline, which is more fitting in repeat specific and time-variety clouding channel, is permitted and gage.
- Determine BER execution of OFDM arrangement underneath Rayleigh fading medium and AWGN medium and find out efficiency of employ 2-D pilot channel analysis to OFDM arrangement.

IV. SYSTEM ARCHITECTURE

In OFDM, Forward Error Control/Correction (FEC) coding and interleaving are joined in the OFDM framework to accomplish the strength, required to ensure against burst mistakes. An OFDM framework with expansion of channel coding and interleaving is relegate to as Coded OFDM (COFDM). In a computerized space, parallel information is a massing and FEC coded with plans like convolution codes.

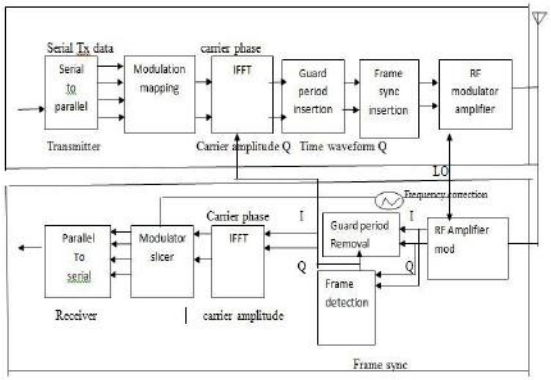

Fig.1.1: OFDM Transceiver System

The coded bit stream is interleaved to get to decent variety pick up. A while later, a blend of channel coded bits is related together (i. e. 1 for BPSK, 2 for QPSK, 4 for QPSK, and so on.) and mapped to comparing star grouping focuses. Now, the information is characterized in complex numbers and they are in serial. A serial to parallel converter is utilized and the IFFT operation is executing on the parallel complex information. The different data is coordinate together once more, specified by the number of approve transmission subcarriers. Cyclic prefix comprises each part of data as per the framework confirmation and the data is multiplexing in serial form. To transform across time area electronic information to time space basic information a Digital to analog transform is used. Accomplish RF regulation and swap across the signal to transmission frequency. Afterwards the transference of

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signal from the transmitter recuing wire, the signs go across all the peculiarity and antagonistic vibe of remote channel. At the season of down-change of desired signal, transporter recurrence synchronization is actualizing. After employ the demodulated pilots ADC transformation, image timing synchronization is procured. A FFT is employ to demodulate the OFDM signal. From that extent onward, channel evaluation is really. The complex desired information is desired utilizing the estimation which is damped relating to the transmission heavenly body graph. FEC unravelling and interleaving are connected to recoup the initially transmitted piece stream.

V. CHANNEL ESTIMATION

Radio signal transmitted through the remote divert in versatile correspondence. In remote correspondence radio signal experienced time scattering and recurrence scattering caused by multipath propagation and Doppler move, in this way, diminish the performance of the resemblance framework. OFDM framework can fundamentally diminish the impact of multipath fading, OFDM signal is effortlessly influenced by Doppler move, since Doppler move is identified with recurrence balance and abatement the orthogonality of OFDM sub-bearers. Channel estimation is technique to minimize fading and difficulty in OFDM framework by identifying the recurrence reaction of the fading channel.

VI. EXPERIMENTAL RESULTS

The tabular representation of simulation parameter utilization for the system is shown below.

No. of bits transmitted = 10000

No. of carriers used = 6

Bits per each carrier = 1000

Spacing between the each carrier = 6 KHz

Carrier frequencies are used as 6 KHz for BPSK, QPSK modulation techniques.

TABLE.I: SIMULATION PARAMETER

Channel Model	Raleigh and AWGN Fading Channel
Modulation	16 QPSK
Noise	AWGN
Detector	ML Detector
Technique used	FFT and IFFT (Single Impulse)
Separation Distance	1/2
Antenna transmitting power	Equally
FFT size	128 samples per frames
Length of Guard Interval	22
Total symbol length with guard interval	150
Bits per each carrier	1000

The graphical representation of BER calculation of AWGN channel and Rayleigh fading channel is shown below

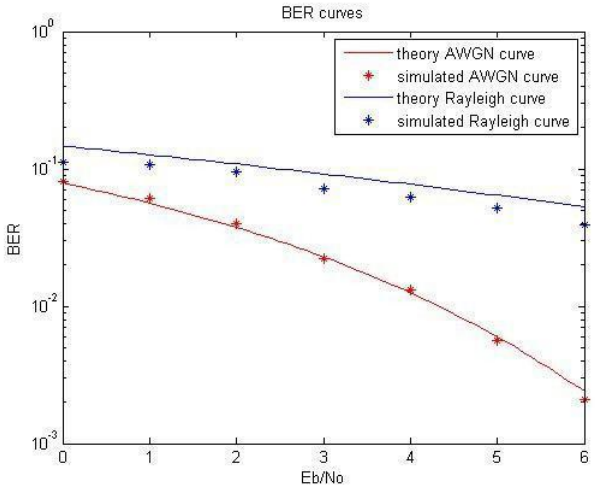

Fig 5.16 Comparisons between BER Calculations for AWGN and Rayleigh curve

VII. CONCLUSION

We have considered a more reasonable channel show for impromptu systems, considering genuine channel impacts, for example, multipath. We have picked a Rayleigh fading model to catch the impacts of the multipath. A correlation of the execution of a specially appointed system working in a Rayleigh fading channel with the all the more usually utilized as a part of range channel demonstrate has demonstrated that the correspondence term versatility metric is defective for depicting the execution of the Rayleigh fading channel display for most uses of intrigue. We have presented the connection proportion as a more fitting execution metric which gives a more natural sign of connection accessibility (in a general sense) in specially appointed systems working in a Rayleigh fading channel condition. We will build up this work utilizing a more advanced model for the Rayleigh fading channel. Distinctive portability models will be considered for the development of the hubs to decide the viability of the connection proportion as versatility metric over a capacity of adaptability design.

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Application of Remote Sensing & GIS in Agriculture

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Abstract*—This article provides an overview of some of the recent research in agriculture involving remote sensing and GIS. Attention focuses on application of remote sensing and GIS specially in agriculture including geography, land surveying, most Earth Science disciplines, parent child relationship, unique identification, attributes, technical parameters, 2D/3D view and any other requirement customized. These advances have been made over recent years and foundations for future research established and can be efficiently used in Agriculture for better results.*

Keywords*— *Agriculture, GIS, Information, Remote sensing, Satellite.

I. INTRODUCTION

Agriculture is the backbone of Indian economy and the pivotal sector for ensuring food security. Timely availability of information on agriculture is vital for taking informed decisions on food security issues. India is one of the few countries in the world that uses space technology and land-based observations for generating regular updates on crop production statistics and providing inputs to achieve sustainable agriculture.

Satellite-based optical and radar imagery are used widely in monitoring agriculture. Radar imagery are especially used during monsoon season. Integrated use of geospatial tools with crop models and in-situ observation network enables timely crop production forecasts and drought assess-ment & monitoring.

In India, Agriculture plays a vital role in the Indian economy. Over 50 per cent of the rural households depend on agriculture. Agriculture is an important sector of Indian economy as it contributes about 17% to the total GDP and provides employment to over 60% of the population. Government recently launched some major schemes like crop insurance, per drop more crop, Rashtriya Krishi Vikas Yojna to enhance the productivity of the crops. Initiatives like organic farming and increase in the production of pulses are also been taken.

II. REMOTE SENSING

Remote sensing is the acquisition of information about an object or phenomenon without making physical contact with the object and thus in contrast to on-site observation. Remote sensing is used in numerous fields, including geography, land surveying and most Earth Science disciplines (for example, hydrology, ecology, oceanography, glaciology, geology); it also has military, intelligence, commercial, economic, planning, and humanitarian applications.

In current usage, the term "remote sensing" generally refers to the use of satellite- or aircraft-based sensor technologies to detect and classify objects on Earth, including on the surface and in the atmosphere and oceans, based on propagated signals (e.g. electromagnetic radiation). It may be split into "active" remote sensing (i.e., when a signal is emitted by a satellite or aircraft and its reflection by the object is detected by the sensor) and "passive" remote sensing (i.e., when the reflection of sunlight is detected by the sensor).

Who needs remote sensing for agriculture?

Govt. authorities or local agencies can use remote sensing data, in order to make important decisions about the policies they will adopt or measures to tackle national issues regarding agriculture. Individual farmers can also receive useful information from remote sensing images, when dealing with their individual crops, about their health status and how to deal with any problems.

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III. GEOGRAPHICAL INFORMATION SYSTEM (GIS)

Geographical Information System (GIS) combines location data with both quantitative and qualitative information about the location, allowing you to visualize, analyze, and report information through maps and charts. Using the technology, you can answer questions, conduct what-if scenarios, and visualize results. **GIS** is identified as a system used to manage infrastructure assets, natural resources and any objects as per requirement. It is easier to analyze and manage facility and asset data stored in GIS, making design, construction, and maintenance more efficient and profitable.

GIS is a software based system which facilitates end to end information of assets or any type of objects as required by end user on maps having desired accuracy in raster and vector forms. GIS aids geographical location, parent child relationship, unique identification, attributes, technical parameters, 2D/3D view and any other requirement customized. GIS information/data is most adoptable, accurate and user-friendly to meet general requirements of operations and other **software applications**. Using main **GIS application**, other GIS based applications can be easily developed to meet specific requirements of users. Such systems are essential in Utility (Water, Electric, Gas), Local Government Authorities, Defense Services, Aviation, Roads, Transportation Services, Space, Mining and any multi-location business operations requirements. These utilities are managed under various GIS based domains like **Utility GIS**, Municipal GIS.

In ancient India apparently had a clear concept of remote sensing. For instance epic 'Maha Bharata' Sanjaya had been endowed, presumably with some equipment which enabled him to report (in real time) all the events at the distant "Kurukshetra" battle field, whether they were open or camouflaged and occurred in day or by night.

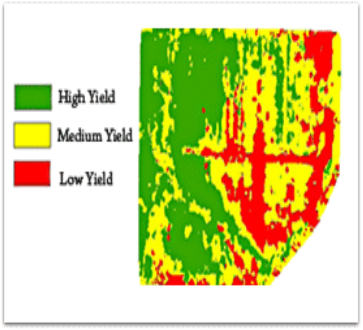
In recent times, Frenchman Mr. Tournachen took photographs for the first time from a balloon which floated over Paris in 1858. The term "Remote sensing" was first used in 1961 when U.S. Naval project on the study of Aerial photographs was renamed as "remote sensing".The application of remote sensing technology to agriculture and forestry was presented in couple of papers in 1968 at the occasion of U.N. conference on peaceful uses of on the space uses and the first satellite in remote sensing technology was launched in July 1972 in U.S.A. In India the remote sensing activities

Agricultural plants, as living organisms require water and nutrients in order to grow and are sensitive to extreme weather phenomena, diseases and pests. Remote sensing can provide data that helps identify and monitor crops. When these data is organised in a Geographical Information System (GIS) along with other parameters, they become an important tool that helps in making decisions about crops and agricultural strategies.

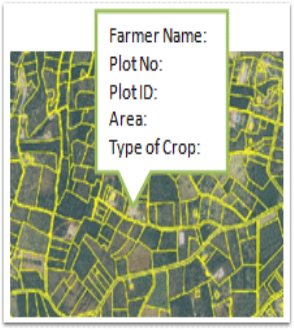
IV. IMPORTANCE OF REMOTE SENSING AND GIS

To identify the potential land for any particular crop, GIS is the best technique as it brings all the data on a single platform for the analysis. Different vegetation indices like NDVI, FPAR and TVI. are widely used to monitor crop health which is also directly proportional to yield. In case of crop insurance, actual damage can be assessed. Claims and compensations can be given on fair basis.

To monitor crop health, its growth and production various factors come into play such as temperature, irrigation facilities and the most important soil health condition. For this purpose government has launched a nation-wide scheme called soil health card.



Crop Yield Map



Agiculture Parcel Mappig

Under this scheme mapping of soil is done along with its nutrient and sub-nutrient information like pH content, nitrogen, phosphorus, soil moisture etc.

Mapping of soil has been done by Ceinsys in Jharkhand, state of India. The project was successfully implemented in 06 districts of Jharkhand state covering 13000 Sq. Km. area.

V. CONCLUSION

In order to implement these programs effectively it is vital to use the latest technologies like remote sensing and GIS. The decision makers can visualize all the farmlands with their allied information and current situation on one click. The tasks like yield estimation & crop damage assessment done by traditional means take month or two and a whole lot of manpower to complete the work. By using these technologies the same task can be completed within half or even in lesser time frame with minimum number of resources and high accuracy. Balancing the inputs and outputs on a crop farm is essential to its success and cost-effectiveness. The ability of GIS to study and envisage agricultural environments and workflows has proved to be favourable to those involved in the farming industry. While natural inputs in farming cannot be

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measured but, can be better understood and managed with GIS applications such as crop yield estimates, soil amendment analysis, erosion identification and remediation.

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Numerical & Experimental Investigation of Solidification Thickness around Cylindrical Surfaces for HVAC Cold Storage Systems

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Abstract— *Thermal Ice Storage System (TISS) is an innovative way of storing night-time off-peak energy for daytime peak usage. In many locations, demand for electrical power peaks during summer time. Air-conditioning equipment are the main reason accounting for as much as half of the power demand during the hot mid-day hours when electricity is most expensive. Since utilities have spare electrical generating capacity at night, electricity generated during this "off-peak" is much less expensive. In this research a numerical model for Latent Heat Storage (LHS) cylindrical tank has been obtained from a numerical package, ANSYS software ver. 15, and compared to an experimental data gathered from similar tank. The data showed good agreement with the experimental data with an error of 9%. The numerical model can be used to estimate ice thickness and tank geometries for any future work.*

Keywords— ANSYS, Phase Change Materials (PCMs), Latent Heat Storage, Thermal Ice Storage System, Thermal Storage Systems.

I. INTRODUCTION

Thermal Ice Storage Systems (TISS) are used in the HVAC systems for their benefits in reducing the consumed electrical power in building and hence reducing cooling loads needed [1, 2, 3]. Those systems uses Latent Heat Storage (LHS) phenomena to absorb or release large amount of heat (heat of fusion) when they change phase from solid to liquid and vice versa [4]. Habeebullah et al. [5] presented an experimental results of ice growth rate on the outside of cooled copper tubes. The tubes, which were immersed in water in an insulated vessel, were internally cooled by circulating glycol through them. He found that axial growth rate of ice is distinct at low values of the coolant Reynolds number and short freezing times. The slope of the ice thickness with axial distance showed moderate dependency on time but varied with coolant flow rate, and with Stanton and Biot numbers. A key result from the experiments is the abrupt ice thickness enlargements on the surface of tube bends. This anomaly may be attributed to internal flow disturbances of the coolant, and creation of local eddies inside the bends that enhance growth of ice. The effect was evident for a low Reynolds number ($Re \geq 251.9$ and $Bi < 1$), and fades out for large Reynolds number flows. Sait et al. [6, 7] investigated experimentally ice formation on cold vertical banks of horizontal tubes subjected to falling-film, jet mode. In the charging and discharging process, a set of internally cooled vertical banks of horizontal tubes of brine was subjected to a falling film of water. The formed ice was periodically observed, photographed and measured in falling-film jet mode at specific internal coolant (ethylene–glycol solution) flow rates and temperatures. The maximum gained ice has a thickness that is approximately equal to half of the tube spacing between the tubes utilized, which is formed in approximately 45 min and released in 12.5 min. Hosseini et al. [8] studied experimentally and numerically the role of buoyancy driven convection during constrained melting of commercial paraffin (RT50) inside a shell and tube heat exchanger. A series of experiments is conducted to investigate the effect of increasing the inlet temperature of the heat transfer fluid (HTF) on the charging process (melting) of the PCM. The computational results show that by increasing the inlet water temperature to 80 °C, the total melting time is decreased to 37%. Yingxin et al. [9] Studied the melting of an unrestrained phase change material (PCM) around a horizontal tube arises in many applications such as ice storage for HVAC (Heating, Ventilating and Air Conditioning) systems. The instantaneous heat transfer rate during the melting process must be known for optimal system design and operation of the application. A series of experiments on internal melting of unrestrained ice around a fixed horizontal tube were reported. The validation results show that the model accurately predicts the solid PCM melting rate. Yari et al. [10] developed a numerical method for solving energy equation and describing solidification phenomenon around a circular pipe. The results have shown that the effect of decreasing pipe surface temperature is more than the effect of decreasing initial water temperature. Ismail et al. [11] validated a numerical study by experimental

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measurements on the solidification of PCM along a horizontal tube by using the boundary immobilization technique. Liu et al. [12] performed a charging transient simulations based on a two dimensional numerical model, the melting processes of the storage units with staggered tube bundle structure and parallel tube bundle structure are compared with that of flat plate structure. Sugawara et al. [13] investigated a freezing/melting of water/ice around a horizontal cylinder placed in a square cavity of the inner side length numerically.

In this research, a Computational Fluid Dynamic (CFD) software, ANSYS Package, is used to estimate the geometry of the latent storage tank, the suitable parameters of the Heat Transfer Fluid (HTF), and the ice thickness around a cooper tubing (charging process) based constant cooling load and specific working hours (8 working hours). The obtained numerical data is compared with experimental data to verify the CFD model chosen.

II. NUMERICAL MODEL ASSUMPTIONS

Specific and logical assumptions are going to be used in the numerical model to obtain the ice thickness of the LHS for our experiment. The assumptions are:

1. Insulated cylindrical heat storage tank with evenly distributed copper tubing inside it, Fig. (1), transporting the Heat Transfer Fluid (HTF) from the cooling source. The diameter of the tank will be determined based on the ice thickness around the copper tubing.
2. Regular water is the phase change material inside the tank surrounding the copper tubing.
3. The working hours of the cooling source, which is a chiller, is eight night hours only.
4. The temperature of the Heat Transfer Fluid is (258.15 K) from the cooling source and it is a constant temperature. The HTF is water with 40% Ethylene Glycol (EG) [14].
5. An internal diameter bigger than (2 cm) has little effect on the ice thickness around the copper pipe [15].

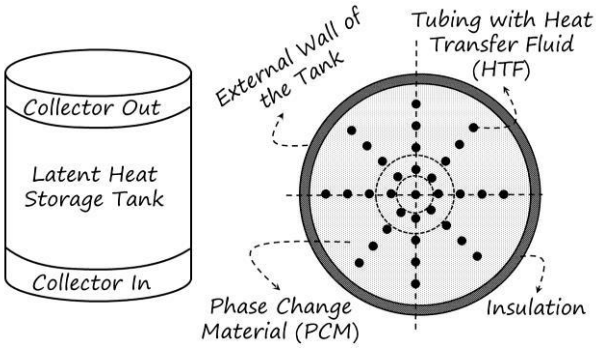

Fig.1: Conceptual ice storage tank.

III. NUMERICAL MODEL METHODOLOGY

In order to determine the diameter of the storage tank experimentally, firstly, a big tank filled with regular water and **one copper pipe** for a specific Internal diameter, Fig. (2), will be tested based on the data shown in Table (1).

Table.1: Input data for the numerical Model.

PCM Properties	
PCM Initial Temperature	298.15 K
Thermal Conductivity	1.88 W/m K
Density	1000 kg/m^3
Heat of Fusion	334 kJ/kg
Copper Tube Properties	
Thermal Conductivity	110 W/m K
Internal Diameter	2 cm
Thickness	0.1 cm
Heat Transfer Fluid (HTF)	
Volumetric Concentration	40%
Initial Temperature	258.15 K
Velocity	1 m/s

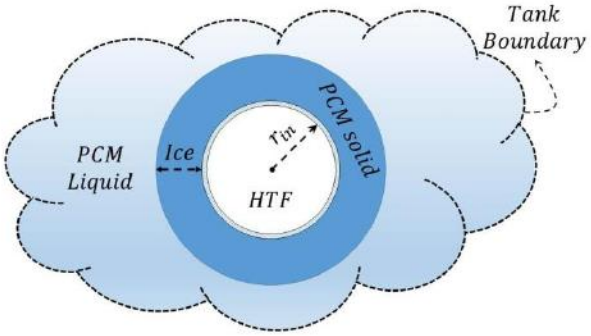

Fig.2: One Copper Pipe in a storage Tank.

After running the cooling source for about eight hours, which correspond to constant temperature of the external surface of the copper pipe, some essential parameters will be obtained such as the ice thickness around the copper pipe. Secondly, based on the data obtained from the first run which will define the diameter of the storage tank, a specific diameter tank will be tested with evenly distributed copper tubing to show the piping effect on each other's.

IV. NUMERICAL MODEL FOR A COPPER PIPE

The effect of the HTF temperature and also the PCM initial temperature will be studied on the ice thickness around the pipe in the ice storage tank. A tank with a diameter of (15 cm) and a height of (100 cm) will be used in the numerical analysis, the tank has only one copper pipe with the thermos-physical properties shown in Table (1). Table (2) shows that data obtained from the numerical run after eight hours of work for every hour.

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The maximum ice thickness was (3.5 cm). Fig. (3) shows the trend on the ice thickness with time based on the data from Table (2). It shows that data obtained from the numerical run after eight hours of work for every hour. The maximum ice thickness was (3.5 cm).

Table.2: Output data for the numerical model.

Time (hours)	Ice Thickness (cm)
1	1.2
2	1.8
3	2.1
4	2.5
5	2.8
6	3
7	3.3
8	**3.5**

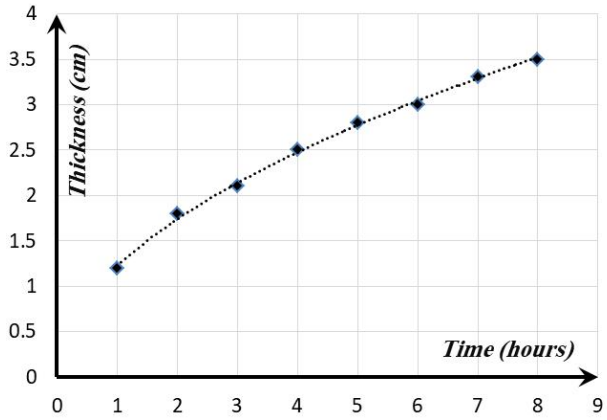

Fig.3: Ice thickness with respect to time numerically.

Fig. (4) shows temperature distribution from the surface of the one copper pipe outward after eight hours of work. Red color indicates a temperature of (274 K) and blue color indicates a temperature of (258.15 K) which is equal to the temperature of the HTF. The Figure shows also that the ice thickness in uniform along the length of the pipe.

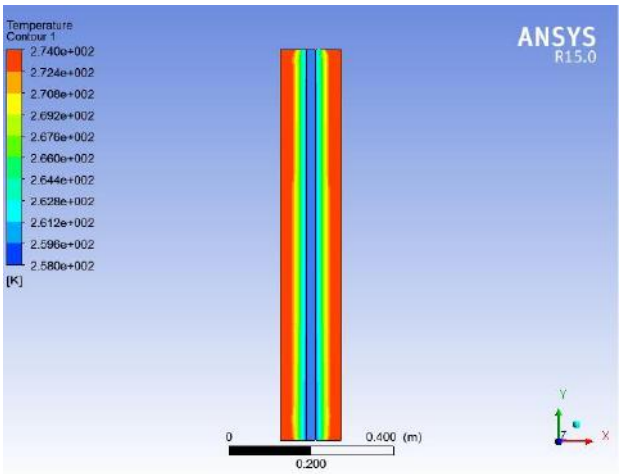

Fig.4: Temperature distribution along the diameter of the copper pipe.

Fig. (5) shows the effect of the HTF temperature (T_∞) on the ice thickness (δ) with a pipe length of (100 cm) on the final hour (eighth hour) only. The Figure reassures that increasing the HTF temperature decrease the ice thickness formed around the tube and vice versa decreasing the HTF temperature increases the ice thickness.

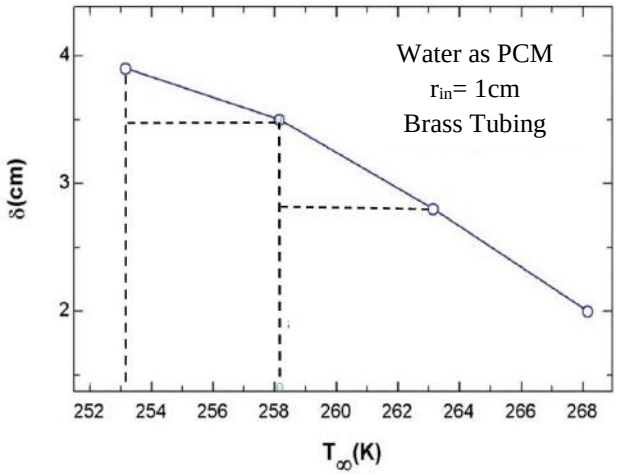

Fig.5: The relationship between ice thickness & HTF temperature on the eighth hour.

The Fig. (5) also shows that decreasing the HTF temperature below (258.15 K) reduce the ice thickness (slop is decreased). Working below that temperature will increase the electrical power consumption on the cooling source which reduces the efficiency of the whole system. Fig. (6) shows the effect of the length of the copper pipe on the ice thickness around the copper pipe. It shows that a pipe length longer than (200 cm) will decrease the ice forming around the pipe. Using several storage tanks with (200 cm) length connected in parallel could be the solution for this states. The data in this Figure is obtained at the final hour (eighth hour) of work.

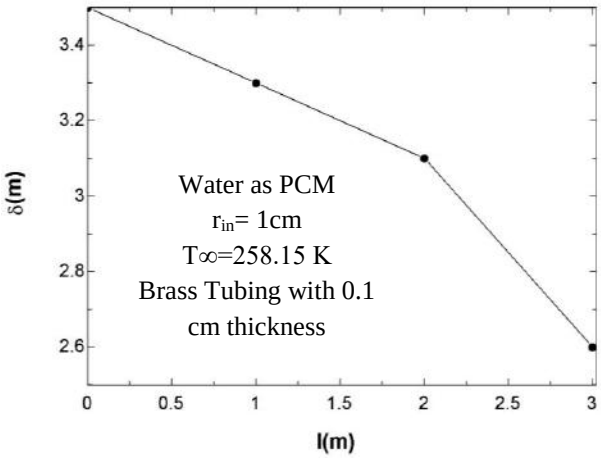

Fig.6: The relationship between Ice thickness and pipe length on the eighth hour.

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To study the effect of PCM initial temperature ($T_{initial}$) on the ice thickness, several numerical tests were conducted based on the data shown in Table (3).

Table.3: PCM Initial Temperature Tests

No of Tests	PCM Initial Temperature
1	298.15 K
2	293.15 K
3	288.15 K
4	283.15 K
5	278.15 K
6	273.15 K

Fig. (7) shows the results obtained from the previous tests. It indicates the relationship between the ice thickness and the PCM initial temperature on the final hour (eighth hour) of work.

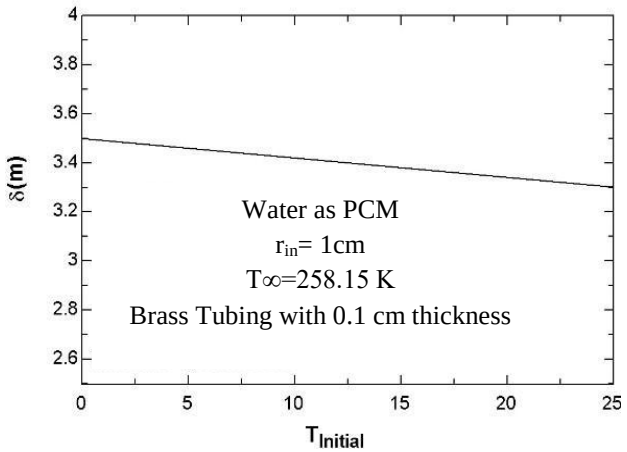

Fig.7: The relationship between Ice thickness and PCM initial temperature on the eighth hour.

The Fig. (7) shows that the effect of the PCM initial temperature is negligible, decreasing the PCM temperature will increase the ice thickness about 5.7% (0.2 cm) only. The sensible load removal by dropping the PCM temperature has little effect of the ice thickness. Based on previous data, the ice storage tank can be selected to have PCM with initial temperature of (298.15 K), length less than (200 cm) and HTF temperature more than (258.15 K). These finding will lead numerically to a maximum thickness of (3.5 cm) around the copper tube.

V. NUMERICAL MODEL FOR SEVERAL COPPER PIPES

Previous obtained data will be used to study the effect of implementing several copper pipes in the storage tank. The optimal distance between the pipe will be measured numerically which specify at the end the diameter of the storage tank. Fig. (8) shows the numerical solution of a storage tank with a diameter of (32 cm) and height of (100 cm) which contains (7) cylindrical copper pipes on the final hour (eighth hour) of work. The distance between the center of pipes has been calculated to be (9.4 cm) based on the previous data. As mentioned before, red color indicates a temperature of (274.15 K) and blue color a temperature of (258.15 K) which is equal to the temperature of the HTF. The Figure shows regions interference between the solid and the liquid which can be explained by decreasing the amount of liquid between the pipes which leads to an increment in the ice thickness at the final hour. Table (4) reveal the ice thickness obtained hourly numerically.

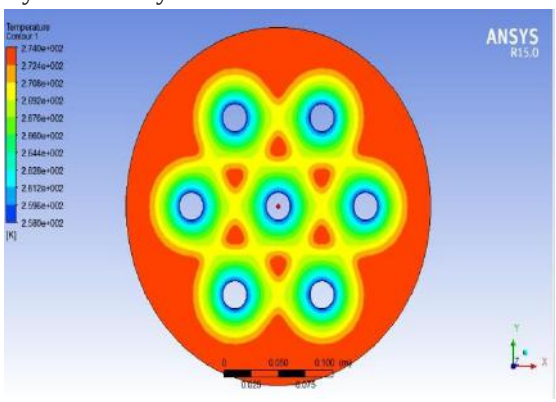

Fig.8: Temperature distribution along the diameter of the copper pipe.

Table.4: Numerical data output for several pipes.

Time (hours)	Ice Thickness (cm)
1	1.2
2	1.8
3	2.1
4	2.5
5	2.8
6	3
7	3.3
8	**3.7**

The table shows the same data obtained for one pipe test but the ice thickness increased at the final hour and became (3.7 cm) instead on (3.5 cm). To verify this finding, several test numerically were done on the same storage tank with different HTF temperatures as per Fig. (9). The Figure gives the optimal space between the pipes with relation to the HTF temperature at the final hour (eighth hour) of work.

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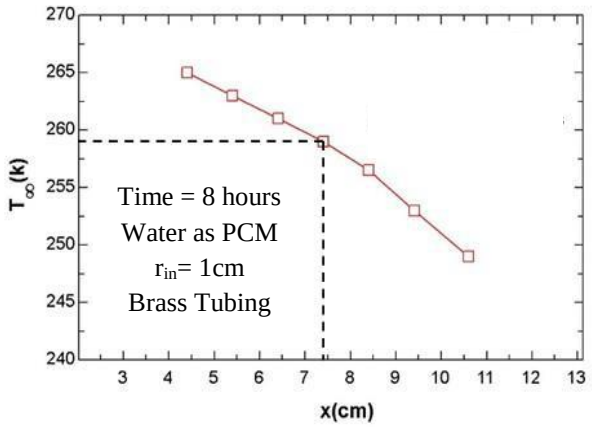

Fig.9: The relation between HTF temperature and optimal pipe spacing for eighth hour.

Fig. (10) shows the numerical solution of a storage tank with a diameter of (100 cm) and height of (100 cm) contains (61) cylindrical copper pipes on the final hour (eighth hour) of work for the same data before. Also the interference between regions is clear.

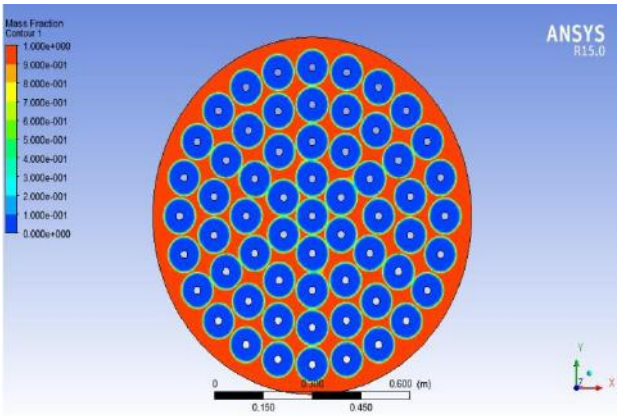

Fig.10: Temperature distribution along the diameter of the copper pipes in a storage tank.

Fig. (11) shows the numerical solution of a storage tank with a diameter of (100 cm) and height of (150 cm) contains (37) cylindrical copper pipes on the final hour (eighth hour) of work for the same data before where the space between the pipes were increased to be (13.6 cm). No interference was found.

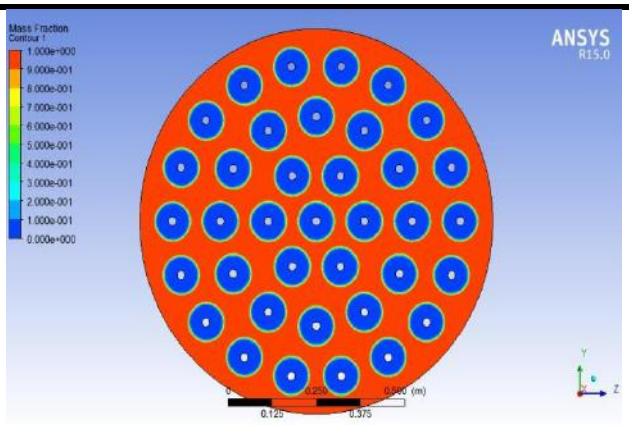

Fig.11: Temperature distribution along the diameter of the copper pipes in a storage tank.

VI. EXPERIMENTAL TEST AND RESULTS

In order to rely on numerical data obtained before, test experiment has been conducted. A storage tank with a diameter of (32 cm) and height of (40 cm) contains (7) cylindrical copper pipes was test. The PCM was a regular water, with an initial temperature of (298.15 K), HTF is 40% Ethylene Glycol (EG) with a temperature of (267.15 K) and velocity inside the tube is (1 m/s), copper tubing with an internal diameter of (2 cm) and thickness of (0.1 cm), eight hours of work. The numerical solution shown in Fig. (12) with hourly details data from Table (5). The final ice thickness was (2.2 cm).

Table.5: Numerical data output for several pipes.

Time (hours)	Ice Thickness (cm)
1	0.3
2	0.8
3	1.1
4	1.4
5	1.6
6	1.8
7	2
8	**2.2**

In Fig. (12) yellow color indicates a temperature below (274.15 K) as per the temperature scale on the Figure but no solidification phase, and blue color a temperature of (267.15 K) which is equal to the temperature of the HTF. Fig. (13) shows the actual storage tank insulated with a collector in and out ready to be tested.

Table (6) shows the **actual** ice thickness every two hours for eight hours of work. The table shows that the maximum ice thickness was (2 cm) which is shay by (0.2 cm) from the numerical model, the error was in the order of 9% only.

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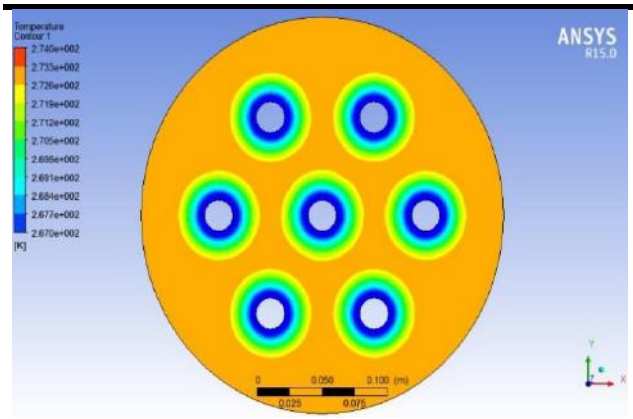

Fig.12: Temperature distribution along the diameter of the copper pipes in a storage tank.

Table.6: Experimental data output for several pipes.

Time (hours)	Ice Thickness (cm)
2	0.5
4	1.1
6	1.6
8	2

Figure (14) shows the formation of the ice at the eighth hour of work. It shows a uniform thickness around the pipe and along the pipe which verify the numerical model used.

Fig.13: Actual storage Tank.

Fig.14: Actual ice thickness in the storage tank.

Fig. (15) shows the comparison between the numerical data and the experimental data. The data shows that the error is small as stated before and the numerical model can be used in predicting the dimensions of different ice storage tanks.

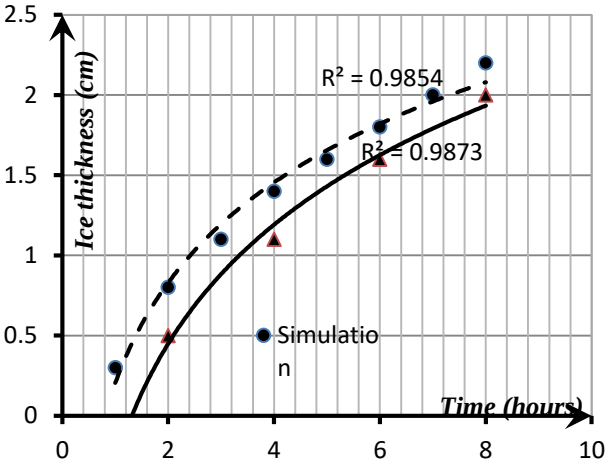

Fig. 15: Comparison between numerical and experiment Results.

VII. CONCLUSION

The data obtained before stated that the speed of the interface between solid and liquid decreases with time because of the increase of solid thermal resistant. The ice thickness increases with decreasing of HTF temperature up to (259.15 K). No effect in changing the diameter of the copper pipes bigger than (2 cm) on the ice thickness. No effect of the copper pipe length which less than (200 cm) on the ice thickness. No effect on the PCM initial temperature (amount of sensible load) on the ice thickness. Good agreement between numerical and experimental data after eight hours of work with an error of 9%.

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Integration Readiness levels Evaluation and Systems Architecture: A Literature Review

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***Abstract*—** *The success of complex systems projects is strongly influenced by their architecture. A key role of a system architect is to decide whether and how to integrate new technologies in a system architecture. Technology readiness levels (TRL) scale has been used for decades to support decision making regarding the technology infusion in complex systems, but it still faces challenges related to the integration of technologies to a system architecture. Integration Readiness Levels (IRL) scale has been elaborated in the last decade to face these challenges, representing the integration maturity between the technological elements of a system. The aim of this theoretical article is to perform a literature review on IRL scale evaluation and on systems architecture, through bibliographic research. Results show the review organized in five topics that surrounds the research objective, presenting the IRL and TRL scales evolution, comparing their evaluation practices, and exploring the architecture complexity of systems. Suggestions for future research are proposed based on these results.*

Keywords*— *Integration Readiness Levels, systems architecture, systems integration, system readiness assessment, Technology Readiness Levels.

I. INTRODUCTION

Systems architecture has strong influence on the success or failure of complex systems (Maier & Rechtin, 2000), and one of the key roles of a system architect is to decide whether and how to integrate new technologies in a system architecture (Crawley, Cameron, & Selva, 2016). Complex Products and Systems (CoPS) are defined (Hobday, 1998) as high cost and engineering intensive products, systems, networks and buildings.

The Technology Readiness Levels (TRL) scale was developed to support decision making in relation to the introduction of technologies during the development of complex systems (Mankins, 2009). Although this scale has been used for decades, it does not reflect well the integration of technological elements into the system architecture, and its application has other challenges related to system complexity, project planning, subjectivity and imprecision of the scale (Olechowski, Eppinger, & Joglekar, 2015).

In the space systems industry, the current global scenario presents notable factors such as intense technological innovation, growing globalization, entrepreneurship, proliferation of increasingly smaller satellites, and product modularization (Futron, 2014). Many techniques used for space systems development were conceived at the time of the space race, where the projects had large budget and greater continuity in planning (D. Hastings, 2004; Ross, Hastings, Warmkessel, & Diller, 2004). Given the current scenario of greater technological, commercial, political and application uncertainties, space-system architectures must face such uncertainties (D. E. Hastings, Weigel, & Walton, 2003), and technology readiness assessment methodologies should be updated (Olechowski et al., 2015).

The Integration Readiness Levels (IRL) scale was proposed to represent the maturity of the integration between technological elements of a system (Sauser, Verma, Ramirez-Marquez, & Gove, 2006) and has been evolving over the last decade.

The objective of this research is to perform a literature review on IRL scale evaluation and systems architecture. The literature review aims to compare the incipient IRL evolution and evaluation practices to the more consolidated TRL literature, and to explore the systems complexity environment where both scales are used, by reviewing concepts related to systems architecture, integration and their representation.

II. METHODOLOGY

Research methodology consisted in bibliographic research with qualitative analysis, comprising five topics. The first topic presents the TRL scale fundamentals and current limitations. In the second topic, the IRL scale is analyzed through an historical perspective and according to topics of interest for this research. The third topic presents methodologies and best practices related to TRL assessment process and the equivalent IRL assessment process. The fourth topic presents concepts about systems architecture and integration. The last topic shows selected concepts about the representation of dependencies in complex systems.

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III. RESULTS AND DISCUSSION

3.1 TECHNOLOGY READINESS LEVELS

According to Mankins (2009), in the 1970s the National Aeronautics and Space Administration (NASA) introduced the concept of Technology Readiness Levels (TRL) as an interdisciplinary scale to allow better assessment and communication related to new technologies development.

The main objective of the TRL scale is to assist the decision making regarding technology infusion in complex systems development. When a technology is not mature enough, its introduction in a system under development may lead to deviations in the project schedule, budget and performance (GAO, 1999; Mankins, 2009; Olechowski et al., 2015).

The TRL scale was modified during its decades of existence. The scale was originally conceived to assist the transition from technology development projects to space missions development (Sadin, Povinelli, & Rosen, 1989). In 1995, TRL scale was strengthened by a NASA publication (Mankins, 1995) which detailed each technology readiness level definition and provided TRL application examples. This latest version of the TRL scale considers nine discrete levels (1 to 9), where higher TRL ratings relate to more mature technologies.

In the United States, Government Accountability Office (GAO) in 1999 recommended to the Department of Defense (DoD) to adopt the NASA TRL scale or similar scale to improve the research and development results (GAO, 1999). The DoD adopted the TRL scale with some changes to the original version (DoD, 2011). Also the Department of Energy (DOE) adopted the TRL scale with major modifications to the original version (DOE, 2015).

In the 2000s, the TRL scale began to be used in space programs from other regions such as Europe and Japan (Mankins, 2009). In 2013, the ISO 16290 standard "Space systems - Definition of the Technology Readiness Levels (TRLs) and their criteria of assessment" (ISO, 2013) was published. This standard was proposed by European Cooperation for Space Standardization (ECSS, 2017a) and discussed at international level by the International Organization for Standardization (ISO) committee members.

According to ECSS (2017a), the TRL scale proposed in ISO 16290:2013 (ISO, 2013) standard presents some differences to the original TRL scale (Mankins, 1995), which are: Level 5 is a new intermediate level defined when subscale breadboards are used; level 6 is equivalent to the original TRL level 5; level 7 is equivalent to the original TRL level 6; The original level 7 relates to system prototype demonstration in space environment and is not defined by the ISO 16290:2013 (ISO, 2013) TRL scale.

According to Cornford and Sarsfield (2004), the TRL scale is focused on a particular technology evaluation, and significant integration challenges may occur when a technology is included in a space system. So even that the technology is mature, using this technology in new applications may be challenging, and the TRL scale usually does not represent the challenge of integrating the technology in a space system.

Olechowski, Eppinger and Joglekar (2015) investigated the use of the TRL scale in different industrial sectors through interviews and analyzes on industry standards and organizational guidelines. These authors (Olechowski et al., 2015) found that the TRL scale is widely used in different complex systems industries and identified fifteen challenges to improve the TRL scale utilization, categorized in three topics: system complexity, planning and review, and assessment validity.

Subsequently, Tomaschek, Olechowski, Eppinger and Joglekar (2016) conducted a survey with TRL scale practitioners in different industries worldwide to identify, among the fifteen identified challenges, which were the most priority challenges. The survey results show that the four highest priority challenges are related to the systems complexity, and they are: representation of the integration between technologies, interfaces maturity, modifications in the system and system overall maturity.

3.2 INTEGRATION AND SYSTEM READINESS LEVELS

Research initiated at the Stevens Institute of Technology, led by the researcher Brian J. Sauser, proposed two new readiness levels scales (Sauser et al., 2006) to complement the TRL scale, as options to overcome the TRL scale challenges related to the systems complexity, the same challenges identified by Tomaschek et al. (2016). The two new scales proposed were: Integration Readiness Levels (IRL) and System Readiness Levels (SRL).

The research about the integration maturity between components in a system is also justified by the fact that failures of many space systems are related to the integration of components (Sauser, Reilly, & Shenhar, 2009).

For Sauser, Ramirez-Marquez, Henry and DiMarzio (2008), technology integration is part of the systems engineering effort and demands a quantitative assessment tool to evaluate the risk of technology integration in a complex system.

Sauser, Gove, Forbes and Ramirez-Marquez (2010) consider the systems integration definition proposed by Buede (2000), as the aggregation process from components that need to be aggregated from the system configuration items. Sauser, et al. (2010) also consider the integration process as the upward slope in a "V" model

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commonly used in systems engineering. Subsequently, the scale was modified to also represent the architecture definition activities, the downward slope in "V" model in systems engineering.

Sauser, et al. (2010) propose that the IRL scale should be able to be applied to different hierarchical levels from configuration items to the system level, and that the scale should represent the integration in sufficiently general terms, but specific enough to be useful. Sauser, et al. (2010) suggested that scales have been extensively used to support the integration between components in the computer industry, but scales to support more general systems integration are less developed.

The first version of the IRL scale (Sauser et al., 2006) was designed using the International Standards Organization's Open Systems Interconnect (ISO / OSI) scale, used in computer networks, which represents data integration levels in a particular interface between one or more systems. The first version of the IRL scale had seven readiness levels, based on the ISO / OSI scale.

Sauser, et al. (2010) included two new levels to the IRL scale, when compared to the original IRL version (Sauser et al., 2006). The two new levels were: Level 8 related to qualification through testing and demonstration and Level 9 related to the successful operation in a mission.

Further, the IRL scale was modified to better reflect the systems development process and to be more consistent with the fundamentals of TRL scale (Austin & York, 2015, 2016).

The IRL scale is commonly assessed using a Design Structure Matrix (DSM) to represent the integration between the system components (Olechowski et al., 2015).

The System Readiness Levels scale, or SRL, was proposed to quantify the readiness level of a component in relation to the other components that constitute a system, and indicate how much the whole system is integrated (Sauser, Ramirez-marquez, & Tan, 2008). Equation 1 (Austin & York, 2015) shows the composite SRL calculation for a system with 'N' components, where the matrix $[SRL]_{Nx1}$ is obtained by multiplying the matrix $[IRL]_{NxN}$, which represents the integration readiness levels between the 'N' components, and the matrix $[TRL]_{Nx1}$, which represents the technology readiness levels for each of the 'N' components. The SRL of the overall system can be obtained by the normalized average of the elements of the matrix $[SRL]_{Nx1}$.

$$[SRL]_{Nx1} = [IRL]_{NxN} \text{ X } [TRL]_{Nx1} \quad (1)$$

The SRL scale can be transformed in a scale of discrete numbers comprising certain calculated SRL intervals (Austin & York, 2015, 2016).

Other applications proposed for the IRL and SRL scales, together with TRL scale, are: use the readiness levels as a baseline coupled to a earned value management system for project management (Magnaye, Sauser, Patanakul, Nowicki, & Randall, 2014); system development planning and system development costs minimization (Magnaye, Sauser, & Ramirez-Marquez, 2010); and the association with effectiveness metrics for systems design, such as the Equivalent Mass System (Sauser & Magnaye, 2010).

The IRL scale is being used in the aerospace industry (Sauser, Long, Forbes, & McGrory, 2009), and customized to reflect the system integration process for oil and gas exploration (Knaggs et al., 2015, 2017, Yasseri, 2013, 2016).

Other papers communicate the experience evaluation about using the IRL scale (Atwater & Uzdzinski, 2014; Baiocco et al., 2015; Knaggs et al., 2017; Lemos & Chagas Jr., 2016; London, Holzer, Eveleigh, & Sarkani, 2014; Mantere, 2014; Mantere & Pirinen, 2014; Mapamba, Conradie, & Fick, 2016; Mcconkie, Mazzuchi, Sarkani, & Marchette, 2013; Pirinen, 2014; Sivlen & Pirinen, 2014).

Kujawski (2013) criticized the SRL scale, with the argument that the scale is a product between two ordinal numbers, which represent the TRL and IRL scales, and its results should be analyzed with caution. Jimenez and Mavris (Jimenez & Mavris, 2014) criticized the IRL scale, at the time that the IRL scale was based on the ISO / OSI data integration scale, proposing that the scale was very specific to the data management effort, and suggested to use only the TRL scale. However, the IRL scale has evolved to address this criticism.

The International Systems Readiness Assessment Community of Interest (ISRACOI, 2018) is a worldwide collaborative community of researchers, practitioners and stakeholders interested in system readiness metrics such as TRL, IRL and SRL. New researches and white papers are published in the ISRACOI website (2018).

3.3 TECHNOLOGY READINESS ASSESSMENT

According to Mankins (2009), key factors for effective use of the TRL scale are: to perform objective and well documented assessments for the readiness and risks about the technology under evaluation; and perform the assessments at critical decision making milestones in the complex system development project. Mankins (2009) proposed the concept of Technology Readiness Assessment (TRA) as a methodology used to conduct the TRL scale evaluation process. For Mankins (2009), a rigorous TRA should include clear evidences that the declared TRL was achieved - such as photos of a breadboard in the laboratory, quantitative data verification tests, among other evidences.

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The main methodologies used to perform a TRA have been qualitative analysis from experts to establish the adequate TRL level, and analysis supported by structured interviews and quantitative methods (Hueter & Tyson, 2010). These quantitative methods may be supported by probability and statistics analyses (Ristinen, 2010). Bayesian networks may also be applied to calculate the most adequate TRL level (Austin et al., 2017).

Air Force Research Laboratory (AFRL) developed an automated tool (Nolte, Kennedy, & Dziegiel, 2003) to structure the TRL assessment interview and quantify the TRL level more appropriate to the responses. The questionnaire presents questions regarding the level of knowledge about the technology and its potential customers, about the technology development documentation, future aspects of integration, modeling and simulation, verification and system environment where the technology might be infused. According to these authors (Nolte et al., 2003), the main application envisioned for the TRL scale in this case was to guide the transition from technology development programs to the technology use in operational systems.

Similarly, the Jet Propulsion Laboratory (JPL) developed a TRA process (Frerking & Beauchamp, 2016) based on NASA's recommendations. This process contains a questionnaire based on a previous questionnaire proposed by Bilbro (2009).

Cornford and Sarsfield (2004) argue that: the TRL assessment techniques at that moment were qualitative; and that the importance of the language and culture involved in the technology transfer process between laboratories and their integration in space systems was generally underestimated. In this way, the TRL assessments were subjective due to factors such as: the team carrying out the assessment was usually the same development team and not a third party with more impartial view; the original settings of the TRL scale could be interpreted in different ways; even though quantitative methods were used, the database was still subjective due to limitations in the TRL scale definitions objectivity.

A list of supporting information for each TRL level was developed by the DoD (2011) in order to make more objective assessments, containing information related to systems engineering, verification, technical requirements and circumstances relevant to each TRL level.

The ISO 16290:2013 standard (ISO, 2013) presents a list with the work performed and documented as evidences required to achieve each level TRL. This list of evidences presents predominantly elements of space systems verification discipline, accompanied by their respective performance requirements and technology definition documents (ECSS, 2017a).

GAO (2016) published a preliminary report in order to establish a methodology based on best practices that could be used by the USA federal government to perform technology readiness assessments (TRA), aiming mainly to support decision making on programs and projects which involve large commitments of financial resources. Some of the TRA best practices described in this document (GAO, 2016) are:

- The responsible for the TRA should understand which evidences would be needed for the TRL scale and understand the operational environment in which the technology should operate, depending on whether the assessment is performed to meet government agencies requirements or it is performed as an internal exercise to monitor the technology readiness;
- Reliable assessments are supported by artifacts and clear information, such as requirements documents, analyzes, test reports and environmental testing considerations;
- Supporting information and evidence needed for each TRL level are best practices. They are not exhaustive and may vary according to the technology or application, so it is necessary to adapt these definitions to better reflect the technology and its application;
- The quality of a TRA depends on the accuracy and relevance of the artifacts, test data, analysis reports, and other supporting information. This information can be dependent on other technologies or activities that are outside the assessment scope, but may need to be included to better assess the technology readiness. Changes or refinements in requirements, technology parameters or other factors may affect the TRA, in which case the TRA should be updated.

ECSS published the handbook ECSS-E-HB-11A "Technology readiness level (TRL) guidelines" (ECSS, 2017a) as a guide to the TRL scale application in space missions and programs, offering guidelines for the interpretation of the TRL scale and best practices related to the technology readiness assessment process. ECSS adopted the ISO 16290: 2013 (ISO, 2013) standard for the TRL scale definition.

Regarding the IRL scale, Sauser, et al. (2010) established decision criteria to support the assessment for each IRL level. The criteria were based on two sources. The first source was the evaluation of standards, researches and other documents related to systems engineering and acquisition processes (such as DoD 5000.02, INCOSE Systems Engineering Handbook, IEEE 15288, NASA Systems Engineering Handbook). The second source was based on discussions and interviews with experts in the areas of systems engineering, project management and procurement management, to assess what would be the

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most important decision criteria for each IRL level. As integration is a complex topic, Sauser, et al. (2010) recommended that future researches could continue to review and modify the decision criteria list and their relative importance.

Austin and York (2015, 2016) presented the latest version of the IRL scale. A column in the IRL scale presents the required evidences for each level, incorporating the most relevant criteria identified by Sauser, et al. (2010) and including data integration testing particularities.

The list of required evidences for the IRL scale presents a potential improvement opportunity (Jesus & Chagas Jr, 2017) for its definition, when compared to how the list of required evidences for the TRL scale is structured in the ISO 16290:2013 (ISO, 2013) standard.

The integrated process for assessing the TRL, IRL and SRL scales is defined as the System Readiness Assessment (SRA) (Austin & York, 2015, 2016). A system mapping provides an understanding of the relationships between the different architecture layers. The highest hierarchical level of this mapping is based on operational requirements and activities. Then the functions supporting these operational activities are mapped. After that, the system components that perform these functions are identified. In turn, the components are composed by technologies. Connection diagrams between the components help to understand the system architecture and integration. Fig. 1 illustrates an example of SRA application (Austin & York, 2015).

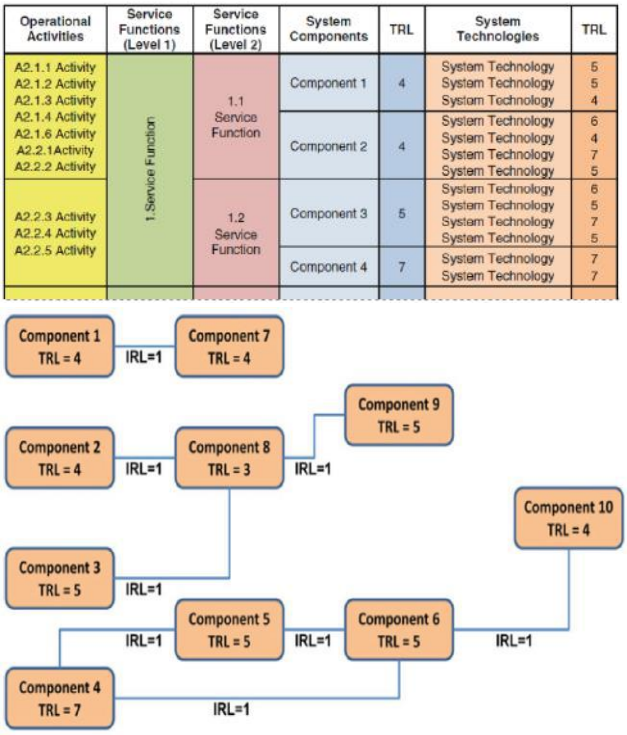

Fig.1: Example of System Readiness Assessment application.

Source: Austin and York (2015), which is published under a CC BY-NC-ND license (Creative Commons, 2018).

3.4 COMPLEX SYSTEMS ARCHITECTURE AND INTEGRATION

Hobday (1998) defined Complex Products and Systems (CoPS) as high cost and engineering intensive products, systems, networks and buildings. CoPS tend to be manufactured in single projects or in small batches and the production emphasis tends to be on design, project management, systems engineering and systems integration. Examples of CoPS include satellites, telecommunications networks, flight simulators, aircraft engines, avionics systems, train engines, air traffic control units, electrical network systems, offshore oil equipment, intelligent buildings and telephone network equipment. Due to its high cost and customization features, the dynamics of innovation and the nature of the industrial coordination are different in relation to other types of products, especially the low cost, mass-produced, and based on standard components.

Hobday, Davies and Prencipe (2005) suggested that systems integration became an essential capability for modern corporations. Many major global companies are developing a new industrial organization model based on systems integration. Instead of performing all the productive tasks in-house, companies are building capabilities to design and integrate systems, while managing networks of component and subsystem suppliers. In this sense, systems engineering and project management disciplines are needed to coordinate the technical and organizational effort required for systems integration (Eisner, 2008).

Some applications of readiness scales for system integration are: analyze the depth of systems integrators technology base (Chagas Jr., Leite, & Jesus, 2017), categorize (Lemos, 2016; Shenhar et al., 2005) and support (Jesus & Chagas Jr., 2016) CoPS development projects, and apply to a technology vigilance system (Andrade, Silva, Chagas Jr., Rosa, & Chimendes, 2017).

Eisner (2005) identified in the literature factors that contribute to greater complexity of systems, which were: size, number of functionalities, parallel versus serial operation, number of operating modes, duty cycle (dynamic versus static), real-time operations, very high performance level, number of interfaces, different types of interfaces, degree of integration, non-linear behavior and human-machine interaction. Regarding the different types of interfaces, many systems have a simple mechanical and electrical interface, as connecting stereo components and connecting a cable to a DVD player, VCR or TV set, but if we add for example thermal,

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environmental interface requirements, data structure and protocols, the system becomes more complex.

Blanchard and Fabrycky (2006) proposed the following main system life cycle phases: Conceptual Design, Preliminary Design, Detail Design and Development, Production/Construction, Operational use and system support, Retirement. The activities of testing, evaluation and validation of the system are progressively carried out throughout its development.

According to Blanchard and Fabrycky (2006), models are created to represent a system under study and can be classified as physical, analogue, schematic, and mathematical types. Physical models look like what they represent, analogue models behave like the system, schematic models describe graphically a process or situation, and mathematical models represent symbolically the principles of a situation under study. During the early phases of detail design, breadboards, bench-test models, engineering models, engineering software, and service test models are built aiming to verify specific performance or physical design characteristics. Formal tests and demonstrations are carried out during the latter activities of the detailed design phase when pre-production prototype equipment, software, and similar formal procedures are available.

Also, according to Blanchard and Fabrycky (2006) the basic architecture of the system is established with the definition of system operational requirements, the concept of maintenance and support and the identification and prioritization of technical performance measures (TPMs). A system architecture represents the system high-level design or configuration, its operational interfaces, anticipated usage profiles (mission scenarios) and the environment in which it must operate, describing how these various requirements should interact for the system. Next, the functional architecture describes the system in functional terms. From this analysis, through the requirements allocation process and the definition of the various resource requirements necessary for the system to reach its mission, the physical architecture is defined.

Maier and Rechtin (2000) proposed that the progressive refinement of the design is one of the most basic patterns for the engineering practice. The process of systems architecting is performed through the progression, or gradual reduction of the abstraction, modeling, evaluation criteria, heuristics and purposes, from the initial ideas up to reach the most formal and detailed processes in different fields of engineering. Thus, the evolution and development of models are threated as the core process of systems architecting. The models represent and control the system specification, its design and its production plan. Even after the system delivery, the modeling will be the mechanism to evaluate the system behavior and plan its evolution.

Rechtin (2000) proposed that decisions related to the evolution or creation of new system architectures influence directly the competitiveness of organizations to meet the demands of their customers, and therefore influence directly the success of these organizations.

Regarding the product development process, Ulrich and Eppinger (2012) proposed that product architecture is the allocation of functional elements to physical elements of the product. The purpose of the product architecture is to define the basic building blocks of the system physical elements in terms of what they do and what are their interfaces with the rest of the product. After completing the architecture definition, it is possible to perform the detailed design and testing of these building blocks, allocate them to teams or suppliers, so that the development of different parts of the product could be done simultaneously. Decisions on the product architecture and modularity influence directly important aspects of the organization success, such as future changes in the product range, components standardization, product performance, manufacturing, and product development management (Ulrich, 1995; Ulrich & Eppinger, 2012).

Crawley, Cameron and Selva (2016) proposed that a simple definition for system architecture is the abstract description of the system entities and the relationships between them, and proposed that in systems engineering the architecture can be represented as a set of decisions. These authors (Crawley et al., 2016) proposed that system architecting is a composition of science and art, with the rationalization of decisions through the formulation of how these decisions can impact the system performance. These authors (Crawley et al., 2016) also suggested that the system architecture can be used to map and analyze an existing system, in a reverse engineering method, or be used in the synthesis of a new system, in a direct engineering method.

Crawley, Cameron and Selva (2016) considered that a new technology is often at the heart of a new product, and a change in the technology is often a major motivation for a new architecture development. So, according to these authors (Crawley et al., 2016), one of the key roles of the system architect is to decide whether and how to infuse a new technology into a system architecture. This infusion would require deep knowledge of the available technology and its maturity, the process to integrate the technology into the system, and the value that this integration would create. Still according to these authors (Crawley et al., 2016), the TRL scale is useful to support system architects to take these decisions.

Ross, et al. (2004) and Hastings (2004) suggested that many techniques to support space systems development were conceived during the space race, where the projects had large budgets and great planning continuity.

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Nowadays, in addition to face the technical challenges in building such complex systems, engineers must also deal with changes in the political and economic context that influence the design and development of space systems.

Hastings, et al. (2003) proposed that decisions in system architectures should help to address these uncertainties, with a focus on strategies such as flexibility and robustness that can lead designers to different optimization solutions to meet specifications or other specific criteria.

Crawley, et al. (2004) suggested that system architectures are not static, but they evolve for long periods as technologies mature. They also evolve during the natural process of designing a system. These evolutionary patterns are useful for understanding the importance of the representation and the decisions involved in a system architecture.

In line with the previously described context that systems and their architectures face, Olechowski, Eppinger and Joglekar (2015) proposed that is important to update the TRL scale application methods. The argument is that since the current context of growing systems complexity, greater dynamics of innovation, the current use of TRL in decision-making and the current use in different organizational processes, are significantly different from the context experienced by NASA in the 1970s when the original TRL scale was created.

Regarding the definition for systems integration, the systems engineering literature and standards propose a common notion for systems integration as the process of assembling and integrating elements of smaller hierarchical levels, successively into larger hierarchical levels, until the system and its desired functionalities are realized (Buede, 2000; DoD, 2017; ECSS, 2017b; IEEE, IEC, & ISO, 2007; INCOSE, 2006; Kossiakoff, Sweet, Seymour, & Biemer, 2011; NASA, 2017; Peterson & Rodberg, 2005). The ISO / IEC 26702-2007 IEEE 1220-2005 “Standard for Systems Engineering - Application and Management of the Systems Engineering Process” (IEEE, IEC & ISO, 2007) added that to perform the integration of elements into a system, the design and interface logic of these elements must be met.

For Sage and Lynch (1998), the integration of technical parameters and interface compatibility are generally assumed as a technical effort carried out during the latter parts of the system development lifecycle. However, if this effort is not planned properly in the definition phases and in the early parts of the development phase, integration is likely to be difficult at the end of the development phase. To perform concurrent engineering and simultaneously develop different parts of the system, initial efforts must be made in system architecture and system partitioning, and then an explicit system integration stage is required.

In this way, Sage and Lynch (1998) suggested that if we consider that the activities of analysis, definition, design, requirements and control of interfaces are all integration efforts, then the system integration occurs at almost every stage of the systems development lifecycle, not just in its later stages.

In his proposal for a general system integration theory, Langford (2013) proposed that integration is the approach of building or creating a whole from parts, and is more than simply combining or assembling these parts. Many system integration efforts undergo changing requirements for many reasons, and while there are numerous strategies for solving these system integration problems, it is time consuming to plan and integrate any part of the system as part-by-part, because the problems persist (Ramamoorthy, Chandra, Kim, Shim, & Vij, 1992). The integration concept proposed by Langford (2013) expresses integration of artifacts as "part-to-all-expected" rather than "part-to-part". For example, to integrate parts A and B to reach system C: Plan and integrate Part A in the way that system C should behave, and then Part B in the way that system C should behave, is more effective than integrating Part A to Part B to reach system C. If Part A is not available, Part B can still be integrated with the behaviors of C to show how Part A would (and should) behave. According to this author (Langford, 2013), the application of this "part-to-all-expected" system integration concept illustrates the power of thought and theoretical planning, that is, most situations that need to be addressed during integration planning could be threated regardless of the individual parts situation.

Zandi (1986) suggested that science and engineering should make use of systemic thinking, considering that a system is more than the sum of its parts, possessing emergent properties. Crawley, Cameron, and Selva (2016) proposed that emergence refers to what appears, materializes, or surfaces when a system operates, or in other words the functions that emerge when a system operates. Emerging functions can be classified as desired or undesirable, and anticipated or unanticipated (Crawley et al., 2016). Sillitto (2005) proposed that systems engineering could be defined as the management of emerging properties, such as the importance of emerging properties in the management of a system.

3.5 REPRESENTATION OF DEPENDENCIES IN COMPLEX SYSTEMS

According to Browning (2016), the Design Structure Matrix (DSM), also called the dependency structure matrix, became a modeling framework widely used in many areas of research and practice. DSM has advantages of simplicity and conciseness in its representation and, supported by appropriate analysis, may also highlight important patterns in system architectures (design

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structures) such as modules and clusters (Eppinger & Browning, 2012). DSM is a square matrix where diagonal cells normally represent the elements of the system and off-diagonal cells represent relations (such as dependencies, interfaces, interactions, etc.) between the elements.

Recent publications on the IRL scale use a DSM matrix to map the system architecture and perform the IRL evaluation (Olechowski et al., 2015).

The N-Squared (N2) diagram is also an widely used tool (Crawley et al., 2016; Lalli, Kastner, & Hartt, 1997; Larson, Kirkpatrick, Sellers, Thomas, & Verma, 2009; NASA, 2017). The diagram, in a matrix form, is used to represent the interfaces of a system. The components or functions of the system are placed diagonally, while the other cells in the NxN matrix represent the inputs and outputs of the interfaces, the outputs being represented in rows and the entries in columns. Alternatively, the interfaces may be represented without polarization, that is, without distinction between inputs and outputs. The N2 diagram may be applied at successively lower hierarchical system levels, and may also represent external interfaces to the system. The N2 diagram application is similar to the DSM (Eppinger & Browning, 2012).

IV. CONCLUSION

This paper presented a literature review on IRL scale evaluation and systems architecture, covering five topics that surrounded the main topics of interest.

The fundamentals of the TRL scale and its assessment methods were analyzed in order to understand the IRL origin and be able to compare both scales literatures. Systems architecture and systems integration concepts were presented in order to highlight the complexity of systems and explore the context where these scales are used. Selected concepts about the representation of dependencies in complex systems are shown in order to identify methodologies being practiced in the literature.

Through the literature review analysis, it is possible to suggest future researches about the IRL scale, such as: Evaluate the scale definition and the evidences needed for each level, towards a more discipline neutral approach, as the TRL assessment is being consolidated as interdisciplinary and relies on verification and documentation practices, and considering that IRL scale is evolving from a data integration focus to a multidisciplinary approach; Explore complementary methods to analyze the integration readiness through additional systems architecture analysis approaches, given that systems architecture is a vast topic, reflecting the complexity of systems; Analyze a system with multiple interface types between its elements is also a topic not yet explored in IRL scale literature.

This paper may support researchers and practitioners to better understand the IRL scale evolution, opportunities to the scale evaluation process, and IRL scale relations to the system architecture and integration concepts.

IRL scale complements TRL scale as a tool to support decision making in the development of complex systems. System architects need to decide whether and how to integrate new technologies in a system architecture, being the system architecture a critical factor for the system success.

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Design and Analysis of low coupling, high transmission optical wavelength Demultiplexer based on two dimensional photonic crystal

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Abstract**—** *In this work, design and simulation of two dimensional photonic crystal with hexagonal lattice based wavelength division multiplexer is investigated. It is consists of high dielectric rods of GaAs with refractive index 3.375, surrounded by air. This device is ultra compact. The demultiplexing of wavelengths 1330nm and 1470nm is done, based on different output line defects with different radius by pitch ratio. The Discrete Fourier Transforms and power spectrum is obtained using OptiFDTD method and results are compared for various wavelengths.*

Keywords**— *DFT, Fast Fourier Transform, photonic crystal, wavelength division demultiplexing, FDTD.***

I. INTRODUCTION

Photonic crystals (PhCs) are inhomogeneous dielectric media with periodic variation of the refractive index. In general, photonic crystals have a photonic band gap. That is the range of frequencies in which light cannot propagate through the structure. Photonic crystal has periodic crystal like an organized structure so to get tailor made properties and its arrangement can be varied. As it works on photons (optical frequency) so called photonic. Guiding of light occur better when the pitch (distance between adjacent rods) is smaller than the wavelength of the signal [1].

Photonic bandgap materials can be viewed as a subclass of large family of material called Meta material. In which property is derived from structure rather than material itself. These materials have highly periodic structures that can be designed to control and manipulate the propagation of light. And can be designed to acquire escalate properties over conventional optical fibers. Philip Russell in 1998, who first developed the photonic crystal fiber. Electromagnetic wave propagation in periodic media was first studied by Lord Rayleigh in 1888 [Ray1888].In 1987, Yablonovitch and John - by using the tools of classical electromagnetism and solid-state physic introduced the concepts of omnidirectional photonic band gaps in 2D and 3D structure [2].

In communication system there are various multiplexing techniques which provide multiplexing of different signals in different format. For optical networks, different light source emit diverse wavelength thereby wavelength division multiplexing is one of the important enabling technologies in optical communication. WDM combines these input signals, and are launched over single optical fiber channel, this process is called multiplexing. Multiplexing allows to access very large band width available in an optical fiber. At the destination, a wavelength division demultiplexer separates the prismatic signal into integral wavelengths, which are narrow band channels. This process is called demultiplexing. Traditionally, de-multiplexing components are realized using thin-film filters, fiber Bragg gratings (FBG), or arrayed waveguide gratings [3].

II. PROPOSED STRUCTURE

In this paper, a novel design of 2-D photonic crystal based demultiplexer with hexagonal lattice is proposed and analyzed for optimized performance. Plane wave expansion (PWE) method is utilized to obtain photonic band gap (PBG) of the structure. The device is ultra compact. Hexagonal lattice based demultiplexer is made of high dielectric rods suspended in low dielectric air. High dielectric contrast provides large bandgap for photonic crystal. Bandgap is the range of frequencies that are allowed to pass through the structure. Various other parameters such as refractive index, lattice constant, radius of holes, lattice structure, air hole shape etc. determine the photonic crystal waveguide [4]. Number of rods in x- direction are taken 11, whereas in z- direction 15. The lattice constant (distance between the centres of two neighboring rods) is .570 μm and is denoted by ‘a’, and the radius of the GaAs rod is 0.114 μm.

In this paper, radius of GaAs rods for hexagonal lattice ‘r’ is chosen to be 0.2*a. material GaAs has negative differential mobility due to this it is more suitable for microwave applications and is low noise material. Defects are added by altering the radius of rods, it can be seen

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from the fig. 1 that at radius 'r' equals to 0.25*a, the wavelength 1330nm will have minimum losses and high transmission and will follow the straight path. Whereas at radius equals to 0.27*a, wavelength 1470nm will follow bend path with high transmission [6]. This photonic crystal structure is designed, simulated and analyzed by using optiFDTD simulation software. Line defects are utilized to design this demultiplexer. Observation points are placed to obtain DFT response and observation lines are placed for power spectrum response. Fig. 1 represents the layout of proposed photonic crystal structure. And fig.2 shows refractive index profile in which red part represent refractive index of GaAs rods whereas blue part shows refractive index of air.

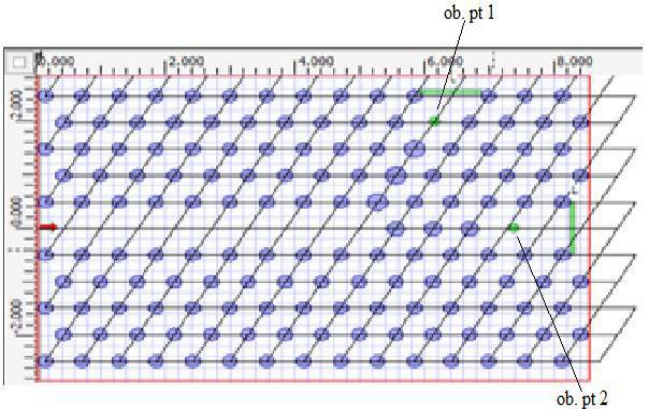

Fig. 1: Layout of the proposed de-multiplexer design based on photonic crystal architect

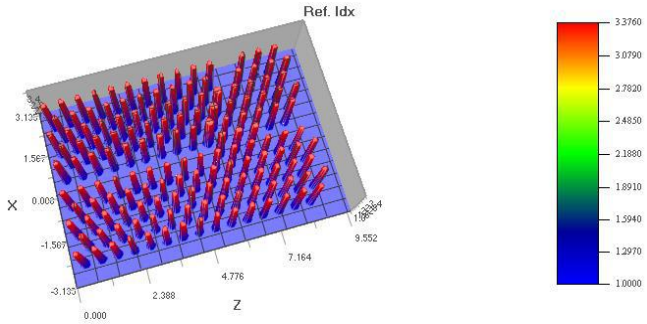

Fig. 2: Refractive index profile of proposed de-multiplexer design

It can be seen from fig. 4 that at wavelength 1.33 µm loss is minimum at radii 0.1425µm line defect and for 1.47µm wavelength, at 0.1539µm line defect. Based on this structure is drawn. Which is more compact and observation points are placed in such a position to have most optimum and better results than the previously proposed demultiplexer structure.

III. SIMULATION AND RESULTS

A 2-D 32 bit simulation is performed to obtain the transmission response of this demultiplexer. The result shown is of transverse electric (TE) polarization.

3.1 Band-gap Calculation

A photonic band gap is the range of frequencies where the light cannot propagate through the structure. This interaction results in the formation of allowed and forbidden energy levels. Fig. 3 represents the photonic band-gap for the hexagonal lattice structure. It has been found that for TE polarization largest photonic band gap occurs when shape of the Brillouin zone is hexagonal lattice [5].

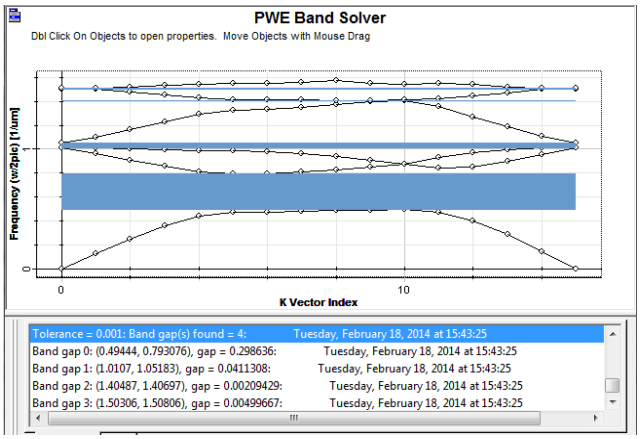

Fig. 3.:Photonic band gap diagram for the proposed structure

3.2 Discrete Fourier Transform

Fig.4 below shows the DFT plot for wavelength range from 1.1µm to 1.6µm.

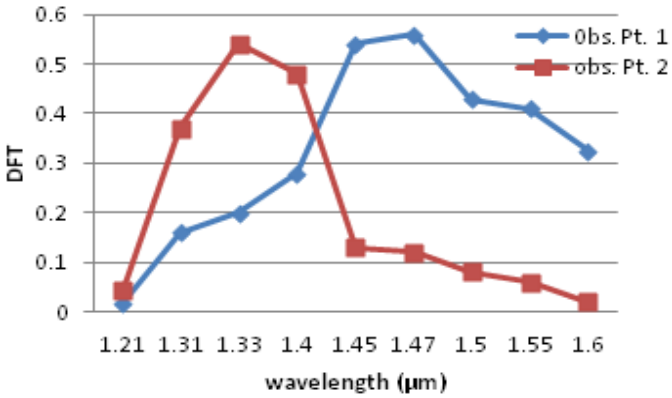

Fig. 4: DFT plots at two observation point for various wavelengths

3.3 Electric Field Distribution

Fig.5 depicts the electric field distribution of two wavelengths. The presented demultiplexing characteristics are for TE polarization only.

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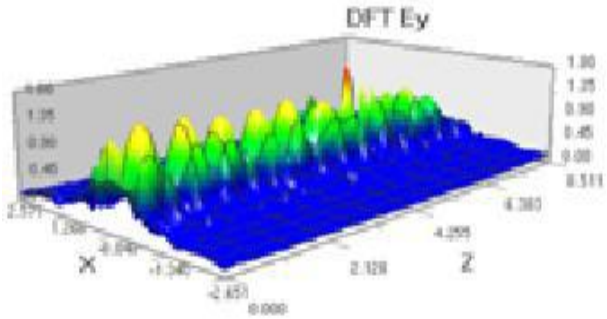

Fig. 5 Simulated electric- field distribution for 1.33µm

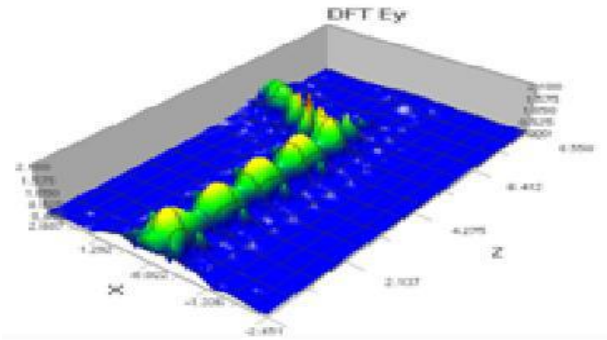

Fig. 6: simulated electric- field distribution for 1.47µm

The demultiplexing action is clear from fig. 5 and fig. 6, such that the wavelength 1.33µm will pass through the defect having radius of holes 0.1425µm and will follow the straight path. And the 1.47µm wavelength will pass from the rods having radius 0.1539µm through the bend path. At wavelengths other than specified wavelength, transmission is very low with high interference. It can be observed that at observation point 1, wavelength 1.47µm has peak value of DFT compared to other wavelengths. Similarly at observation point 2, 1.33µm wavelength has peak value of DFT compared to other wavelengths. Also the plots show that coupling at both the observation points is negligible. Simulated results are highly improved and low interference than reported till date for hexagonal lattice structure.

3.4 Fast Fourier Transform

Fig. 7 and fig. 8 illustrate the FFT graph for both l.33 and l.47 µm wavelengths respectively.

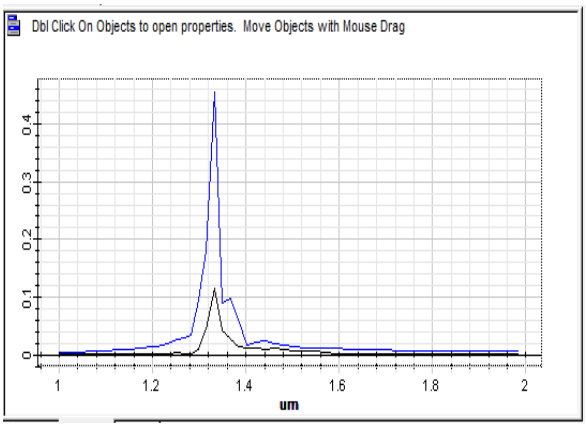

Fig. 7:FFT graph at 1.33µm wavelength

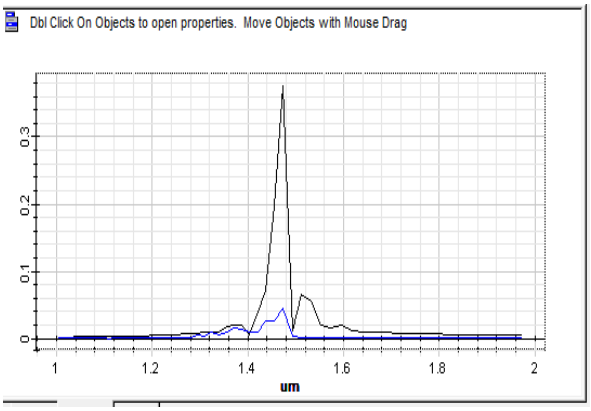

Fig. 8: Power spectrum at 1.47µm wavelength

3.5 Coupling Measurement

While DFT for the observation point gives the spectral response for a series of wavelengths. Transmission graphs show better demultiplexing with highly efficient response and very low coupling at both the receiving points.

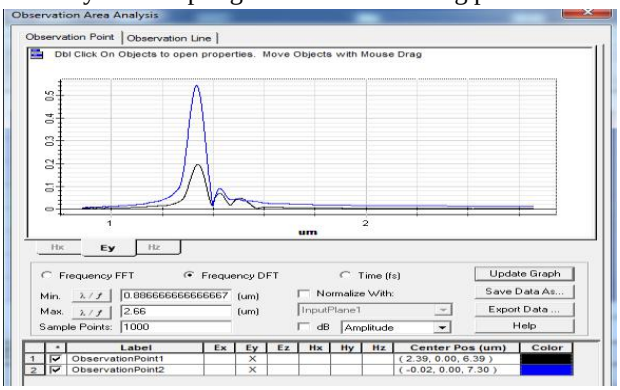

Fig. 9: Coupling of 1.33µm wavelength

Fig. 9 depicts the transmission of signal with wavelength 1.33µm at both the observation points in the term of coupling which is very small.

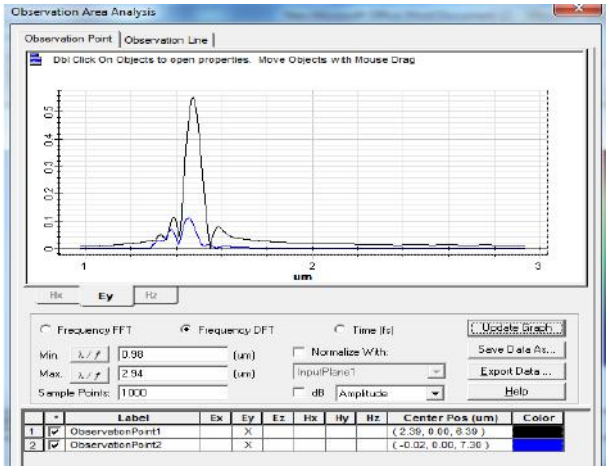

Fig. 10.:Coupling of 1.47µm wavelength

Fig.10. shows transmission of 1.47µm signal at both

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observation points with negligible coupling.

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The Role of Quality Product in Sale Increase of Ulos at Boi Tulus Sianipar Weaving Fabric in Toba Samosir Regency

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Abstract— *This research was conducted at one ULOS fabric (Boi Tulus Sianipar Weaving Fabric) in Toba Samosir Regency of North Sumatra, Indonesia. Every organization or company engages in product selling, creates strategies, or attempts aiming at increasing their sale or market. One of them which is discussed in this research is the implementation of quality product improvement in increasing product sale. The objective of this research is to investigate the effect or the role of quality product improvement in increasing its sale in Textile Fabric of Boi Tulus Sianipar in Toba Samosir regency. This research also concerns on unique product of one area compared with others. Based on the data gathered and data analysis, it is concluded that the improvement of quality product affects its sale.*

Keywords— Ulos, Quality Product, Sales Increase.

I. INTRODUCTION

It's real that companies in similar products both domestic and international face competition. Quality, price, service, stock or reach availability, and sales man skills are the main issue. Besides, understanding the costumers' need is also a challenge for company. These elements have become the concern of Boi Tulus Textile Company. A company which competes with others has to produce a unique product in the same category in order to survive or win the market, and one of it, is strengthening the quality. Boi Tulus Company which produces 'ulos' (ulos is a kind of muffler in Batak tribe) takes that as the major consideration in its sales management.

Ulos is made from thread, in which the thread quality decides Ulos quality. Normally, the quality of a product is the main component in marketing competition. Boi Tulus Company has to realizes this in term of costumers' satisfactory and brings advantage or benefit for the company. In other words, the quality of a product denotes its company. In marketing, costumers' satisfactory is number one because it is the best promotion in promoting the product, as matter of fact, it must be first to be issued in every company deals with goods production. In relation to marketing, the company also needs to understand the style which is in trendy. The company which is able to predict the future trend, will win the market.

II. LITERATURE REVIEW

Marketing

Marketing is originated from the base form of word market. Marketing is process of shifting goods or services from producers to costumers. In selling service or product, many strategies are practiced. In fact, marketing is not only about selling product or service, but everything relates to goods and service can be said as marketing.

Different authors define marketing by different words, but their thoughts of essence come to one idea. Below are some ideas proposed by some authors relating to marketing definition.

Umar (2002:179) states "*Pemasaran adalah sistem keseluruhan dari kegiatan yang ditujukan untuk merencanakan, manentukan harga, mempromosikan dan mendistribusikan barang dan jasa yang dapat memuaskan kebutuhan kepada pembeli yang ada maupun yang potensial"*. (Marketing is a set of activities dealing with: plan, price decision, promotion, goods or services distribution for the purpose of users or costumers satisfaction)

Mursid (2008:26) *"Pemasaran adalah semua kegiatan usaha yang ada bertalian dengan arus penyerahan barang dan jasa dari produsen ke konsumen"* (Marketing is the activities of goods and services current shifting from producers to costumers)

Stanton (2012:67) *"Pemasaran adalah keseluruhan sistem yang berhubungan dengan kegiatan-kegiatan usaha yang bertujuan merencanakan, menentukan harga, mempromosikan dan mendistribusikan barang atau jasa yang akan memuaskan kebutuhan pembeli baik aktual maupun yang potensial".* (Marketing is a whole system

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refers to the trade activities attempting to plan, decide price, promote, distribute, goods or services which satisfy the need of actual and potential costumers). Based on those ideas or definitions, it can be concluded that marketing is an integrity set system of activities conducted by a company in running a business in term of fulfilling market need by production, price decision, by shifting for the purpose of costumers and producers satisfactory.

The Marketing Mixture

Each company which produces goods or services faces difficulties or problems in selling their products. Therefore, a combination of factors affecting marketing is needed. In reaching the marketing target, normally, a company applies a marketing theory called 'marketing mix'. Kotler defines marketing mix as *"seperangkat alat pemasaran yang digunakan terus menerus untuk mencapai tujuan pemasarannya di pasar sasaran".* "a marketing toolkit continuously applied in reaching the marketing target of a targeted market". According to Ricky dan Ronald (2003:280), *"Bauran pemasaran adalah gambaran strategi produk, penetapan harga, promosi dan distribusi yang digunakan untuk memasarkan produk".* (mix marketing is the picture of production strategy, price decision, promotion, and distribution applied in selling product). In addition based on *Amirullah (2005:19) "Pemasaran adalah kombinasi variabel atau kegiatan yang merupakan inti dari sistem pemasaran yang dapat dikendalikan oleh perusahaan untuk mempengaruhi reaksi para pembeli atau konsumen".* (Marketing is the variables combination or activities which is the main system of marketing system controlled by the company in affecting the buyers' or costumers' reaction). Relating to those definition given, the writer concluded that marketing mix is the combination of variables controlled by a company in gaining the target.

Marketing Strategy

According to Kotler (2004:98) "*Strategi pemasaran adalah logika pemasaran dan berdasarkan itu unit bisnis diharapkan untuk mencapai sasaran pemasarannya. Srategi pemasaran terdiri dari pengambilan keputusan tentang biaya pemasaran dari perusahaan, bauran pemasaran dan alokasi pemasaran dalam hubungannya dengan keadaan lingkungan yang diharapkan dan kondisi persaingan*." (Marketing strategy is a marketing rationality expected to reach the marketing target. Marketing strategy consists of decision making of marketing cost, marketing mixture and marketing allocation relating to market area and condition of competition)

Based on Sofyan Assauri (2005:5) "Stategi pemasaran adalah rencana menyeluruh terpadu dan menyatu bidang pemasaran yang memberikan panduan tentang kegiatan yang dijalankan untuk dapat tercapainya tujuan pemasaran suatu pemasaran." "Marketing strategy is an integrated and integrated plan integral field that provides guidance on the activities undertaken to achieve the marketing objectives of a marketing." Basu Swasta (2002:69) "Strategi Pemasaran adalah suatu rencana keseluruhan untuk mencapai tujuan." "Marketing Strategy is an overall plan to achieve goals." From the above definitions, it can be concluded that the marketing strategy is a plan to achieve corporate goals. Some companies have the same goals, but the marketing strategies applied by each company is vary. It can be seen that the marketing strategy is one of the foundations used in preparing the company's overall plan. Planning is a starting point of the whole enterprise to be followed by other steps. Determination of marketing strategies that are beneficial to the organization then the organization first knows the growth rate of company development. The growth rate of a company organization according to Fred R. David (2006: 228) can be divided into three parts:

a) Integrated growth (integration) is to identify opportunities to build or take over business related to the existing business of the company. In this integrated growth rate, the company implemented 3 strategies:
    1. Strategy of backward integration. In this strategy, corporate management reviews business activities related to the supply of raw materials or raw materials more than essentially affecting a larger profit gain.
    2. Strategy of integration forward. In this strategy, company management seeks to increase ownership or increase control over its distribution system.
    3. Strategy of horizontal integration. In this strategy, company management may consider mastering one or more competition as long as it is not prohibited by the government.
b) Diversified growth is to identify opportunities to increase the attractiveness of a company that has nothing to do with current business activities. In this level of diversification growth, companies implement 3 strategies.
    1. Diversification of concentration, which adds new products that have similarity technology and or marketing similarity with existing product line. This product usually attracts a new consumer class.
    2. Horizontal diversification, which adds new products that are able to attract existing

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customers even though the product has no relation with the existing product type.

3. Diversification of groups (conglomerates), which add new products that have nothing to do with technology, products and markets that exist today. This product usually attracts consumer class.

c) Intensive growth is to identify further opportunities to achieve growth in the company's existing business. In today's intensive growth rate, an organization implements three marketing strategies:

1. Market penetration strategy, in this strategy corporate managers seek to find a way to increase the market share of their existing products. As for the businesses that are applied in the application of market penetration strategy are:
2. The company is trying to encourage its existing customers to increase their current purchases. 3. Product development strategy.

Understanding Product Quality

Every industrial company as a producer will always try to produce products that can meet the needs of the community or costumers, then the production must be in accordance with the wishes or needs of the community. Therefore, every company is not possible to meet all the needs and desires of consumers as a whole. In addition, the company must first determine what products will be produced, which if appropriate in accordance with the ability of the company and consumer desires. The product has an important meaning for the company because without the product, the company will not be able to do anything from its business. Buyers will buy the product if they feel fit, because the product must be tailored to the desire or the needs of the buyer for successful product marketing. In other words, product creation is better oriented to the market need or consumer tastes. In general the quality of the product is the overall goods and services related to the desires of consumers who excellently products are worth buying and selling as expected from the customer. While the product according to Kotler (2009: 71) “merupakan hasil akhir yang mengandung elemen-elemen fisik, jasa dan hal-hal yang simbolis yang dibuat dan dijual oleh perusahaan untuk memberikan kepuasan dan keuntungan bagi pembelinya”. "is the end result containing the physical elements, services and things that are symbolically made and sold by the company to provide satisfaction and profit to the buyer. Stanton (1985: 285-286) states that “*Kualitas produk adalah suatu jaminan dalam rangka memenuhi kebutuhan konsumen dalam memilih suatu produk dan dalam masalah ini pribadi sangat berperan ”.* "The quality of the product is a guarantee in order to meet the needs of consumers in choosing a product and in this, private matter is very important". Kotler and Armstrong (2001: 346) argue that *“Kualitas produk adalah segala sesuatu yang dapat ditawarkan kepasar untuk mendapatkan perhatian, dibeli, digunakan, atau dikonsumsi yang dapat memuaskan keinginan atau kebutuhan”* "The quality of the product is anything that can be offered to get attention, bought, used, or consumed that can satisfy wants or needs ". McCharty and Perreault (2003: 107) “mengemukakan bahwa produk merupakan hasil dari produksi yang akan dilempar kepada konsumen untuk didistribusikan dan dimanfaatkan konsumen untuk memenuhi kebutuhannya” "argue that the product is the result of production to be thrown to consumers for distribution and consumer use to meet their needs." The alternatives of consumers to choose a product based on color, quality and price. Product quality is a company strategy to promote the product produced. Strategy is applied so that companies can avoid price competition.

Price Attribute

According to Kotler and Armstrong (2001: 354) some attributes that resemble products (product attribute characteristics) are:

a. Brand

A Brand is a name, term, sign, symbol, or design, or combination of all of these that is intended to identify a product or service from one or a group of sellers and differentiate it from a competitor's product. Branding is expensive and time consuming, and can make the product succeed or fail. A good brand name can add great success to the product (Kotler and Armstrong, 2001: 360)

b. Packing

Packing is the activity of designing and making a container or wrapping a product.

c. Product Quality

Product Quality is the ability of a product to perform its functions include durability, reliability, ease of operation and repair, and other valuable attributes. To improve product quality the company can establish the program "Total Quality Management (TQM)". In addition to reducing product damage, the ultimate goal of total quality is to increase customer value.

Product Classification

According to Kotler and Armstrong (2001: 280) product classification is divided into two parts, namely:

a. Consumed Goods

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Consumed goods are goods that are end on consumer's own interests, not for business purposes. Generally consumption can be classified into four types, namely:

1. Conventional goods are goods usually purchased by consumers (have high purchase frequency), needed in the immediate time, and require minimal time in comparison and purchase.
2. Shopping Goods are goods that are characteristic in comparison to the various alternatives available to consumers based on conformity, quality, price, and power in the selection and purchase process.
3. Specialty Goods are goods with unique characteristics and or identification, for which a group of large buyers are willing to always make a special effort for the buyer.
4. Unsought Goods are goods that are not known to consumers or even though it is known but in general consumers have not thought to buy it.

b. Industrial Goods

Industrial goods are goods consumed by an industrialist (consumer among or business consumers) for purposes other than direct consumption, that is to be changed, produced into other goods and then resold by traders without physical transformation (production process).

Purpose of Quality Improvement

An overall goal of the company and marketing strategy to achieve the goal, the goal of quality improvement is the increasing quality of the product then the consumer will feel satisfied, believe the quality of the product, and also affect consumer purchases. The general goal of quality formation itself is to convince consumers that the best product according to the needs of consumers. Even to be more convincing there are companies who dare to provide compensation if the product is not qualified or not in accordance with the promotions submitted.

In today's free trade where competition is getting tougher or more things quality and service becomes very important to find. Because if things are not highlighted then the logical consequence is that the quality of products and services offered can be displaced by the quality of products and services of the same type, which is more convincing consumers then the improvement of product quality is very important for the company to retain customers. According to American principle of Anality Control, quality is a characteristic of product and forture which has customer quality and there is greatness of a bend or product.

Definition of sales

The task of management is to increase sales, because management assumes that the company needs to hold sales, and promotion activities are vigorous. Definition of sales by Basu Swasta (1998: 48) *"adalah ilmu dan seni mempengaruhi pribadi yang dilakukan oleh penjual untuk mengajak orang lain bersedia memenuhi barang dan jasa yang ditawarkannya"* "is the science and art of personal influences made by the seller to invite others willing to meet the goods and services offers". Understanding of sales in general is an integrated activity to develop strategic plans directed at the business of satisfaction buyers' needs and desires, in order to earn profitable sales.

Types of Sales by Basu Swasta (1998: 11) are:

a. Trade selling
That can happen when manufacturers and wholesalers invite to attempt to improve the distributor of their products. This involves distributors with promotional activities, demonstrations, inventories and new product procurement. So the emphasis is on selling through dealers rather than sales and end buyers.

b. Missionary Selling
In missionary selling, sales try to improve by encouraging buyers to buy goods from the company's dealers. In this case, the company concerned has its own distributor in the distribution of its products.

c. Technical Selling
Technical selling increases sales by targeting and giving advice to the end buyer of his goods and services by showing how the products and services offered can solve the problem.

d. New Business Selling
That is trying to open a new transaction by turning potential buyers into buyers. This type of sale is often used by insurance companies.

e. Responsive Selling
The main sales here are route driving and retailing. This type of sale will not create sales that are too large even though good service and pleasant customer relationships can lead to repeat buyers.

Factors Affecting Sales

In practice, sales planning is influenced by several factors. According to Basu Swasta (1998: 129) factors are:

1. The condition and ability of the seller a sale and purchase transaction is the transfer of a commercial's right to goods and services. In principle involves two parties: the seller as the first party and the buyer as the second party. Here the seller must be able to convince the buyer in order to get the expected sales target. For

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that purpose the sellers must understand some very important related issues: Type and characteristics of goods to be offered.

2. Product prices.
3. Terms of sale such as payment, delivery, after-sales service and after sales service and so on.

III. RESEARCH METHODOLOGY

The research was conducted at the Boi-Tulus Sianipar Weaving Factory in Balige Subdistrict, Toba Samosir District. This study was conducted from April to July 2015. In this study, the population was the product of Ulos Ragi Hotang. The samples in this study are ulos ragihotang produced by weaving factory Boi-Tulus Sianipar.

Data collection technique

a. Interview
   Conducted by a question and answer activity directly to the respondent about the data needed.
b. Documentation
   This method was used to obtain data about company profile, corporate organizational structure and other data.
c. Observation
   Conducting observations of objects to be studied. Observations were conducted to obtain information about the company's raw material planning, the volume of production produced by the company, and the sale of the company.

Data analysis technique

Data analysis method used in analyzing all data obtained was descriptive comparative (comparison) before and after product differentiation, so from analysis, it was possible to make conclusions that was used alternatively in the company's discretion.

IV. RESULTS AND DISCUSSION

Product Quality Analysis and Discussion

In this part of the analysis, the researcher tried to analyze whether the product quality policy conducted by Weaving Factory of Boi Tulus Sianipar could increase sales. Boi Tulus Company strived to produce products that could meet the needs of society, then the production had to be in accordance with the wishes of the community. The purpose of doing product quality was to increase sales. Then it was interpreted that the Boi-Tulus Company provided an affordable price by the general public layer from lower level to upper level and consumer tastes was satisfied.

Analysis and Discussion of Product Quality in Increasing Sales

It had been described above that the purpose of the role of product quality was to increase sales. In reality, it was known that in fact the market was heterogeneous for one product. Profitable sales was the goal of the marketing concept. This means that profits was obtained from consumer satisfaction. With this profit, the company could grow and expand, have greater capability, could provide a greater level of satisfaction to consumers, and could strengthen the overall economic condition. With the policy of improving the quality of Weaving Factory Boi Tulus Sianipar, sales amount was greatly increased. The number of sales each year changes, this was caused by the level of purchasing power and consumer consumption, as well as competition from similar products that change every year. Given the increasing competition while the seller's income was decreasing then the seller could not control the price because of the similarity of their products. Similarly, weaving factory of Boi Tulus Sianipar Toba Samosir District which has a rival like other weaving plant business. So by seeing this reality, the seller began to acknowledge the added value of applying the policy of product diversity that directly affected the level of sales volume of the product itself.

Based on the data of sales statistics, the writer tried to do things to increase sales such as:

a. The place
   The Boi-Tulus Sianipar weaving factory was supported by a strategic place used as a place of activity, where the operational location is close to the consumer, realizing that proximity to the market is a major factor in the success of the Weaving Plant business Boi-Sincere Sianipar in increasing sales.
b. Distribution Strategy
   To expand sales and gain greater profits, an appropriate distribution strategy was needed. The distribution of goods/services merchandise to consumers. The following was the distribution method that was operated by Boi-Tulus Sianipar Toba Samosir Regency:
   1. Intensive distribution strategy
      This distribution strategy was done by placing ulos products on many retailers, and placing the distributors in various places.
   2. Selective distribution strategy
      This strategy was done by distributing ulos products in certain marketing areas by selecting only a few distributors in different area.

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c. Quality
Before selling the product, the quality of a product sold was a main concern. The Weaving Factory of Boi Tulus Sianipar used good quality in products to be sold, so consumers who buy the product was not hesitate. With the existence of good product quality then the consumer increased, this increased sales at Boi Tulus Sianipar Factory.

d. Price , most prices was offered with variations that complemented the company's basic functions. Weaving Factory of Boi Tulus Sianipar provided affordable prices for consumers.

V. CONCLUSIONS

From various information and discussion above, it was concluded:

a. Marketing strategy with the implementation of product quality policy was one of the added value for Weaving Factory of Boi-Tulus Sianipar Toba Samosir in face competition.
b. Analyzing a good market and applying a product quality strategy that has different characteristics than the previous product was an attempt to attract interest and desire from the company's product market.
c. Improve quality begins from customer needs, satisfaction of desire and so those who should determine the quality of the product, customer perception of quality is a comprehensive assessment of the superiority of a product.Need to improve service delivery to consumers, such as maintaining relationships.

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School Evasion in the Brazilian trends: analyzing the vectors that influence students' decision to interrupt their formative process

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Abstract— *Research data demonstrate that the analyzes built around School Evasion considers, primarily, the quantitative metrics of students' entry and exit and also the monetary losses, especially because it would be incoherent not to take as reference the goals and objectives outlined for education school system. However, analyzing the vectors that influence students' decision to interrupt their formative process, according to purely numerical criteria, would imply in ignoring the function of educational institutions and the real causes/reasons stemming from the social and relational demand of students' passage on educational institutions. For this reason, problematizing some of the recurring issues and incidents generated by certain investigations seems instigating and challenging. If in on the one hand, the attitude of understanding the conceptualization, the investigative tendencies and the characteristics of the studies give rise to certain criticisms that put in check the complexity of the object in question, on the other, it can stimulate the construction of other tendencies, new pathways, other possible ways of overcoming the gaps identified in the studies about School Evasion in Brazil.*

Keywords— ***School Evasion in Brazil, education school system, analyzing the vectors.***

For a presentation to the critical public: concept and origin

On the course of this research proposal, we firstly discuss some questions about the originality of the term evasion and then, more precisely, about the conceptual insights of "school evasion" giving rise to its use as a tagline of this research. In the next moment, the construction scenario of the first analyzes undertaken in Brazil is presented, as well as the aspect that ends up showing choices, viewpoints and academic preferences. Then, the main idea was to show part of the panorama represented by the international tendencies, which in a way, have inspired the Brazilian researchers. In order to represent the end of the explanatory work, the intention was to stimulate the visualization of the details identified in the researches, as aspect widely used in Brazil, and the possibility of suggestions for the construction of other possible models to be produced and used in the country.

I. IS SCHOOL EVASION A TIMELESS CONCEPT? USES AND SEARCHES

In general, in the Portuguese language, the word evasion refers to a feminine noun that names the act of evading, fleeing, escaping or disappearing. The action of dropout something or move away. As a Latin word, from the denotative point of view, the term carries with it, meanings close to verbs such as: to divert, to avoid, to deceive, to steal (with skill or cunning), to change (a direction) or to change (a goal). It appears as "Evadere" meaning "to leave, to throw itself out, to escape, to be saved, to avoid" (SARAIVA, 1993, p. 438, our translation). In the figurative sense, the term evasion is also a subterfuge, an evasive attitude, a ruse or a vague response when trying to get out of some difficulty.

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Also in the denotative sense, the Luso-Brazilian Encyclopedic Dictionary (LELLO and LELLO, 1991, p.940) presents, etymologically, the discursive evasion element based as reference the Latin term *evasione*. It presents the term's meaning as: "act of evading, escaping from prison: planning an escape".

Extending the search for meaning, it was defined by Gaioso (2005) as the interruption in the cycle of studies and by Kira (1998) as the escape of students. Other more complex definitions were presented by Polydoro (1995, 2000) and Cardoso (2008) who, in a common way, have identified the existence of several interpretations. The last researcher has presented two main questions: i) it does not appear in a consensual way in the investigations carried out by the academic community; and ii) it is considered, in several surveys, as a similar term of abandonment, transfer (external or internal), retirement, decoupling, loss (of vacancy), cancellation (school registration), etc.

About the studies on evasion, one of the most meaningful references is the investigations of Vincent Tinto. One of his most widely used studies in evasion research was the Dropout from Higher Education: A Theoretical Synthesis of Recent Research, created by the sociologist in 1975. In order to predict the determinants of student avoidance in student institutions in the United States, he has explained the phenomenon as being an interactive process between the individual and the institution. The theoretical proposal of Tinto (1971, 1973, 1975) was based on three basic principles: (i) Emile Durkheim's conception of suicide (conceived as a fact that could be treated sociologically rather than for reasons motivated by acts of self-destructions, since the unit of analysis would be the society, not the individual); and ii) in the idea of the rite of passage of the French anthropologist Arnold Van Gennep, that when he was studying the ceremonies that occurred in several societies, he realized that they were marked by the transition of individuals from one status to another – what has contributed to Tinto systematizes a similar sequence based on the rites: "separation", " liminality " and " incorporation "; and (iii) the cost-benefit ratio of the values applicable to education. For his theoretical construction, the postulates were sufficient to support the hypothesis that the student's attitude in taking a decision to evade would occur from a longitudinal process, marked by phases and influenced by the interaction between individual and institution, so that this process would be influenced by both elements, as demonstrated in the following section:

> The theoretical model developed here suggests then that dropout this multidimensional process which results from the interaction between the individual, and the institution and which is influenced by the characteristics of both elements. The basic elements of this model are diagrammed (...) in a manner which suggests that there exists a longitudinal dimension to the process of dropout (TINTO, 1975, p.41).

In terms of the incidence and reasons that triggered the evasion process, Tinto (1988, p.448), inspired by Social Anthropology, have traced three stages that would precede the decision to evade. These would be: i) the stage of separation; ii) the liminality stage e; iii) the stage of incorporation. He reinforces the idea:

> In employing the stages of separation, transition, and incorporation in our analysis of student departure, we do not mean to oversimplify what is a very complex and quite fluid situation. The stages of passage we have described are abstractions that necessarily simplify for purposes of analysis the more complex phenomena we understand as student departure.

By employing the stages in his explanations, he has inferred them as abstractions that would simplify for purposes of analysis, a possible explanation of the student evasion phenomenon. However, it is understood that some weaknesses and uncertainties of the studies on evasion in Brazil emerged due to the way international research was interpreted, once even between them, the analyzes did not present themselves defined. Conclusions of a review about subject between the years 1950 and 1975, for example researches realized by Pantagen and Creedon (1978), showed that low performance was the main evasion factor for students, but also the good performance did not guarantee the non-evasion in the course.

In Brazil, according to Baggi and Lopes, (2010), the two formal milestones of the evasion studies occurred from 1995 with the Seminar on Evasion in Brazilian Public Universities, promoted by the Secretariat of Higher Education and Ministry of Education (MEC). The second was the creation, in the same period, of the Institutional Evaluation Program of Brazilian Universities (PAIUB) for public Higher education institutions.

As a result of the previous events, the Special Committee on Studies on Evasion in Brazilian Public Universities was created whose definition was considered "as the definitive exit of the student from its course of origin, without concluding it" (BRAZIL, 1996 , p.15).

In an attempt to conceptualize, Cardoso (2008) presented two different appraisals around the concept which are: "apparent evasion" and "real evasion". The first one, referring to mobility, that is, the passage from one course to another, and the second, the dropout of the

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student from educational institution. In addition, Silva Filho and Lobo (2012) expressed two similar qualifications. One called annual school evasion, which would partially verify the difference between students enrolled from one year to the next. The other would be total evasion that would compare the number of students first enrolled with the final number of graduating students at the end of a course or cycle.

The term had also been brought into the research by Palharini (2010, p.13, our translation), when he tried to conceptualize it in the following way:

> Evasion is understood the definitive exit of the student from the course of origin without completing it. Although this is a practically consensual definition among scholars of the subject, it should be noted that from this point, for different reasons, the divergences begin to manifest themselves. These differences are seen in the parameters by which the student evaded is identified, since this definitive exit can assume different conformations, both with regards to the form as to its meaning. Usually, the following forms of exit are considered: the student does not enroll and leaves the course; the student officially communicates the withdrawal; the student chooses to transfer to another course of the same institution; the student is excluded by institutional norm, the student chooses to transfer to the same course in another institution.

According to Ristoff (1996), there is a difference between evasion and migration. The evasion would correspond to the abandonment of the studies while the migration of students would be the change from one course to another without leaving the educational system, mean mobility. Without exhausting the way of thinking the concepts, Palharini (2010) has warned that we must distinguish the difference between school evasion and retention. The concept of retention in Brazil had been used to characterize the student repeated enrolled in his or her course of origin who already extrapolated the average time of payment curriculum. This distinction is not always taken into account in the different forms of evasion, especially before 1996.

Returning to the issue of the terms evasion and retention, it was noticed that a problematic in the trajectory of studies, especially in Brazil, refers to the interpretation of impact models as a theoretical basis in the international literature, with greater relevance in the American literature, greatly in vogue in the Brazilian's researches. The epistemological and conceptual question did not seem to appear itself clearly. The problematic revolves around, on the one hand, the fact that the term in the North American works refers to actions and proposals of permanence of the students in the institution, in the opposite direction to the phenomenon of the evasion. On the other hand, in some Brazilian studies, the researchers addressed the issue to students' non-approval (Pereira, 1997, Pontes, 2012, Santos, 1999).

As an example of this mistake, Tinto (1987) has noticed that even though the word retention was related to actions whose purpose was to stimulate the presence of students for a longer time in the institution (in order to conclude the course), the work was mistakenly taken as synonymous of evasion in many scholarly works in Brazil. It is suspected that the mistake was initiated because of the report prepared by the Special Committee on Studies on Evasion in Brazilian Public Universities (created in 1995 by the MEC to study in depth the issue of evasion in the country) by presenting the term as synonymous with retention. In it, the word retention appeared as: "permanence in courses beyond the maximum time of curricular payout" (BRASIL, 1996, tradução nossa).

Faced with this confirmation, it was noticed that several studies followed the same tendency, when they have misused the term retention (used in North American researches to refers to the students' longer time in the institution in order to not leave the course but to complete it) as the non-conclusion of course in the foreseen time. Verified fact since works published in the 1990s, such as Pereira (1997), to some most recent such as Pontes (2012), Gemaque e Souza (2016), Nodari (2016), Ambiel, Santos, Dalbosco (2016).

Still on the forms of understanding, in recent works, school evasion appeared as a broad, ambiguous and polysemic term. Agreeing with this position Freitas (2016, p.13, our translation) warned that:

> As early as my first readings, it became clear to me that in the various papers about this subject, there is no single definition of the term evasion, as it is also possible to find different terms for this event. However, in spite of this, in several studies on this subject, it is sought to find the causes of that, once termed as conceptual evasion, leads the student to give up, whether through abandonment, stop out, cancellation or transfer.

Thus, in addition to the multiplicity of definitions surrounding the concept of evasion in general and specifically related to education, the main investigations outside and inside Brazil presents several conceptual orientations and questions that make some

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conclusions about the subject questionable and imprecise.

It seems to be a consensual that the own concept of school evasion made it difficult to carry out studies or standardization / categorization on this issue. If on the one hand there were those who considered that the term would have a great elasticity to understand the students' exit process, others pointed to the need for a greater rigor for such analysis. For example, it would be possible to point out a student who had passed away as a point of discussion among the various ways to understand school evasion. If an individual dies before completing his studies, he would fail to attend classes, which would make him officially a "quitter", and thus, along the lines of most analyzes, would contribute to the increase in the percentage of evasion from an educational institution or network. Another common example would be the fact that many students were unable to graduate in the expected time, delaying from their initial class. The case would configure the student's repetition, that in turn, depending on how school evasion was measured, would increase the number of evaders.

Starting from a conceptual discussion, it is proposed in the next section to verify how the Brazilian researchers responsible for the first investigations were positioned as to their meanings, methodological criteria and scientific view about the subject.

II. CHRONOLOGICAL EVIDENCE OF SCHOOL EVASION IN THE BRAZILIAN SCENARIO

Several efforts were being made to investigate the phenomenon of school evasion in an attempt to find its causes. One of them was the research of Alvarenga and Alvarenga (1971) that analyzed the correlation between the grades of the vestibular in the tests of Chemistry, Physics and Biology of the Medicine course. It was verified that none of the mental processes measured by the test were necessary to the good performance in the chairs evaluated in Higher Education. They observed several negative correlations, among them and their connection with student avoidance.

Faced with the problem, researchers have positioned themselves on their concerns about studies on the phenomenon of school evasion in Higher education, pointing out as the main ones: difficulty in determine and adequacy for the calculation and understanding of the phenomenon; the absence of appropriated methodologies; the quality and fidelity of the information of the academic records and inappropriate analysis of the data (Ristoff, 1999, Pereira 1996, Gonçalves 1997, Polydoro 1995, 2000).

In the same period, the investigations by Almeida and Cerqueira (1971) have analyzed the influence that the global society exerts on the young students. The results showed that their socio-economic status was a determining factor in the course choice and that the students' preferences are concentrated in the professions of the technical-scientific and biomedical areas, while many others do not get to know some professions and that is why they evade.

For Barroso (1972) the demotivation would be the main cause of the candidates' evasion, mainly because they did not pass the first option in the vestibular. He also considered that evasion is more sensitive in full-time courses.

On the other hand, CAPES (1975) denounced the fact that only 15% of the students enrolled in the postgraduate degree manage to reach the degree. The study by Messender (1976) about the first cycle of the Federal University of Bahia has found that the most influenced situation to evasion would be the teaching methodology used.

In turn, Rosa (1977) started from the suspicion that the evasion was very costly for the graduated student. There was a lack of bibliography about evasion, which is not the case with aspects related to the cost of education. The different personal characteristics of the students, the structure of the course and the profession (for example, the prestige level of the profession) are linked to the occurrence of evasion.

From Andreola's point of view (1977), socioeconomic status and lack of career stimulation are the variables that can cause evasion. In the conception of Passos (1978) the lack of connection between the personal values of the students and the choice for the course are the main causes of the evasion in the educational institutions. This investigative perspective gained space in that area, when school evasion was restricted by individual failure. Two dimensions were considered as relevant factors in the school evasion process: exogenous and endogenous factors to the institutions. The first concerns the factors which are external to the organization, among them the financial condition of the students, their "aptitude", previous preparation and their perspectives. Considering the endogenous factors: the teaching staff, the curriculum, the organization of the institution, the adequacy to the content, and others.

In Costa's (1979) view, the high rates of retention and evasion in the first semesters of the basic cycle is a consequence of the type of selection promoted by the vestibular. The evasion does not seem to be related to the quality or difficulty of the course, since the students do not even know it because they leave the

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basic cycle. They identify the evasion, retention and performance indices compared with the order of option attended in graduation courses.

As a reflection of the academic concerns, from a temporal point of view, data showed that the first decade of production of the first researches in Brazil on school evasion analyzed different analytical categories. Freitag's work (1980), for example, analyzed the category of school failure in the country between 1960 and 1973, showing that there was about 44% of evasion in the primary year, 22% in the secondary, and 17% in the third. In the same way, the author has associated these rates with the rates of failure that between 1967 and 1971 reached about 63.5% of the total number of students enrolled.

Although there was a consensus about the existence of a number of issues involved, the different studies developed are wariness about the weaknesses of the analysis and conclusions regarding the causes of 3school evasion. This wariness is due to the difficulties of access to the student who evaded, the lack of conditions for the clear configuration of the sample of the investigated students and the possible concomitance of the multiple causes in the decision to leave the course (Carraher, Carraher and Schliemann, 1982).

Discussing about the evasion in Higher education in Brazil in general, Benda (1984) emphasized that can affects it: the privatization issue, the drop in quality of courses and the lack of resources. With regard to the reasons for dropping out of the course at the Federal University of Paraíba, studies by Maia (1984) revealed that the subjects declared that they were the result of their own lack of motivation and personal problems such as marriage.

In her study, Gatti (1984) reported that evasion at the University of São Paulo and at the State University of São Paulo occurred independently of the distribution of courses in careers. When investigating the variables that determined students' evasion at the Federal University of São Carlos, Martins (1984) has concluded that it was the student's lack of identification with the course. A fact that was related to the lack of orientation for the professional choice in the period before the student's choice.

Investigating the causes of evasion at the State University of Rio de Janeiro, Brandão (1985) has found that they are concentrated in the university itself. According to the reports, the students had trouble reconciling working hours with the academic load (which in a way generated dissatisfaction), as well as excessive disciplines, lack of research development, and disagreement with the relevance of the offer of some subjects.

Based on a 25 year longitudinal analysis, Moysés (et al., 1985) has concluded that there are institutional and extra-institutional factors that affect student evasion. He understood that the main causes are in the institution.

Professor Hamburger (1986) has analyzed the causes of evasion and he found that 42% of university students in Brazil in the 1980s evaded because of the socio-economic situation. On the other hand, in a joint investigation, the team of researchers formed by Paul, Ribeiro and Pilatti (1990) has concluded that there was a real need for investment in evaluation activities and establishment of a process of comparison between quantitative and qualitative approaches, in order to exchange of experience betwixt institutions.

Studying graduation at the Federal University of Bahia, Carvalho (1992) has found that families, especially economically privileged, had a long influence on the trajectory of the students, influencing the choice of careers and access to the most competitive courses.

In studying graduate school evasion, Silva (1993) raised the suspicion that some causes were related to the structure and functioning of the courses. Still on the protagonism of the students, another issue approached by Bueno (1993) was the differentiation between evasion and academic exclusion. For the author, evasion in education may correspond to an active stance of the students who decides to leave their own and responsibility, while exclusion, would imply a responsibility of the school institution for not creating mechanisms for utilizing and directing the student. In this way he endorsed:

> Is it an evasion phenomenon or a case of student exclusion? The word evasion may mean the active attitude of the student who decides to disconnect by his own responsibility. The word exclusion implies the admission of the responsibility of the school and of everything that surrounds it, because they do not have mechanisms of profit and direction of the adolescent that presents himself for a professional training. There are undoubtedly intra and extra-school factors affecting the student's permanence in the university. What is our responsibility? What have we done and what can we do to beard intra-school factors? Are only these factors, which are closer, to consider in a discussion about the evasion of our students? Or is it not for the university to use its leadership position and help to remove the difficulties imposed by external factors? (BRENO, 1993, p.13, our translation).

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In a comparative research between two institutions of Curitiba, one public and the other private, Paredes (1994) seeks to verify the existence or non-existence of a correlation between evasion and the prestige of the course. It was observed that, in both cases, the most frequent reasons for evasion were really close.

In order to realize an investigative methodologies of the determinants of the phenomena permanence/evasion, Mercuri, Moran and Azzi (1995) sought to verify the variables related to them in the first year of student enrollment. The research was limited to the evasion occurred in the first year once it occurs most markedly in this period, since in others it can be minimized by planning strategies aimed at the new entrants. The partial results of the investigation indicated that the phenomenon of evasion (in the case study) was the result of a complex and longitudinal process, affected by internal and external factors from school organization.

The studies developed by state universities in São Paulo (Bicudo, 1995) and the Report of the Special Committee for studies on evasion (Brazil, 1996) were also highlighted in the context of the investigations. In the report, it was verified that the phenomenon took on dramatic lines, it means that, in some courses, only 20% of those student who joined has graduated. It was observed a tendency towards concentration of evasion in teaching graduation courses and in the area of exact sciences. It is important to note that the formula for assessing evasion at the time was based on the difference between the number of participants and the number of graduates.

In a Bordas (1996) research, she understood that the object of school evasion research needs to be seen as a process where one must overcome the purely economic stance, derived from the essentially utilitarian view of training. She has argued that indexes should be examined in their complexity and not only as a finality itself, or with an objectives ranking. It should be considered as a contribution to the identification of problems and adoption of pedagogical and institutional measures capable of overcoming it.

In the view of Pereira (1996), although school evasion is a highly discussed subject in Brazil, what is meant by "evasion" varies from institution to institution. Otherwise, influenced by American studies, Santos (1999) has presented the results of a research conducted at the Federal University of Ouro Preto about the flow of students in their graduation courses. It was part of a set of concerns that had been mobilizing institutions around the world about the institutional evaluation. The research aimed to: i) identify the success points of the enrollment, retention and evasion rates; ii) to map the tendency of the indicators of diploma, retention and evasion; iii) to subsidize the Collegiate Courses and others involved with the dynamics of teaching and political pedagogical projects' evaluation. It is observed that the indicators show a specific behavior in each one of the courses and that the evasion manifested itself indistinctly in the courses, to different degrees.

The authors argue that they can not be restricted to the raising of quantitative indices only, since the numerical values would need to be subsidized by information and analysis that would qualify the phenomenon (Pereira, 1997; Polydoro, 2000).

The brief review of the literature indicated a tendency until the early 1990s to understand school evasion as a phenomenon related to academic failure, either by the student (and, above all), or by the course and/or institution. Its causes would be associated to the process of democratization of access to Higher education, verified in Brazil from the 60's (UNICAMP, 1992, Paredes, 1994, Silva, 1995, Bicudo, 1995, MEC, 1999; Peixoto et al., 2000). Basically, the investigations have presented that: I) In the investigations of Elementary and Middle School, the phenomenon of evasion was mostly related to school failure, evidencing the protagonism of the student. II) While in the researches in Higher Education, the causes of the evasion would be related, predominantly to the process of democratization of the access in the expansion of the vacancies, from the decade of 60. In a certain way, some research pointed to the role of the institution in the student evasion process.

III. INTERNATIONAL TENDENCIES THAT BECAME REFERENCE IN BRAZIL: SCHOOL EVASION AS A PATCHWORK QUILT

Considered classics, pioneers in studies of evasion in education, Tinto and Cullen (1973) have elucidated that it was necessary to discuss and distinguish the variety of meanings attributed to the term. Analyzing their trajectories as researchers they realized that they followed in the direction of the deepening of the thematic for some years. In their early studies, in the early 1970s they presented a basic theoretical model that sought to explain evasion in American Higher education as an interactive process between the individual and the institution. In the same period, they focused on the analysis of the definitions and distinctions of the concept of evasion. It brought problems for those individuals who pretend to investigate on the subject among them the fact that there are different definitions of school evasion: i) the exit in the enrollment of an institution; ii) the exit as failure to obtain the diploma; iii) the exit due to the absence of perspective, motivation or individual interest of the student; iv) or permanent exit. It elaborated a basic theoretical model that sought to explain evasion as an

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interactive process between the individual and the institution and also sought to develop a distinction between voluntary avoidance of the non-volunteer, as well as the transfer of permanent evasion in Higher education.

Differently other American researchers, Pascarella and Terenzini (1977) published a paper entitled "Patterns of student-faculty informal interaction beyond the classroom and voluntary freshman attrition" creating a model to measure the effect of the academic environment on students' cognitive development and learning. It started from 5 variables, the first four being inspired by the American bibliography (at the time) and the fifth created by the author: a) history of the student; b) structural and organizational characteristics of the institution; c) institutional environment; d) frequency and modes of interaction of students with socializing agents (teachers and peers); e) quality of the effort to develop learning (ways in which the association between organizational or structural characteristics of the institution can influence the educational outcomes of the students).

In an opposite direction, Bean (1980) seeks to explain the evasion process in education. He emphasized the role that external factors would play in the decisions and attitudes of leaving the institution. He cited the background of family and friends, financial issues and perceptions about transfer opportunities to other institutions as some of these factors.

Pascarella and Terenzini (1980, p.649-650) presented a new general and casual model of analysis, focusing no longer on the explanatory character of evasion, but on learning, on the cognitive development and, therefore, the permanence of the students. They have concluded that:

> Finally, because the causal model was estimated with correlational data, one cannot infer strict experimental causality from regression results (...) Rather, causal modeling as employed here should be thought of as an attempt to establish the plausibility of a hypothesized causal structure by fitting it to existing longitudinal data (...) Thus, when estimating a causal model, the terms "direct effect" and "indirect effect" are commonly accepted for theoretically plausible causal relationships within a causal model . They imply only the possibility, not the actuality, of cause and effect.

The absence of theoretical models that would explain the phenomenon (since the few attempts before have only described it), the fact that there is no predominant behavior or pattern of behavior that better characterizes the phenomena that the researchers mistakenly label as school evasion, Tinto (1987, p.4) believes that "the student's quit assumes a variety of forms and arises from a diversity of individual and institutional sources." The author dedicates a few years of his life to the studies on evasion in the American Higher Education stimulating deep reflections and proposing an inversion in the look and a theoretical model of practical actions for the institutions.

Regarding the perspective at the student on Higher Education, it was noticed that there was an opening of new perspectives and ways of researching evasion in the 1990s. While researcher Tinto (1991), hitherto a reference in the area, has corroborated with Pascarella and Terenzini (1980) by confessing that the integrated study of the variables learning and permanence could clarify the relationship between both and positively influence the permanence of the students. They also concluded that classroom space, the role of teachers and peers, curriculum and teaching-learning strategies added to external factors from the institution can impact the students' cognitive development and permanence, that is why he has argued:

> We have too long overlooked the essentially educational and develop-mental character of persistence as it occurs in most college settings. There is a rich line of inquiry of the linkage between learning and persistence that has yet to be pursued. Here is where we need to invest our time and energies in a fuller exploration of the complex ways in which the experi-ence of the classroom comes to shape both student learning and persis-tence. Among other things, we need to pursue Braxton's (1995) lead and ask about the role of faculty teaching in persistence and more carefully (TINTO, 1997, p. 619).

From this new conception, the author dealt with the character of what could be translated into Portuguese as "school permanence" as a new line of research defining learning as the primacy of education studies. He has argued that as a core of training in educational institutions, one should talk about "school permanence" as an important issue from the educational practice point of view.

Likewise, the American researchers Cabrera, Nora, and Castaneda (1993, p. 135) have conducted some studies that took as basis the studies of Tinto and Bean. To explain the evasion in Higher Education, they have presented the following postulates: i) non-evasion in the institution would result from a complex set of interactions over time; ii) the typology of education would have direct effects on the student's life; (iii) the decision whether or not to remain in the institution seems to be influenced by

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the combination of characteristics of the student and the institution. About this synthesis, they have explained:

> Results indicated that when these two theories were merged into one integrated model, a more comprehensive understanding of the complex interplay among individual, environmental, and institutional factors was achieved. In this respect, the effect of environmental factors was by far more complex than the one envisioned by the Student Integration Model.

Testing the convergence between these two theories, the researchers have concluded that the combination of the two analyzed models allowed them to better understand the evasion process in the institution. Their merge would contribute to the comprehension, in a more comprehensive way, of the factors that would influence the students' evasion or not (Cabrera, et al., 1992).

The researchers, in addition to collaborating with the American findings on the issues that permeated education, offered what they called a causal modeling as an alternative analysis and attempt to establish a plausible relationship between the role of an organizational structure adjusted to the longitudinal data existing. In this context of investigatory changes and rearrangements, after analyzing some explanatory models proposed with a focus on the institution and the influence of external factors as well as those that emphasized the student's role, Cabrera, Nora and Castañeda (1993) have pointed to the role of interaction between the student and the institution, also reporting that both models would be correct. They thought that when choosing to analyze school dropout, the focus would be on the product of what is produced due to a complex process of interaction of personal and institutional factors, however, if the choice were to promote permanence, the exam would be around the result (understood as search for resolution) of the association of these factors.

In an attempt to explain the evasion phenomenon, especially in the first year of Higher Education (considered critical), Tinto (2001) believed that there would be a variety of forms emerging from a diversity of individual and institutional origins. He affirmed that there would be no reason that prevailed in the explanation of the evasion by the students, but it categorized the 7 that in their conception would most approximate to the explanatory categories of the phenomenon in question: 1) Academic difficulty; 2) Difficulties of adaptation; 3) Objectives / Goals; 4) Commitments; 5) Finance; 6) To belong and 7) Involvement.

In this direction, over the years, many researchers have been developed in the international scope, but it is necessary to present a study of Ambiel, Santos and Dalbosco (2016, p.294) that when investigating the reasons for the avoidance in a psychological perspective, have used what they called scale of reasons for evasion on Higher Education and constructed indicators of what they called a career adaptability scale (CAAS). On the one hand, they observed the presence of negative and not very explanatory correlations with all the domains of CAAS. On the other hand, they have realized that students who felt good emotionally tended to have no reason to leave the institution because, "in addition to the physical structure of the institution, the established relationships, when healthy and positive, can contribute to the permanence and completion of the course ".

IV. CONTEMPORARY REVIEWS: THE SIEVE OF ACADEMIC RESEARCH THAT ANALYZE SCHOOL EVASION

An ascertainment another tricky point in evasion research concerns is its own results. Trying to understand the phenomenon in two different institutions in Brazil, Paredes (1994, p. 22) has concluded that in both, the percentage of final evasion was approximately 13%, once many of the students who had left the institution completed their studies in another course or institution. He concluded that "about 64% of the pupils who, apparently, dropped out of higher education because they had dropped out of the course in which they were enrolled, complete tertiary grade."

Concerning about theoretical and investigative methods, it is important to highlight those who apprehend the indexes and statistics regarding the student staff, coordination and the office responsible for didactic accompaniment. Taking the student as object of the analysis, we can find questions about sex, culture and economic level of parents, student's age, expectations and support from relatives and friends. When the focus is on the institution, it is common to emphasize the workload, the ease of access, the security of the student, the classification according to the MEC assessments, teacher training, technological and information resources, bibliographic collection among others. A problem commonly encountered in investigations concerns the reliability of the data found, since it is common for the collections to be pledged; information is often lost or partial; there is disagreement among the data found; so many others do not correspond to the reality; in many institutions the concept of school evasion does not seem clear, which directly influences the nature of the data (Palharini, 2010).

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Reflection of this observation could be observed by a team of researchers formed by Azzi, Mercuri and Moran (1996). They realized that about 68% of students who were considered evaded, have returned their studies the following year and 27% stated their desire to restart. In this direction, other studies have suggested that, in addition to contacting the evaded students, it would be necessary to collect information from those who did not evaded, in other words, those who completed their studies (Moysés, 1985; Moreira, 1988).

Following the criticisms made by scholars about the research that takes school evasion as an object, other raised aspects were the predominance of centralization of the causes of evasion in the person of the student and the inefficiency, from the practical point of view of the academic analyzes. Regarding the centralization of reasons for evasion, researchers pointed out the need to consider not only the student's responsibility in the decision to evade, but also the role of the institution, especially regarding its structure and rules of operation (Red , 2001; Kira 1998; Polydoro, 1995, Paredes, 1994).

Reflecting on the weaknesses in the analysis of the studies that pointed to the causes of evasion, authors enumerated the recurrent related to the institution as: teachers' commitment; quality of the course; structure of the curriculum; and absence of student-focused programs. If, on the one hand, "the history of each student and his / her personal characteristics will determine forms of interaction (...) with or without the completion of the course, on the other, the institution may prove to be a facilitator or not from this process "(POLYDORO, 2000, p.52, our translation).

Expatiating on referrals concerning the researches that dealt with evasion in institutions, Polydoro (2000, p. 1) argued that in order to do understand the phenomenon of school evasion, it would have to be considered differently. He believed that the data provided by the institution (especially the quantitative ones) may fail to address a multitude of real and subjective questions, especially because the focus of attention should not be restricted only to negative meanings about the decision, "but one should also look for the student who often sees in the decision to evade an appeal to achieve his professional and personal goal". From this perspective, evasion should not be considered a failure or wastefulness, but as an investment of the student, in an attempt to find himself and to consider himself an active participant in his own formation. In addition, it may be necessary to go back into the institution and seek, with the remaining students, information not only about their integration, but also specifically about actions to overcome the difficulties faced in this process, which for others, would result in definitive evasion.

Considering the applicability of theories and researches in educational practice, despite the several investments and research developments about the evasion phenomenon, authors affirm that the scenario is still unchanged, since methodological limitations and lack of proposals generate naive and misleading analysis and has not really contributed to overcoming the problem (Polydoro, 2000; Tinto, 2006).

Another issue that confers to the research on school evasion a troubling status in the scope of research, concerns the collection of official data on the phenomenon. According to Baggi and Lopes (2011, p. 364-365, our translation), the website of the National Institute of Educational Studies and Research Anísio Teixeira (INEP) does not explicitly provide the data of students' exit, since the calculation can be approximated when taking into account the number of students enrolled, entering and finishing students each academic year. In the case of Higher Education, it may differ from what is done in educational institutions, so they explain:

> The lack of details about the numbers found causes problems because we can not qualify them, it means that, there is no tracking of the student's movement within the educational system and thus evasion in one institution can represent enrollment in another. The various existing concepts for evasion can not be identified in the Inep data; this is done through academic research within the various areas of education.

In these terms, Silva Filho (et al. 2007, p.10, our translation), when questioning himself about the reliability and methodological clarifications about the calculations made to measure evasion, points to some questions and makes a severe criticism to the office responsible for the accounting survey of the enrollments in the institutions. The researchers came to the following conclusion:

> It is also true - and obvious - that if internal transfers and re-entries are excluded, the evasion conceptually understood to be due essentially, the transferences between Higher Educational Institution or abandonment of studies by students is less than when it is considered, also the two ignored variables (internal transfers and re-entries) by INEP as of 2009.

Faced with the assumptions that make research on school evasion an object of scientific study and questionable, studies have emerged and with the intention of presenting other ways of facing school evasion, some of them from a positive bias. From this point of view,

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they make it clear that this form of research means that attention should not be limited to the registers or perspectives of the institution; but also prioritize the student's speech, which must present the student's perception about the event and the attribution of causality to the decision of interrupting their studies in a certain institution. School evasion can be seen from the academic point of view as a way to achieve a certain goal. In this case, it can not always be understood as wastefulness or failure, since it can be characterized as the active participation of the student in the definition of his trajectory and of his formative process. For that matter, evasion is even desirable, as a result of the student's decision and/or the institutional role of clarifying their role and can contribute to increase the student's capacity for choice and criticism. For this reason, the suggestion of betting on relationships and lived experiences - contrary to the studies of evasion - appears subtly in the speeches of researchers who dealt with this object, according to Polydoro (2000, p.59, our translation) when he suggested that:

> the remainder may also present relevant information, not only regarding their integration into higher education, but also about the actions to overcome the difficulties involved in this process, which may indicate intervention strategies.

In addition to the identifiable vulnerabilities in evasion research and weaknesses in official and real data, another questionable element seems to be the student's protagonism and his or her decision-making, as well as the ways in which it is understood.

In response to the criticisms and gaps of the evasion research in Brazil after 1990, a few surveys have started in a timely manner to turn their attention and consider the role of the institution in the students' decision to evade. One of them was the research developed by Braga, Miranda-Pinto and Cardinal (1997), that observing the average time of stay of the evaders in an educational institution considered that the end of students' persistence had a direct relation with questions of disillusionment within the school education institution.

In this meander, educators have classified as an intelligent posture of those who have decided to evade perceiving the non-identification with the institution, course or career (Carmo, Silva, 2016). In an American perspective, based on this logic, Tinto (1987, p.14, our translation) has presented one of the contradictions identified in the investigations on school evasion. He has defended the existence of a paradox between the institutional commitment and the limits of institutional action; since the phenomenon of school evasion could occur, when in the context of the educational process, an institution has clarity of its own function, commitment and educational choice, and realizes that it would help the student to understand the gaps and mismatches of the institutional action regarding the desires and pretensions of the students. The author affirms that "When confronted with individuals whose needs and interests can not be adequately met, the institution must be equally prepared to help the individual to go somewhere else."

Considering the dynamics of the relations and the protagonism of the actors within the institutions Sbardelini (1997), analyzing the decision to leave an institution, understands that the student probably would stay in an institution if the institution effectively hosted him or her. Corroborating with the question of social and sometimes problematic dynamism in the formal learning environment, Polydoro (2000, p.53, our translation) observed:

> Decision taking about permanence in the course or institution occurs within the dynamism of the relationships between the factors involved in the longitudinal process of interaction between student, institution and external events, which are confronted and also confronts at every moment.

Regarding the issue of reception, when dealing with the reasons for evasion, the research team considered that the institution's role in overcoming "would not require large additional investments in complex retention programs, but small daily actions that may increase the sense of well-being to the institution" (AMBIEL, SANTOS and DALBOSCO, 2016, p.295).

Taking back and confirming the weaknesses of analyzes in the investigations on evasion, Polydoro (2000, p.56, our translation) foreseeing a more dynamic, real and less naive forms of analysis, has defended already at the beginning of the 21st century the following idea:

> In general, the analysis of factors that led to the permanence of students entering a non-preferential option confirms the importance of the EXPERIENCE LIVING throughout the course to strengthen the initial commitment (...).

Elaborating analyzes about school evasion in the Brazilian tendency, researchers made certain reflexive criticisms. Considering the theoretical-methodological limitations of Ambiel, Santos and Dalbosco (2016, p.295-296, our translation), they drew attention to the following question:

> It should be noted that at least in Brazil, previous studies have limited themselves to identifying statistics on evasion in large-scale samples (...) without considering the reasons

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that led to such a decision, or relating it only to vocational issues (initial professional choice) or financial.

In addition to the mistaken problematic regarding the considerations referring to the researches about evasion in Brazil, the most striking criticism refers to the translation of the concept. In academic circles, the word "retention" in Brazil can designate students who have been retained and have not moved on to the next educational series or stage. But the term, in English the term retention, in addition to appearing more objective, commonly refers to the set of viable measures designed to keep the student in the institution. Studies and actions in countries such as the United States and Australia demonstrate the importance given to the issue as they discuss and invest in research on it. Moreover, the seriousness given to the subject appears to be proven by the management of retention sometimes exercised by a specific management, if not by a board-level occupant in educational institutions. In some institutions, a considered professional would be called Retention Director, whose function would be to collaborate with the pedagogical team of the institutions, as well as to develop and implement programs and actions that will enable students to complete their studies (Portela, 2013).

V. SYNTHESIS EXERCISE: THE NEED TO CUSTOMIZE SCHOOL EVASION

The aim of this essay was to discuss issues that permeate meaning, through use in the educational universe, in Brazilian investigations and, finally, outside the country. Among the several perceptions, it was verified that in academic productions that investigate the issue of school evasion, some problems were evident. The first one was the question of polysemy, accompanied by inaccuracies, multiplicity of views, and often non-propositional character. Even if the researcher chooses to prefer more rigorous studies, involving a whole generation of students, with their different characteristics; it could be a problem to find indexes that supposedly would have more relation with reality, it can not be capable of covering all generations of students, which in turn would indicate more reliably the research.

On the other hand, even if there are studies that attempt to understand the phenomenon of school evasion in recent years, administrative barriers (such as lack of or inconsistency of information) would not allow the possibility of an accurate view of the indexes. Thus, the debate between the trustworthiness and the actuality of the studied phenomenon is established, which characterizes a little objective field in the area of academic research.

In view of the discussions about the conceptualization of the term school evasion, according to the analysis of the first Brazilian researches, the observation of the international trends and the criticisms built around the investigative object, it seems urgent the dialogue in the Brazilian territory with a view to the necessity of proposition of another type of notion, approach and horizon in contrast to the way in which school evasion is investigated in Brazil.

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Production and Operating Strategies with Focus on the Efficiency of the Public Service

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***Abstract*—** *This study focuses on the strategy for efficiency in production and operation in the services of a people management sector in a public judicial organization. Identified the need to innovate practices to achieve excellence, the U and Contingency Theories were used to reach proposed objectives. The general objective was to study the strategy for efficiency in production and operation in the Department of Personnel Management, and as specific objectives characterize the strategy of efficiency in production and operation, perform the SWOT analysis on the practices of the process operation and suggest innovation for efficiency of the productive process. The question asked was: What is the strategy for efficiency in the results of the production and operation of the services provided? To achieve the objectives and answer the question asked was qualitative research. Data collection was obtained through exploratory research in loco, followed by a descriptive phase through field research, using open interviews and application of quer forms. Consequently, SWOT analysis and the DMAIC model were applied to finally suggest innovation. The proposed objectives were reached, where the contingency approach with a behavioral focus and guided leadership was envisaged. The question was answered and the motivation for suggestion of innovations was firmly established in the process of presencing and knowledge management of Theory U. It was concluded that the strategy for efficiency in results should focus on the dynamic organizational complexity, acting in an integrated way, developing abilities of employees until then unincorporated, allowing the evolution of the flow of knowledge management, empowering skills.*

Keywords*— *Efficiency. Strategy. Theory U. Production. Innovation.

I. INTRODUCTION

This study focuses on the strategy for efficiency in production and operation in the services of a people management sector in a public judicial body. Notwithstanding the existence of a strategic map in this body, it is evident that there is a need to innovate the practices in order to improve results. The goal will be the improvement focused on speed with efficiency in the production processes and operations of the sector under study.

II. OBJECTIVES

The general objective of the task is to study the strategy for efficiency in the production and operation of service in the Department of Personnel Management of a public judicial body; and as a specific objective to characterize the strategy of efficiency in production and operation in the sector under study (1), to perform the SWOT analysis on the practices in view of the process operation in the sector under study (2), and to suggest innovation for process efficiency in the sector surveyed (3). The question to be

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answered is: Which is the best strategy for efficiency in production and operation of the services provided in the researched sector?

III. THEORETICAL-CONCEPTUAL REVISION

This research is based on the Contingency Theory which, according to Junqueira et al. (2016, p 335), indicates that an organization must tailor the contingency in order to prevent inefficiency. In addition, it will also be used, as inspiration, the Theory U, created by Scharmer (2010, p 27), which helps to break paradigms of the older models and allows an analysis of the deeper levels, as well as to provide techniques to co-create solutions. This helps to refine the study of the strategy of efficiency in the production and operation of service in the People Management Department of the Public Judicial Forum studied here. The basic theories must go beyond a Bureaucratic Theory of Max Weber, which according to Maximiano (2015, p 95) is a basis for organizing the collectivities. Picture 1 below demonstrates the teaching resource in this task.

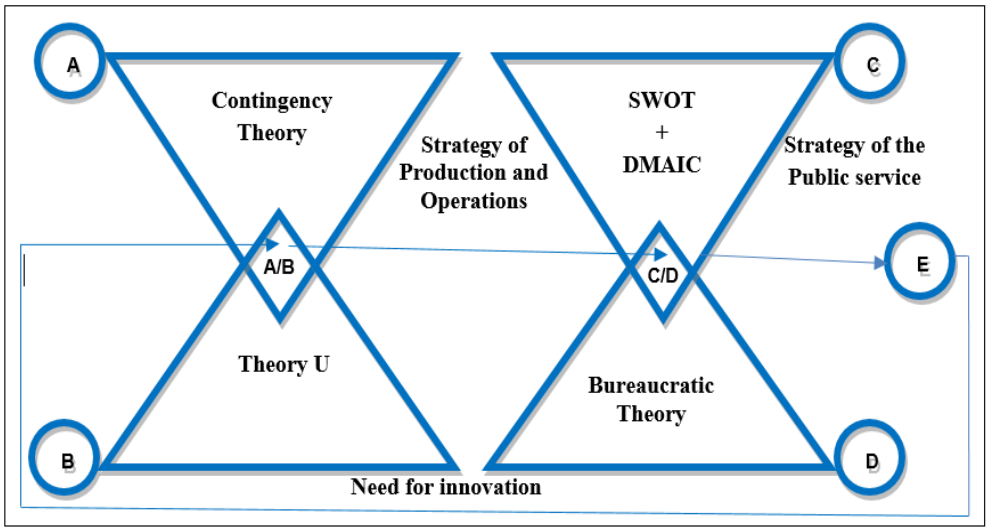

Fig.1: Diagram of the theoretical-conceptual revision

Source: Authors' elaboration.

3.1 Concepts of strategy, efficiency and production / operation

The concept of strategy for Mintzberg et al. (2010, p 24) is something complex that requires several definitions, however, the author defines it as a plan, pattern or coherence in behaviour over time.

For Maximian (2015, p 10), efficiency indicates if an organization uses its resources productively. The author uses as an example a Formula 1 stop box to demonstrate that a team can be efficient and inefficient at the same time, depending on the reference. The tire exchange has maximum efficiency time usage, however, it is inefficient when it comes to the use of human resources. In order to evaluate the efficiency of an organization, it is necessary to know its strategies to know if the trade-offs are coherent, as Corrêa explains (2013, p 28).

When dealing with Production Administration, Reis et al. (2017, p 120) explains that production tends to be more geared towards industrial activity, while operations are focused on service delivery. Consequently, it clarifies when quoting Slack that production is the area responsible for developing products or services from inputs, through a logical system to transform inputs into outputs.

According to Corrêa (2013, p 5), operation management is responsible for managing inputs, their interactions and their transformation processes and outputs, controlling the quality to meet the needs of stakeholders, making them compatible with the organization's strategic objectives.

The organization functions as a living organism in a constant cycle of change and adaptation. The figure of the manager is fundamental to the success or failure of the adaptations so that there is no deviation from the objectives. Scharmer's Theory U (2014) raises the importance of the projection of the leader's essence in decision making since it will influence the actions of the collective, aligning or not the reality to the strategy. Mintzberg et al. (2010, p 44) emphasizes the importance of the leader's role as a strategist, stating that, to be successful, an organization must have a strong leader who is willing to make choices and define what is worth, keeping the coherence of the tasks to the strategy and maintaining a clear and sustained direction over time, ensuring that everyone understands the strategy.

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3.2 SWOT Analysis concept

According to Maximiano (2015, p 320), SWOT Analysis is a tool that systematizes the analysis of the threats and opportunities of the external environment, as well as the strengths and weaknesses of the internal environment. The author refers to the factors that influence the outcome and that will be considered in this study, namely: motivation, individual and group work, and leadership. The SWOT model can be seen in Picture 2 below.

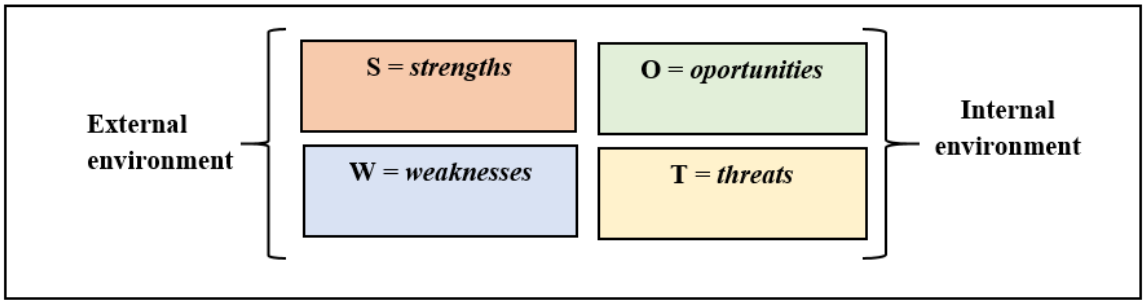

Fig.2: SWOT Model Configuration Diagram

Source: Adapted by the authors' from Maximian (2015, p 320)

3.3. DMAIC Innovation and Technical Concepts

Nascimento *et al.* (2015, p 4) when combining concepts, affirms that innovation begins with the implementation of an idea, then stimulates and directs efforts to transform it into products or processes and obtain a positive result, which can be a quality instrument or a significant and profound improvement. The DMAIC model is a process improvement tool that seeks greater efficiency, speed or any other performance indicator, as explained by Maximiano (2015, pp 409 - 415). The author elucidates that this model is one of the Six Sigma developments that fuses quality management and the efficiency school, resulting in an update of the management of scientific procedures. The DMAIC model is deployed in five known steps: *Define (1), Measure (2), Analyze (3), Improve (4), and Control (5).*

IV. METHODOLOGY

The research is qualitative and according to Nascimento *et al.*, (2015, p 4), seeks to understand human and social phenomena in a naturalistic and interpretative way. As mentioned, the Contingency Theory and U Theory were used as basic theories to carry out the Case Study of the research and suggest the innovation. Case Study, still according to Nascimento *et al.*, (2015, p 4) is a system that is formed by a delimited set of parts that acts in a certain standardized way and performs a certain function.

The data collection was obtained through the exploratory research characterized as in loco in a public judicial body, in the Strategic Planning and in the Department of Personnel Management, in order to characterize the efficiency strategy in the production and operation of the sector under study. Next, a descriptive step was carried out, conducting a field research, using as tools to obtain the information the open interviews, and application of consultation forms to the people crowded in the Department of Personnel Management, in order to obtain several points of view of strategy in production and operation and their applications in the functional routines, as well as to obtain pieces of information that provided a foundation for the SWOT analysis and contributed to the achievement of the research objectives. Finally, a bibliographical research was carried out in order to base the analysis of the results and help in the development of the innovation suggestion for the efficiency of the production process in the researched sector that was developed with the Theory U in mind, in the form of the DMAIC model. Picture 3 demonstrates the methods, steps and methodological procedures of this research.

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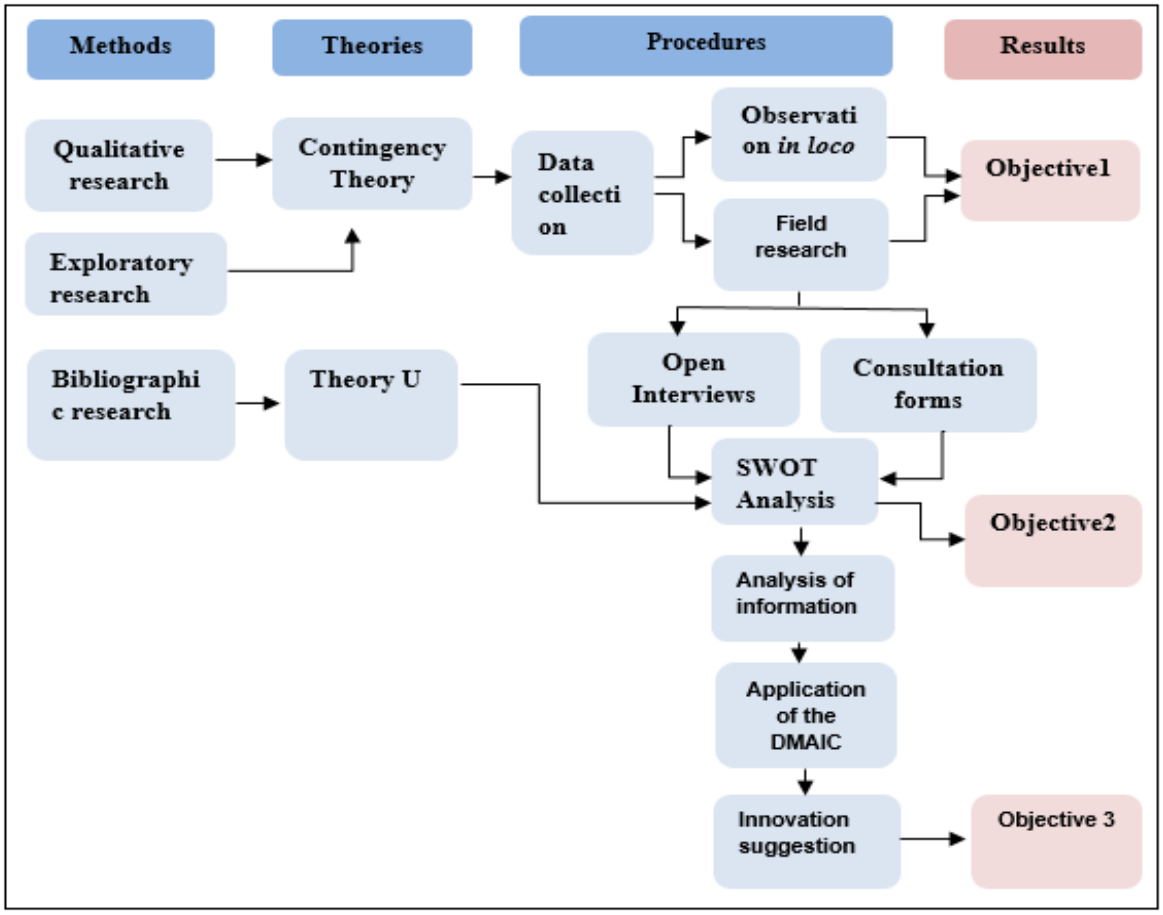

Fig.3: Methodological diagram

Source: Authors' elaboration.

The procedures adopted for the processes of transformation of the research made it possible to obtain data necessary for the elaboration of a conceptual model and the steps defined for the continuation of the research. In order to meet the objectives of the study, it was necessary to establish procedures, as seen in Table 1 below.

Table.1: Specification of methodological procedures.

Methodological points	**Meansofaction**	**Specification**
1. Theoretical review	1.1 Basic theories	1.1.1 Research by themes related to the objectives of the research; 1.1.2 Presentation of concepts published in scientific articles, theses and books.
2. Methodological procedures	2.1 Data collection; 2.2 Field research.	2.1.1 Realization of data collection, through field research; 2.1.2 Observation in loco; 2.1.3 Application of consultation forms to employees of different hierarchical levels; 2.1.3 Open interviews with employees, with the Director of the Personnel Management Department

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		and with the Strategic Planning Management Coordination.
3. SWOT Analysis	3.1 Analysis of the data collected.	3.1.1 Survey of internal strengths and weaknesses; opportunities and threats through open interviews and the outcome of the forms.
4. Analysisofresults	4.1 Analysis of information; 4.2 Application of the DMAIC model.	4.1.1 gathering and analysing the data collected; 4.1.2 Critical representation of results through diagrams, charts and graphs; 4.1.3 Realization of objectives 1 and 2; 4.2.1 Presentation of the required innovation with inspiration in the U Theory, along the lines of the DMAIC model; 4.2.2 Realization of objective 3

Source: Authors'elaboration.

V. STUDY ON THE STRATEGY FOR EFFICIENCY IN PRODUCTION AND OPERATION

Regarding production and operations management, Corrêa (2013, p 5) argues that the organization, even if not seeking profit, generates a value package for its clients. In the case of Public Administration, the client is understood as the whole society; seeking efficiency in production processes for the common good. The author further emphasizes that the purpose of the operations strategy is to ensure that the function of managing the processes of production and delivery of value to the customer is fully aligned with the strategic intent. Picture 4 and Table 2 demonstrate the production process and operations and their cyclic form, which refers to the connection with the other areas of the organization to become effective and efficient at the completion of each cycle. Table 2 below, in addition to specifying the items in picture 4, demonstrate how all the areas of action are interdependent and, therefore, must be aligned with the strategy.

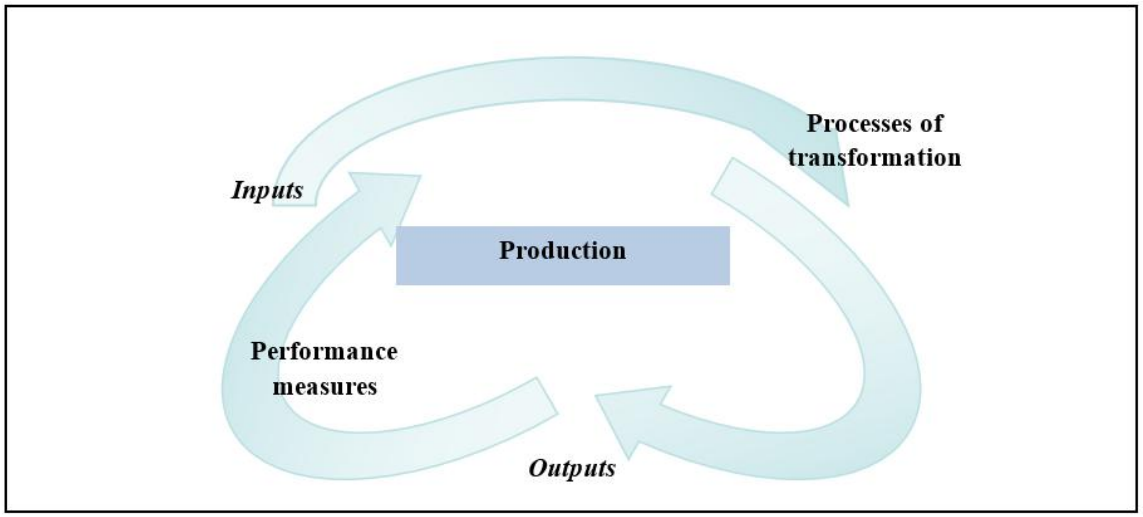

Fig.4: Production diagram

Source: Authors' elaboration., based on Corrêa (2013).

Table.2: Designation elements of the Production Diagram

Indicative of diagram items	Action	Specification
1. Production	1.1 Processes of transformation.	1.1.1 Manages resources made available by other sectors.

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2. Inputs	2.1 Resources to be processed.	2.1.1 Inputs, machines, direct and indirect labor, energy.
3. Processes of transformation	3.1 Transformation.	3.1.1 Transformation of resources into goods and services for revenue generation.
4. Outputs	4.1 Final product.	4.1.1 Goods and services.
5. Performance Measures	5.1 Control and backup of production.	5.1.1 Controls production processes through quality control, cost control and productivity measurement; 5.1.2 Provides feedback for closing and restarting the production cycle more and more efficiently.

Source: Authors' elaboration.

The on-site observation made it possible to appreciate the performance of the production and operation routines in the People Management Department of the public body studied here. These practices occur in accordance with the Flow Chart shown in Picture 5 below.

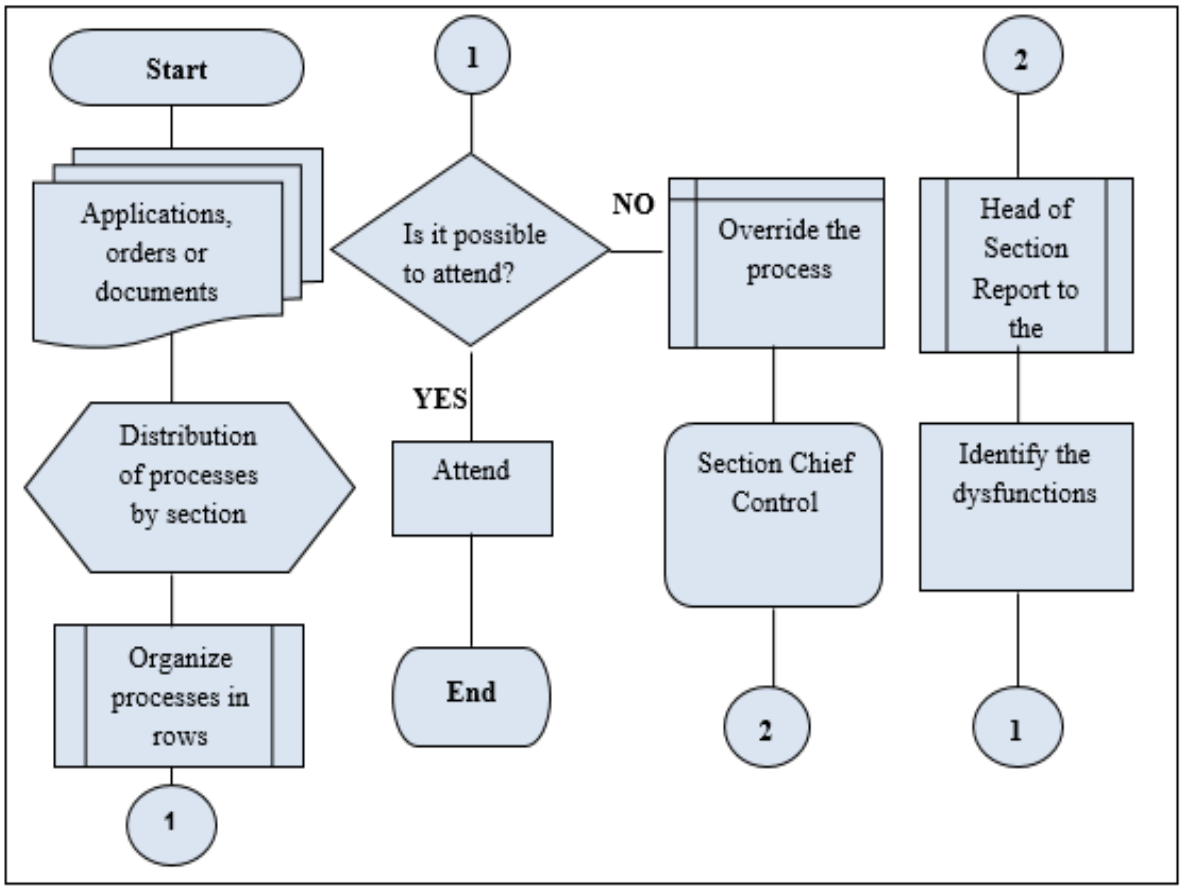

Fig.5: Flowchart of the studied sector production processes.

Source: Authors' elaboration.

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Table.3: Specification of the flowchart of production processes in the sector studied

Process Flowchart Item	Specification
1. Applications, orders or documents	1.1 The servers send electronic processes to the Personnel Management Department with applications, dispatches and documents in general according to their specific needs, to the demands pertinent to the sector.
2. Distribution by sections	2.1 The processes are forwarded to the sections according to the specificity of the request.
3. Organize processes in rows	3.1 In the sections, the processes are organized in queues of increasing chronological order, allowing the control of the efficiency with regard to the speed of productivity of each section. 3.2 Each section has a Section Chief who reports directly to the Director of the Personnel Management Department.
4. Is it possible to fulfill the request?	4.1 It is verified by the collaborators if it is possible to attend the requests. 4.2 If the answer is positive, the request is answered.
5. Override the process	5.1 If the request can not be fulfilled, employees place the requisition in a special follow-up queue.
6. Management Control	6.1 The special monitoring queue is accompanied by the Section Chief who looks for alternatives to solve the deviations that clutter the process.
7. Section chief reports to management	7.1 In case the Head of Section can not solve the deviations, the competence of the process is passed to the Director of the Department who will decide the course of action.
8. Heal the dysfunctions	8.1 If the malfunction is identified, the Department Director will correct it immediately so that there is no cascade effect, since the sections are interdependent.

Source: Authors' elaboration.

In the quest for the expertise of the production and operation performance, the Respondents Consultation Form was applied, namely, the stakeholders located on the departmental service platform. This task involved 21 individuals of different hierarchical levels. It resulted in Table 5, which shows that they are in an age group between 18 and 52 years old, thus identifying a team in which 57.14% is between 26 and 39 years old, and a young people's picture is recognized. A percentage of 71.43% of these individuals are female, and 52.38% of the team has completed middle school education. The predominant family income range is between four and ten minimum wages, with a percentage of 76.19% at this level. Table 4 below shows the extract of these data obtained in loco on respondent collaborators.

Table.4: Summary of respondent employees

Question	AnswerOptions	Quantity (%)	Quantity
Age group	From 26 to 39 yearsold	57,14%	12
Sex	Female	71,43%	15
Degree of schooling	Complete high school	52,38%	11
Family monthly income range	Four to ten minimum wages	76,19%	16
Time you work at the institution	Oneyear	38,10%	8
	Five yearsor more	23,81%	5

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Number of people residing with the consulted	I live with one to three people	57,14%	12

Source: Authors'elaboration.

When analyzing the table above, it is possible to perceive that the sector is formed by a young team, predominantly by employees with a medium level of technical knowledge. These characteristics will possibly influence the results, due to the lack of experience in the labor market and the scientific knowledge of the majority of the respondents. On the other hand, because it is a young team, adaptability to innovation and change is likely to occur in a natural and uncomplicated way, as Maximiano (2015, p 16) points out when talking about the behavioral approach, where he explains that one of the main ideas of this strand is to put motivation as an internal impulse to the behavior and as a product of the interaction with external stimulation.

The next phase of the Applied Consultation Form allowed characterizing the strategy of efficiency in production and operation. In addition, it optimized the elaboration of the SWOT Analysis, with a foundation whose criticism provided the suggestions of innovation for better efficiency of the production process. The adoption of this procedural technique made possible to infer the relations between the managers and their collaborators in the productive platform of the services. The leader and the subordinates were thus interacting head-on with the researcher at the workplace, offering the coherent dimension in the contextual analysis foreseen in this task. In addition, the respondents' view on innovation made it possible to verify the need for changes to raise efficiency levels in the productive process of the sector. Table 5 below shows the extract of the respondents' statements in the Consultation Form, operated through Excel Software. It was taken into consideration: Totally Agree (TA); Partially agree (PA); Indifferent (I); Partially Disagree (PD) and Totally Disagree (TD).

Table.5: *Synthesis of the second stage of the search query form*

Affirmatives	TA	PA	I	PD	TD
1. The institution perceives the external factors that influence the business dynamics.	23,81%	38,10%	14,29%	23,81%	0,00%
2. The institution perceives my needs and aspirations within the company.	19,05%	42,86%	0,00%	33,33%	4,76%
3. The company seeks to remain competitive by analyzing its competitors and employees.	14,29%	33,33%	23,81%	19,05%	9,52%
4. I feel like an important part of the organization.	47,62%	28,57%	9,52%	9,52%	4,76%
5. I participate in meetings that discuss methods and procedures performed.	14,29%	33,33%	19,05%	4,76%	28,57%
6. I give opinions that are discussed in planning meetings.	9,52%	42,86%	9,52%	4,76%	33,33%
7. I have my superior as an example to be followed in the organization.	42,86%	38,10%	9,52%	4,76%	4,76%
8. I am free to express what I think about methods and procedures.	23,81%	42,86%	14,29%	14,29%	4,76%
9. My superior cares about my opinions and well-being within the organization.	28,57%	42,86%	14,29%	14,29%	0,00%
10. I know what innovation is.	76,19%	14,29%	9,52%	0,00%	0,00%

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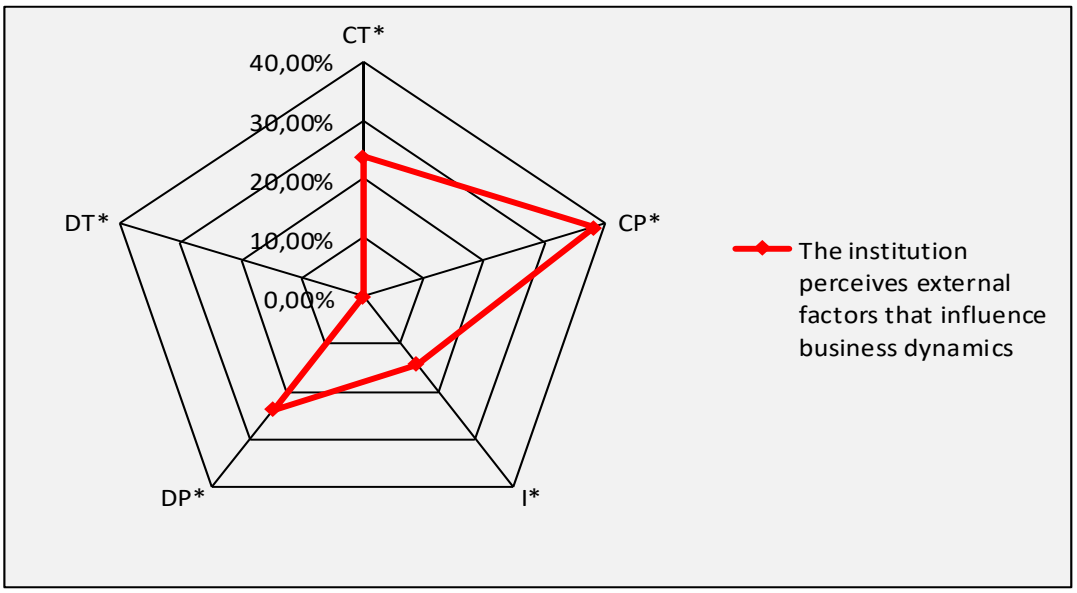
11. Innovation plays a determining role for the company to adapt to the market.	61,90%	33,33%	4,76%	0,00%	0,00%
12. The institution needs to undergo processes of innovation to become excellent.	66,67%	19,05%	14,29%	0,00%	0,00%

Source: Authors'elaboration.

By analyzing the answers of the Query Forms, it is possible to concatenate theoretical parameters to achieve the objectives of this work. It is noticed that most employees feel valued by the company when having their needs and inspirations perceived by the organization, which denotes a predominantly motivated team. This is confirmed by observing that 47.62% claim to fully agree that they feel an important part of the organization, while only 4.76% disagree totally with this statement. This motivation can be related to the department leader and their participatory approach, since 42.86% claimed to have their leader as an example to be followed in the organization and no interviewees, even the unmotivated, have totally disagreed on the leader's interest in opinions and well-being of their subordinates. It should be noted that 90.48% of respondents say they know what innovation is, and 95.23% recognize the importance of innovation for the organization. This view is reinforced when 85.72% of the respondents say that the organization urges innovation to become excellent. This majority position characterizes the need to implant new techniques in the productive processes of the sector, making the most of the employees' skills; adjusting the efficiency in the production strategy, as prescribed by Maximiano (2015, p 290); who approaches systemic thinking, where he raises definitions of organizational complexities. In one of his definitions, he elucidates the technical difficulties inherent in the depth and extent of the knowledge needed to solve a divergence.

5.1 Characterization of the efficiency strategy in production and operation of the sector under study

Initially, the task of comparing the Contingency Theory approach with routine practice in the researched sector is established here. It was possible to verify that the external factors exert influence on the business dynamics, being a condition sometimes decisive, in the collaborators' point of view. So much that Junqueira (*et al*., 2016 p 335) prescribes that, in order to avoid inefficiency, the organization must maintain its strategically adequate structure for contingency. Most of the respondents assert that they perceive the influence that external factors exert on the organizational dynamics, as shown in Graph 1 below.



Graph.1: Perceptions of respondents' on external factors

***** CT (totally agree); CP (partially agree); I (indifferent); DP (partially disagree); DT (totally disagree)

Source: Position of the respondents'.

Graph 1 shows that 38.10% of respondents partially agree that the stakeholders in the body perceive the external factors in the organizational dynamics. In fact, because it is a public agency, the external factors are

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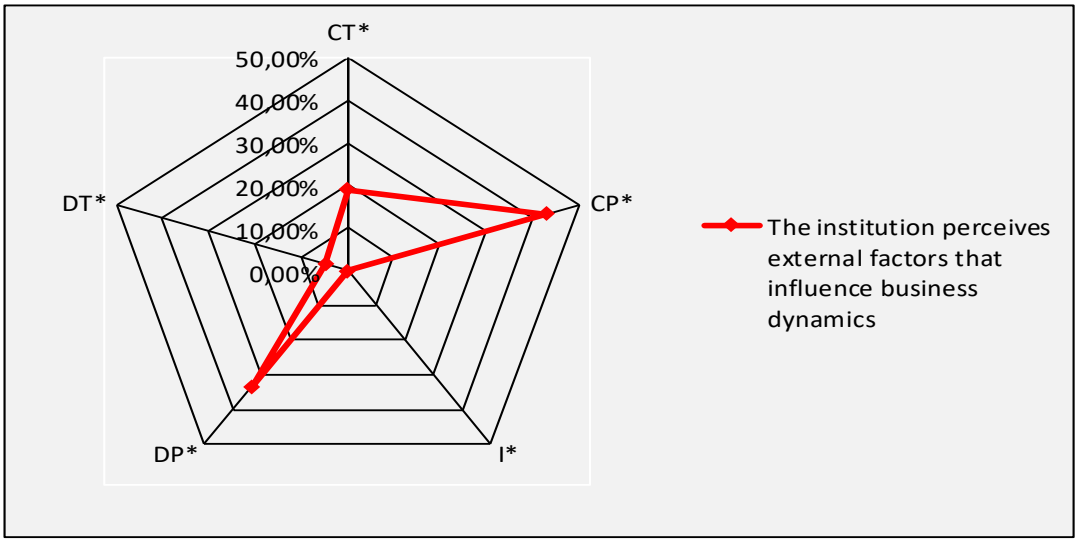
evidenced, since the source of resources and the objective end is the society. As Nascimento *et al.* (2015, p 3) when considering the quality of Public Administration, indicating that not only customer-citizen satisfaction but also continuous improvement of processes and cost reduction; this external clientele referred to by the authors, form real expectations that imply greatly in the qualification of the public services produced.

Through the in loco observation of the Department of People Management and open interviews carried in this and the Planning Sector that supports the institutional practices, it was possible to note the characterization of the efficiency strategy in the production and operation in the researched environment. First, on the plan of goals, it is stated that the Planning Sector has set out to raise the Organizational Climate Index to 5% per year by the end of 2020. Maximiliano (2015, p 201) stresses the importance of the organizational climate for the organization in the face of meaning in cooperative systems; in fact, people cooperate to achieve institutional goals. However, cooperation can only be achieved when there is a balance between the benefits or inducements that the organization offers to the employee and the contributions or efforts that the individual offers to the organization; would be a counterpart between effort and rewards. So much that Maximiano (2015, p 202) states that this approach was a pioneer in the performance of organizations, in addition to highlighting the role of human factors in the work of managers. The effect of this strategy is clearly observed from the positioning of the respondents when pronouncing in the Consultation Form, according to Chart 2 that follows.



Graph.2: Respondents' perception of their needs and aspirations

***** CT (totally agree); CP (partially agree); I (indifferent); DP (partially disagree); DT (totally disagree)
Source: Position of the respondents'.

Graph 2 allows us to analyze that the efficiency strategy in production and operation in the sector under study is focused predominantly on the behavioral approach; being consistent with the human and behavioral dimension of Chester Barnard, as well as George Elton Mayo's vision in analyzing the Hawthorne experiment, as Maximiano explains (2015, pp 203-206). In addition, it raises the importance of the workers' behaviour, since the quality of the treatment dispensed by the hierarchical superior to its subordinates, reinforcing the sense of group, significantly influencing on the performance of the whole workforce; this phenomenon is known as Hawthorne Effect. It is on the basis of this context that Maximiano (2015, p 206) states that in order to achieve efficiency in production on an organization it is necessary to consider the behaviour of people, a fact reaffirmed here, in view of the results of the present investigation.

5.2 SWOT analysis on the practices in view of the process operation in the sector under study

The Department of People Management in a public body of the State Judiciary served as the setting for this investigation. According to Teiga (2012, pp 8 - 28), a personnel management body is the sector responsible for keeping the workforce motivated, qualified and adjusted to the goals and objectives of the organization. For the treatment of the strategy of efficiency in the production and operation in the studied locus, a SWOT analysis was performed, in which we focus on the procedural practices of the current routine.

The research on the service platform allowed the identification of several points of view of the efficiency strategy in production and operation, as well as the applications in the functional routines. This information provided a foundation for critical mass construction, in line

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with the one recommended in Maximian (2015, p 320) when discussing the SWOT Analysis. This provision enables management to manage operational strategy by monitoring internal and external dynamics; and results in decisions that improve or enhance the business model, their specific objectives oriented to competitive advantage. As the organ studied is linked to the Public Power, it is possible to have an adequate understanding of how the competitive advantage and the excellence in the provision of services to the society starts to satisfy the user. As much as Corrêa (2013, p 5) considers that the organization generates a package of value for its clients, and seeking efficiency in the productive processes, the organ will be seeking the common good. This is a premise for the New Public Management that involves the strategy in the administration of the production and operation of the services offered to society, beyond the Bureaucratic Theory and achieving efficiency and excellence in the services provided.

Based on the open interviews with the collaborators and the results of the consultation forms applied in the organ in study, it makes it possible to systematize the analysis of strengths and weaknesses in the internal structure; and through the critique of the position of the organ searched in relation to its objective purpose that is society, it was considered to criticize the opportunities and threats located in the external environment. These two scenarios analyzed resulted in the content shown in Table 6 below.

Table.6: SWOT analysis of the productive platform under study

Monitoring Items	Observed Points	Specifications
1. *Strengths*	1.1 Motivated team. 1.2 Leadership. 1.3 Team participation in decisions.	1.1.1 Employees state that they feel they are an important part of the organization. 1.1.2 The team recognizes the leadership of the Director of the Department and supports their decisions. 1.1.3 Employees claim to have freedom of expression of opinions on methods and procedures.
2. *Weaknesses*	2.1 Bureaucratic deviations. 2.2 Centralization of information. 2.3 Demand overload.	2.1.1 Need for physical documentation in some sections for bureaucratic reasons; 2.1.2 Obligation to publish all acts. 2.2.1 Information related to people. 2.3.1 Labor insufficient to meet the demands.
3. *Opportunities*	3.1 Technologies and technical support. 3.2 Power - political factors.	3.1.1 Access to technologies to promote strategy efficiency. 3.2.1 Political power because it is a public body.
4. *Threats*	4.1 Dependency. 4.2 *Layout*.	4.1.1 Lack of autonomy in the course of action because it depends on the approval of the State. 4.2.1 The sector occupies a small space in relation to the demand of processes; 4.2.2 Inexistence of access control of the external public to the Director of the Department.

Source: Authors' elaboration.

Strengths analysis indicates that team motivation, industry leadership, and the freedom of the employee to express opinions about methods and procedures have been identified. The motivation of the team was identified in the on-site observation and in the application of the Consultation Form, where 76.19% of the interviewees affirm that they feel they are an important part of the organization. The motivation of the employees of an organization is one of the central themes of the behavioural approach. Maximiliano (2015, pp 239-261) points out that motivation theories explain people's performance in work situations and, when dealing with process theories, explains how the motivation mechanism works. The author further explores the theory of equity where it says the belief

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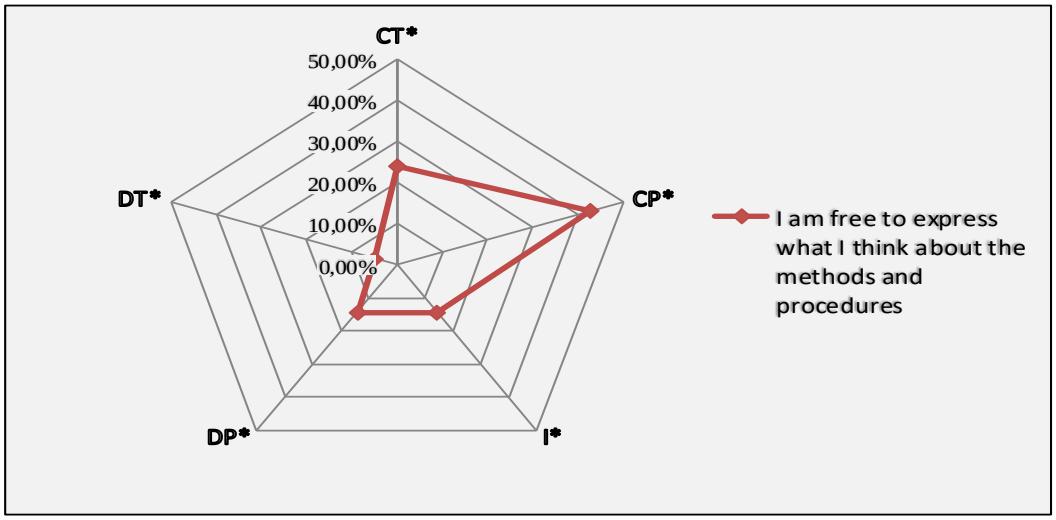
that rewards should be commensurate with efforts and equal for all. This theory applies in this case since 61.91% of respondents stated that their needs and aspirations are perceived by the organization.

Regarding leadership, the team demonstrates the recognition and approval of the leadership of the Director of the Department of Personnel Management when 80.96% say they have it as an example to be followed in the organization and 71.43% agree with the statement that the same is concerned with the opinions and well-being of employees within the organization. Scharmer (2014, p 30) in exploring leadership and Theory U highlights the end of an era where leadership behaved as an inflexible, centralized control structure. In addition, Scharmer (2014, p 47) reinforces that a structure is a pattern of relationships. This refers to a statement by Maximiano (2015, p 268), where he stresses that the processes of motivation and leadership are intertwined. Another factor that seems to stimulate the motivation of the team and also strengthen the leadership of the Director of the sector studied is the participation of the team in the decisions. As can be seen in Graph 3:



Graph.3: Performance on the freedom to express what the stakeholder thinks

*****CT (concordo totalmente); CP (concordo parcialmente); I (indiferente); DP (discordo parcialmente); DT
****** CT (totally agree); CP (partially agree); I (indifferent); DP (partially disagree); DT (totally disagree)
Source: Position of the respondents'.

Analysis of Graph 3 shows that most employees perceive advisory or participative leadership, which Maximiano (2015, p 274) classifies as people-oriented leadership. This leadership model comprises behaviours classified in the democratic model without the use of authority; the leader is flexible, malleable and focuses on the employee or group itself, emphasizing human relationships and developing the ability to work as a team.

Regarding the Weaknesses, open interviews show that employees identify bureaucratic deviations or dysfunctions, the need for physical documentation in some sections, and the constitutional requirement of publicity, which makes it mandatory to publish administrative acts of the public body. Maximian (2015, p 103) scores by exposing the criticisms of Charles Perrow, William Roth, and Robert K. Merton to Max Weber's model; the cited author defines as bureaucratic dysfunction the excess of rules, which turns bureaucracy into a synonym of complications and additional cost to the taxpayer. In spite of this, it is significant to emphasize that the bureaucratic system is inherent in the public service since it guarantees procedural routines the constitutional premises of formality, impersonality and professionalism. Max Weber's bureaucratic theory says that bureaucracies, as Maximiano (2015, p 96) point out, are essentially normative systems, which refers to productive patterns. On the other hand, currently, the Public Administration has been approaching a managerial model, migrating the focus from processes to the efficiency of production and services for the clients, in this case, society. Although the managerial approach is the majority among the other public departments, it is possible to notice the little application of this in the researched sector.

Observation in loco indicates the concentration of information in the people when each sections' collaborator concentrates the information inherent to its attributions. The dysfunction is evidenced when the employee goes away for a long period of time or unexpectedly; the section where this collaborator is located suffers from congestion, consequently obstructing other sections of the service,

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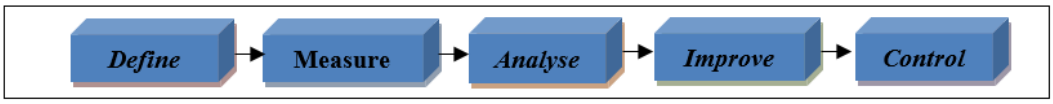
whose routines are interdependent. The demand overload in the face of the number of employees in the sector is another characteristic dysfunction. So much that in Silva, Munhoz and Munhoz (2015, p 4) it is pointed out that this type of deviation tends to generate conflicts, which directly damages the efficiency of the production and operations strategy.

With regard to the Opportunities, the analysis allows affirming that, like any public organ, the organization studied here has State support for access to technologies and Power, regarding the political factors and competitive advantage for not facing competition in the market. And with reference to the Threats, the analysis also points out those inherent to the public service, such as the lack of autonomy in the course of action because it depends on the approval of the State. The second threat relates to the layout of the industry, which occupies a small space in relation to the demand for processes. In addition, a threat to efficiency raised in on-site observation was the lack of external access control to the Director of the Department. There is no secretary in this sector to filter and distribute according to the subject the access to the public. This deviation compromises the efficiency of the entire industry, as people enter and leave the industry, seeking to solve their personal problems and end up interrupting or disrupting the Director of the Department with issues that could have been solved in sections or even in intranet internal systems. Maximiano (2015, p 104) raises the satisfaction of personal interests by listing the dysfunctions of Max Weber's bureaucracy model in Perrow's view. The author explains that Patrimonialism is the term used to designate the practice in which the employee uses the organization to accomplish personal goals. That would hurt production as a whole.

5.3 Suggestion of innovation for the efficiency of the production process in the researched sector

Nascimento et. al. (2015, p 4), when concentrating definitions of several authors consider that the elaboration and study of innovation in public bodies focus on the principles of efficiency and, later, on the model of managerial administration when presenting as an instrumental method to obtain results. To suggest innovation capable of increasing the efficiency of the production process in the researched sector, it is necessary to identify what prevents or decreases efficiency in the production process and operations. According to Scharmer's Theory U (2014, p 47), in a modern society, sectors develop their own style of coordination and self-organization.

One approach to suggest a process or organizational innovation is to use the DMAIC model, which Maximiano (2015, p 414) defines as one of Six Sigma - Six Sigma, which consists on the convergence of quality management and efficient movements. According to Maximiano (2015, pp 412-415), this methodology works through projects and starts when choosing the process to be modified; and ends when the new process replaces the obsolete, through the five steps of the DMAIC method. Picture 6 below demonstrates the five steps of the DMAIC Model; and Table 7 below contains the related descriptive elements, in which the nature of the DMAIC Model is explained, from the definition of the project scope to identifying the focus of the problem, identifying the causes, implementing solutions and finally guaranteeing long-term results.



Picture.6: Diagram of the DMAIC model

Source: Adapted from Maximiano (2015, p 414)

Table.7: Design elements of the DMAIC Diagram

Indicativeofdia gramitems	Meaning in Portuguese	Description
1. Define	1.1 Definir	1.1.1 To define the process that will be modified, with expected results and stakeholders in the project.
2. Measure	2.1 Medir	2.1.1 Measuring process performance through data collection and analysis;
3. Analyse	3.1 Analisar	2.1.2 Identify the focus of the problem.
4. Improve	4.1 Melhorar	4.1.1 Propose solutions to address the causes of the problem.

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5. Control	5.1 Controlar	5.1.1 Ensure the effectiveness of the results.

Source: Adapted from Maximiano (2015, p 414).

After observing the routine in the studied sector, based on the results of the consultation forms and open interviews with the various hierarchical levels of employees of this department, based on the SWOT analysis performed here, as well as based on Contingency Theory and U Theory, it is evident that the origin of the inefficiency of the production process in the Department of People Management occurs in the dysfunctions of Weber's bureaucratic model pointed out by Maximiano (2015, pp 109-109). This inefficiency can significantly influence production and operations strategies. So much that Maximiano (2015 p 313) emphasizes that a strategy is planned and executed through leadership, communication, operational planning, and work in the functional areas. It is clear then that these are interdependent and linked to the processes of production and operations.

The proposed innovation model is based on Scharmer's Theory U (2014, p 19), which posits how perception and mentalization are primordial to the results when saying that the quality of the results depends on the quality of the awareness of the participants that operate the system. In addition to the inspiration in Theory U, the suggestion of innovation was idealized along the lines of the DMAIC model. Defining the scope of the innovation project, the focus of the problem was identified, consisting of the organization of production processes. Consequently, the causes identified in the SWOT analysis were identified. The phases of implementing solutions and ensuring long-term results will be the responsibility of the industry under consideration to ponder the applicability of the suggestions, choosing to adopt them in the productive processes of the sector. This choice may impact the quality of production processes and operations since the model presented here is about the evolutionary convergence of two movements: quality management and the efficiency school or an updated version of the procedures of scientific management, as explained Maximiano (2015, p 411). Table 8 below shows the demonstration of a new model of production and processes that can integrate the objectives in the researched sector.

Table.8: Proposal of innovation in productive processes

Process for innovation	**Innovation Suggestion in the Personnel Management Department**
1. Organization of productive processes	1.1 Automation of processes, in a way that the server itself launches in the system its holidays, trips, vacations, with the approval of the immediate resposible, being the responsibility of the Department of Management of People to validate the acts; 1.2 Unification of the programs in a single software to facilitate the crossing of data for the aforementioned validations; 1.3 Creation of an agenda for the sector's board of directors in order to avoid subordinate competencies and avoid diverting focus in moments where the director lacks concentration, such as when writing Normative Instructions; 1.4 Optimization of the physical space of the sector through the elimination of physical files; 1.5 Deploy a server rotation scheme between the sections that make up the department to prevent information from being linked to one person.

Source: Authors' elaboration.

Automating processes and unifying programs into a single software would increase the efficiency of the industry by optimizing the speed of production, contributing to cost reduction, making the execution of processes more assertive, avoiding material errors, producing a lower environmental impact with reduced paperwork, and improved information security. By reducing paperwork, optimizing physical space by eliminating file cabinets would also increase information security.

Creating an agenda for the board would make leadership more efficient in order to make it possible for

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the Director of the Department to organize priorities through trade-offs, aligning with the strategy. This would allow the manager to effectively organize their duties, actively contributing to the efficiency of production and operations.

As for the rotation scheme of the servers between the sections that make up the department, this innovation would make possible not only to avoid surprises through the unexpected absence of a collaborator and consequent encroachment of the other sections, but would also allow the sharing of knowledge, according to Scharmer (2014, p 53), with increase in the team performance and consequent optimization of the processes production efficiency and operations. It would have a significant impact on public service and efficiency in the sector, since all the employees in this sector would have the knowledge to meet the emergency demands that may emerge randomly, increasing the focus on the sections demanded seasonally.

Based on the study, the motivation for suggestion of innovations is firmly established in the process of presenting and knowledge management elucidated by Scharmer (2014, pp 21-62); this author reinforces the leader's position in decision making, where he must make an introspection to reflect on the possible scenarios, getting rid of the paradigms that tend to sabotage decision making. After this deep introversion, perspectives emerge and innovation occurs naturally for the whole group, as it has in its leader an example to be followed, as stated in the consultation forms. These impact directly on production and operations, since according to Maximiano (2015, p 391) one of the main functions of the organization's culture is to regulate relations among members, such as how to resolve conflicts to define criteria for the evaluation of results, as well as corrective actions to be implemented in cases of errors and problems.

VI. CONCLUSION

This work focused on the strategies for efficiency in production and operation in the services of a people management sector in a public judicial body. It was evident the necessity to innovate the practices to achieve improvement in results. The overall objective of the task was to study the strategies for efficiency in the production and operation of service in the Personnel Management Department of a public judicial body. The proposed objectives were achieved, since it was possible to characterize the strategies through on-site observation, application of consultation forms and open interviews with employees, where the contingency approach was behavioral focus and guided leadership; the SWOT Analysis was elaborated on the practices in face of the procedural operation, in the sector under study, based on the view of employees, in the different hierarchical levels; in addition to the suggestions of innovations, based on the weaknesses and threats, raised in the results of the SWOT analysis and based on the U Theory, along the lines of the DMAIC model. As for the answers of the research questions, the study points out that the motivation for suggestion of innovations is based on the process of presencing and knowledge management elucidated by Scharmer (2014, pp 21-62). From the foregoing, it is concluded that the strategy for efficiency in the results of the production and operation of the services provided in the researched sector should focus on the complexity of dynamic organization, acting in an integrated way, developing skills of the unincorporated collaborators, allowing evolution of the knowledge management flow, empowering skills and allowing the interaction of employees' functional pieces of information in a practical way in the application of services provided, promoting excellence in the application of the production processes and operations of the sector studied.

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Technological Monitoring on Recycled Paper

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Abstract— *The origin of the papermaking took place in China in the year 105 (d.C), its creator, Ts'ai Lun used a process of disintegration of fibers of various materials which resulted in the final product called paper. The discovery of this product has brought humanity several benefits. As important as water and energy, paper, has become an indispensable product in our daily life, everything that is seen, touched and used, paper is constantly present, so much is its use on a world scale that there was a concern of as we would do so that this product could be reused to avoid an environmental catastrophe, polluting our ecosystem. After Law 12,305, the Brazilian National Solid Waste Policy - PNRS sanctioned in 2010, there was a marked increase in the selective collection of this material and a high stimulus to the consumption of recycled paper. The PNRS obliges all public agencies to consume recycled material and demand is increasing, the price of recycled paper tends to fall a lot and finally paper recycling becomes one of the best investments of the sector in Brazil. Nowadays, the paper is manufactured from the extraction of cellulose, through the recycling process. Cellulose can be obtained from any fibrous material, but only a few tree species have the appropriate quality and purity. In Brazil, the most appropriate species for paper production are eucalyptus and pine. Although recycling is considered the core of a circular economy for the return of materials to the supply chain, its procedures are poorly understood. Waste recycling is considered a major source of energy savings and a promoter of CO2 recovery. In addition, it generates jobs and changes markets around the world. This article presents a technological prospection of patent deposits that use paper recycling, as key words were used recycled paper. For the search of patents, the Espacenet database was used, obtaining a total of 244 patent documents, from 1980 to 2017. The results show that the year 2014 obtained the largest number of patent deposits, 17 records. The countries holding patents on recycling are Germany with 47 patent documents, China with 46, the United States with 42, Japan with 40. In short, patent applications in this technology branch have much to grow around the world , since the recycling industry has a high potential to generate innovation, making it an indispensable business in developed economies.*

Keywords— Paper, Recycled, Patents, Technological Monitoring.

I. INTRODUCTION

Based on Law 12,305 of 2010, National Solid Waste Policy - PNR, which obliges all Brazilian public agencies to consume recycled material, the trend is that paper recycling will have more stimulus, increasing its consumption considerably and becoming a good investment in the recycling sector in Brazil, even having sustainable reforestation for the removal of pulp for paper production, can still affect Brazilian flora and fauna [1].

According to [2], Brazilian Association of Pulp and Paper, through a prospective study estimates that with the increase in pulp production from 13.4 million to 20 million tons. In the same period pulp production will increase from 9.3 million tons to 12.5 million tons, and planted forest area will increase by 25% by the end of 2017.

In most of the studies that have been analyzed, recycling is considered the core of a circular economy for the return of materials to the supply chain, its procedures are still poorly understood. Waste recycling is considered an important source of energy savings and a promoter of CO2 recovery.

The purpose of this paper is to raise awareness of the reuse of recycled cellulose paper, which is used in developed countries, and generates several patents, since the recycling industry has a high potential to generate innovation, technologies, and great potential for economic growth. riches and, above all, to clean up the terrestrial environment.

II. THEORIC REVIEW

2.1 The Paper and its History

Humanity reveals its origin from studies of figures drawn on rocks carried by cavemen. The rupestrian paintings, probably these paintings, or graphic representations realized by the man of the caves, brought many knowledge of diverse life cycles in the planet earth.

Accompanying the development of human intelligentsia, graphic representations have become more complex, making man seek a more adequate way to reproduce his representations, according to history, first by the use of the clay tablet, then continues a systematic progression,

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tissues of diverse fibers, papyrus, parchment and finally the paper [3].

Historians agree to attribute to Ts'ai Lun (105 AD), the primacy of having made the paper using rustic means, and later using plant fibers.

2.2 Evolution of Paper

After the invention of paper, many centuries have passed, increasing industrialization and economic development have brought to the planet an accumulation of incalculable waste from paper and its composition, changing from predominantly organic (vegetable fibers) to a greater quantity of elements difficult to break down chemicals. However, by means of recycling processes, the environmental impact of these wastes can be minimized [4].

2.3 Recycling and Technological Monitoring of Paper

According to [5], the industrialized countries have large monetary capital facilitating the recycling of paper, for example selective recycling (separation by manufacturing, recyclable, non-recyclable and organic) and their reuse for several and countries with low financial resources if Brazil has a shortage of financial resources and makes it impossible to recycle paper with innovative methods, lack of an educational policy and adequate collection equipment, unfortunately many selective collection is unfeasible, but on the other hand has a high availability of cheap and unskilled labor that causes companies to seek the recovery of recyclable paper by conventional methods through waste pickers (people who collect recyclable waste with animal or human traction carts), lack of monitoring and technology more efficient.

Even with the method used in the recycling, unconventional is one of the solutions found for the problems generated by the final disposal of the waste, because it prevents potentially re-usable materials from being grounded or incinerated, preserving the environment [6].

According to [7], economic efficiency and the environment must meet three conditions of satisfaction: technological efficiency, product choice efficiency and allocative efficiency. In a perfectly competitive market, it is assumed that companies seek to minimize costs between profits and labor, achieving technological efficiency when it reaches maximum production using productive methods with minimizing costs.

In terms of this reciprocity of the functioning of the economy, the expenses faced by producers are equivalent to social expenses, not causing any damage to nature, therefore, recycling of pulp paper verified the effective environmental pressures all innovation strategies and technologies respect environmental taxes [7].

III. METHODOLOGY

The research methodology, used for the purpose of tracking patents related to recycled paper. Firstly, the database was defined, which involved the European Patent Office (EPO). The keyword "recycled paper" was used in the title and truncation symbols, so they could help find as many documents as possible. We found 245 results that were exported to Microsoft Excel.

IV. RESULTS

Figure 1 shows the number of patents found per year, we can observe that there was an oscillation in the number of deposits between 1990 and 2017, especially in 2014 with the largest number of deposits.

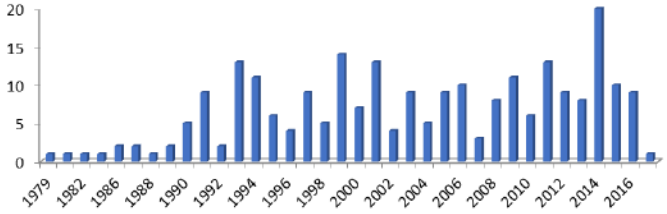

Fig. 1: Patent filing number per year
Source: Prepared by the authors.

By evaluating the documents obtained, as for the countries that develop technology for the subject under study, it was observed that Germany, China, the United States and Japan are the big holders of technology related to recycled paper, according to Figure 2.

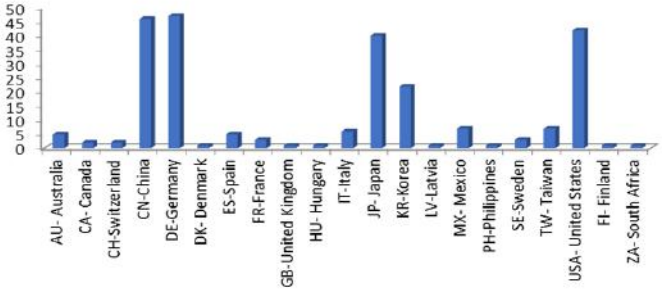

Fig. 2: Patent filing number per year
Source: Prepared by the authors.

In an analysis of the International Patent Classification (IPC), it was possible to know the most cited codes, according to Figure 3. According to the keyword used in the search, the most used base code was the " D21C "which is related to" Production of cellulose by removing non-cellulose substances from cellulose container materials; regeneration of pulp liquors; apparatus", then "D21B ", which refers to "fibrous raw materials or their mechanical treatment "and the code "D21H ", relating to "Pulp compositions; the preparation not covered by subclasses d21c or d21d; impregnating or coating paper;

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paper finishing not covered by class b31 or subclass d21g; paper not provided ".

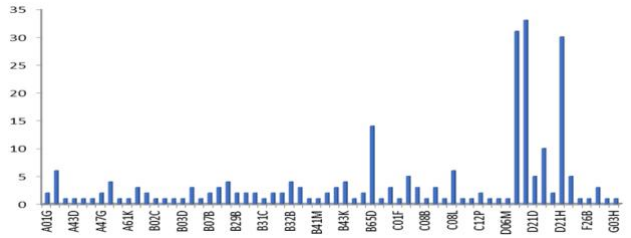

Fig.3: Number of deposits by International Patent Classification (IPC).
Source: Prepared by the authors.

Figure 4 shows the largest inventors of patents in this area. Among these stands out Huang Yuhua with 5 patents, followed by Asakura Kazuyoshi with 4 patents.

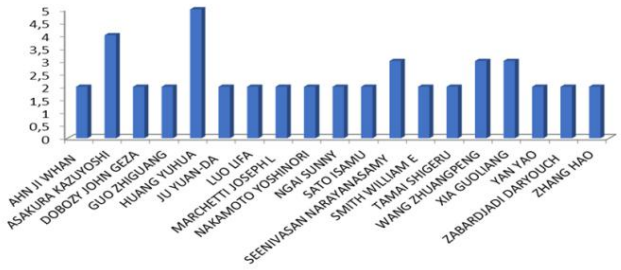

Fig.4: Number of deposits by International Patent Classification (IPC).
Source: Prepared by the authors.

In Figure 5, we can observe the largest patent depositors, especially Voith Paper Patent Gmbh with 8 deposits.

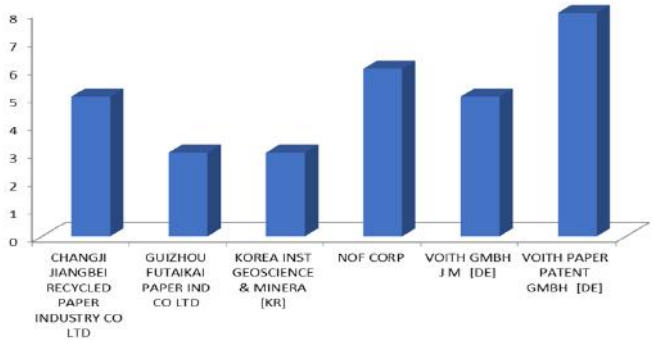

Fig.4: Number of deposits by International Patent Classification (IPC).
Source: Prepared by the authors.

V. CONCLUSION

It is concluded that the number of patent applications in the area of recycling, specifically in recycled paper pulp is not very expressive, which makes it necessary to stimulate and develop productive systems, mobilizing for innovative social development in this area. In addition, there is an uneven distribution of the origin of the application of these patents analyzed, showing the global differences, with three countries (Germany, China and the United States) being the largest deposit holders. There is a need for greater encouragement and development of policies to guide and rationalize this technological production and, consequently, to develop the other countries, since with the production of sustainable pulp and recycling in a conscious and adequate way the norms of preservation of the environment and the quality of life of the people involved in the recycling process are also respected, as well as the new technologies implemented in the process preserve the environment avoiding forest deforestation and emission of pollutants in nature.

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Three-Parameter Logistic Model (ML3): A Bibliometrics Analysis

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Abstract**—** *In the current scenario of Production Engineering, where analysis tools are applied like indicators of production, control and optimization of productive processes or even in the application of advanced analytical methods to support decision making, the Three-parameter Logistic Model (ML3) is one of the most promising, belonging to the Item Response Theory (IRT). This model provides ways of representing the relation between the probabilities of an individual giving a certain response to an item. Also it can identify latent features and parameters of the items, in the area of study knowledge. The objective of this research was to verify the scientific productions found in the electronic databases selected around the Three Parameters Logistic Model. A bibliometrics was carried in the year of 2012 until the last publication of the month of July of 2017. The bases that were investigated are Web of science, Scopus, SciELO and Google Scholar. The authors found twelve articles about the subject. The year of 2016 was the most productive (33,3%), articles with three authors were the most frequent (41,7%), SAGE Journals Educational and Psychological Measurement was the journal with the highest number of publications (25.0%), the USA was the most productive country (41.7%) and Yorkville University was the most profitable university (16.7%). The conclusion is that although the ML3 is relevant for the development of several areas of Production Engineering in relation to IRT, it still little used and exploited in the production of scientific knowledge, revealing a potential area for the development of new researches.*

Keywords**— Item Response Theory (IRT), Three-parameter Logistic Model, Bibliometrics, Production Engineering.**

I. INTRODUCTION

According to Tezza and Bornia [1], identifying problems and proposing improvements depends on high-level surveys in the data collection so that the method of analysis must be appropriate to the scenario to give credibility to the information. That is why data collection and the analysis method are crucial to propose a solution to a given problem, or to suggest an improvement in some process.

Among the instruments used in Production Engineering to build production indicators, to plan, control and optimize production processes or even to apply advanced analytical methods to support decision making, one can highlight the measurement scales. They enable the verification of divergences and the comparison of data through relations and thus propose solutions. In this scenario is the Item Response Theory (IRT).

IRT uses measurement scales to propose methods, in order to analyze, verify and find viable solutions for data analysis, and later for a more effective decision-making process. In Brazil, in addition to being used in school evaluations and psychometric tests, v has also been used in areas such as services, total quality management and evaluation of intangibles in organizations [1].

IRT is a set of mathematical models that represents the probability of an individual giving a certain response to an item as a function of item parameters and the respondent's abilities. This link is always expressed in such a way that the greater the skill, the greater the likelihood of success in the item [2].

The various models proposed in scientific studies and articles depend fundamentally on three factors: (a) universe of the item (dichotomous or non-dichotomous); (b) number of populations involved; and (c) the amount of latent traits being measured.

IRT models follow two assumptions, which refer to the characteristics of the items. The first is associated with one-dimensionality, that is, the group of items must measure the same variable. Although there is a skill set behind any behavioral performance, it is assumed that a single skill is being measured to satisfy the one-dimensionality assumption. The second one refers to the local independence of items. This means that a response to an item has no influence on the responses given to

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other items. Taking this assumption as true, one infers that the sequence of responses of the subject to a series of items will be the product of the probabilities of each item individually. There is no way to demonstrate these two assumptions, they are simply accepted or not [3].

From some models proposed by the IRT, the Three-parameter Logistic Model (ML3) is one of the most used. In the year 1952 Frederic Lord develops a two-parameter IRT model supported by the normal cumulative distribution, but with some uses of the two-parameter model the same author understands the imperative to incorporate a parameter that deals with the adversity of the casual hit. Thus, the three-parameter model emerged.

Although researches on the ML3 do exist, there is no knowledge about statistics regarding scientific production on this subject. This work developed a bibliometric study of scientific production on the ML3 from January 2012 to June 2017. The electronic databases used were Web of Science, Science Direct, Scopus, SciELO and Google Scholar.

The objectives of this work were: (a) quantifying articles about ML3 per year; (b) identifying the most productive authors on the subject; (c) verifying the number of authors by scientific production; (d) verifying the scientific journals and journals with the highest number of articles published; (e) quantifying the most productive countries; (f) verifying the institutions with the largest number of articles published; and (g) observing the H index of the most productive authors.

II. BIBLIOMETRIC STUDY

According to Araújo and Alvarenga [4], bibliometrics is a research tool with indicators that aim to portray the behavior and development of an area of human knowledge. As stated by Andrade [5], these indicators evaluate authors' productivity, quantification of citations, and frequency of the appearance of keywords, among others.

In general, with the evolution of information and advances in scientific production, together with the expansion of scientific databases, areas such as bibliometrics, scientometrics and webometrics are increasingly important [4]. Although these areas have their specificities, they have in common the interest in disseminating knowledge, identifying the main tendencies, structural and quantitative characteristics, regarding scientific articles published in congresses and scientific journals [6].

As stated by Vanti [7], among the several applications of bibliometrics, the most relevant were: (a) identify trends and the growth of knowledge in an area; (b) identify journals at the core of a discipline; (c) measure magazine coverage; (c) predict publication trends; (d) measure the degree and patterns of collaboration between authors; and (e) measuring the growth of certain areas and the emergence of new subjects.

In addition, bibliometrics has several laws and conceptions that employ statistical and mathematical processes dictating foundations of research and ordering in the scientific analyzes on the information universe. Lotka, Bradford and Zipf's Laws [8] are among the most employed laws.

According to Silva et al. [6], Lotka's Law, also known as the Law of Inverse Square started in 1926, where one was found that most published scientific research is produced by a small number of authors, and conversely, most of the researchers do not have the same income as the great researchers, but their research is equivalent to the sum of the publications.

According to Guedes and Borschevier [8], Bradford's Law allows establishing the degree of relevance of journals in a defined area of knowledge, in which the periodicals that publish the greater number of articles on a certain subject form a nucleus of periodicals, presumably of higher quality or relevance to the area.

Zipf's Law or minimum effort consists in measuring the frequency of the emergence of keywords in various texts. For this purpose, a list is organized by terms of a given area. This law is further divided into two others, where the first law states that a word that appears repeatedly in the same text exposes the subject of the publication. The second law reports that in a certain publication, several words of low repetitiveness found in the text have the same frequency [7].

III. ITEM RESPONSE THEORY

The Item Response Theory indicates models for the traits suggesting ways of representing the relationship between the probability of a individual to give an answer to an item and its latent traits or abilities, in the area of knowledge to be evaluated or ascertained, which cannot be directly observed [9].

The applications of techniques derived from IRT are in many areas of knowledge, such as educational, medical, psychosocial, marketing, services and total quality management.

One of the advantages of IRT is the possibility of making comparisons between abilities of individuals of different populations when they are submitted to tests having common items, and the comparison of individuals of the same population undergoing totally different tests. This is possible because IRT has as its central elements the items, instead of the global evaluation [10].

The item response theory indicates aspects still little explored by Production Engineering, although it portrays advances in aspects of control and management of

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resources and processes, such as the "power to position individuals or processes of different groups on a common scale, even though these have responded to different items, allowing the identification of opportunities for improvement or even benchmarking; allowing a more accurate evaluation of properties' items and their results and, consequently, allow greater application of statistical techniques; understand the psychometric properties of the instruments; the possibility of developing more efficient indicators to evaluate individual differences in processes, practices, systems or individuals; and greater robustness of the results" [1].

According to Araujo, Andrade and Bortolloti [10], IRT models lack the type of item and type of response method, being they cumulative or not. The fundamental discrepancy between the two models lies in the connection of the assertive response probability given by an individual to an item in relation to its characteristics in cumulative models. The increase in probability is related to the growth of the latent trait and the item's parameter characteristics. For non-cumulative models, in some cases the probability is, for example, related to the function of the distance between the parameters and the item in the scale and do not exactly depends exclusively on the parameters and the latent trait [11]. IRT offers mathematical models for latent traits, providing ways of representing the relationship between the probability of an individual to give a certain response to an item, its latent trait and item's characteristics (parameters), in the area of study knowledge [10,11].

Of the models proposed by the IRT, the one-dimensional three-parameter logistic model (ML3), the most used nowadays, is given by mathematical formula (1):

$$P\left(Uij = 1 \middle| \theta_j\right) = c_i + \left(1 - c_i\right) \cdot \frac{1}{1 + e^{-D_{ai}\left(\theta_j - b_i\right)}} \qquad (1)$$

Source: ANDRADE et al, [11].

As $i = 1, 2, \cdots, I$, e $j = 1, 2, \cdots, n$, where:

U_{ij}: is a dichotomous variable that assumes the values 1, when the individual *j* correctly answers the item *i*, or 0 when the individual *j* does not respond correctly to item *i*.

θ_j: represents the ability (latent trait) of the j-th individual.

$P(U_{ij} = 1|\theta_j)$: is the probability that an individual *j* with skill θj correctly responds to item *i* and is called the Item Response Function.

b_i: is the parameter of difficulty (or position) of item *i*, measured in the same skill scale.

a_i: is the discrimination (or inclination) parameter of item *i*, with a value proportional to the slope of the Item Characteristic Curve - CCI at point *bi*.

c_i: is the parameter of the item that represents the probability of individuals with low ability to correctly respond to item *i* (often referred to as casual hit probability).

D: is a scale factor, constant and equal to 1. The value 1.7 is used when the logistic function is expected to deliver results similar to the normal warhead function [11].

IV. METHODOLOGICAL PROCEDURES

The present study was carried out based on research in four electronic databases: Scopus, Web of Science, Science Direct and SciELO, besides Google Scholar. The accessions were carried out in the Laboratory of the Center of Studies in Production Engineering (NEEP) of UNESC (Universidade do Extremo Sul Catarinense) from Criciúma, Santa Catarina state. The period of verification of the articles was from January 2012 to June 2017.

The keywords used to perform the search in the databases and in Google Scholar were combined with the Boolean operator "AND" and resulted in the following search expression: "Engineering AND Three Parameter Logistic Model". The research included only scientific papers published in journals, excluding, therefore, citations and patents, chapters of books and publications in annals of scientific meetings and congresses. The selected job information has been exported to Microsoft Excel 2013 software, for further statistic treatment.

V. RESULTS AND DISCUSSIONS

The search strategy used in this research ("Engineering AND Three Parameter Logistic Model") resulted in 10 (ten) articles from Science Direct, 1 (one) article from Web of Science, 4 (four) articles from Scopus, 0 (zero) article from SciELO and 99 (ninety-nine) articles from Google Scholar, totaling 114 articles, being that 12 (doze) addressed the Three-parameter Logistic Model. Table 1 presents data on the publications of the 12 scientific papers analyzed.

Table.1: Number of articles published on ML3 in the period from January 2012 to June 2017.

Articles	2012	2013	2014	2015	2016	2017*	Total
	1	2	2	2	4	1	12

* Values up to June.

Source: Search data, 2017.

Observing Table 1, the publications related to the proposed subject have been maintaining the subject present over the years in the scientific scenario, with publications throughout the analyzed period, offering an average of two publications per semester, being the year of 2016 with the largest number of publications (n = 4). The articles published in the year 2016 approach the application of the Three-parameter Logistic Model (ML3)

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in educational and psychological measurements. IRT models help in this purpose by analyzing items and producing a standardized scale. An elaboration of the items must be carried out by a professional who has knowledge of the subject and must follow techniques for the elaboration of items [3].

In addition to the number of articles published per year, the study has also investigated which were the most productive authors. Table 2 presents the most productive authors with their publications analyzed annually.

Table.2: Number of articles published on ML3 in the period from January 2012 to June 2017.

Authors	2012	2013	2014	2015	2016	2017*	Total
Audrey J. Leroux	0	1	0	0	0	0	1
Christy Brown	0	0	0	1	0	0	1
Kpolovie, P.J	0	0	1	0	0	0	1
Kyung Yong Kim	0	0	0	0	0	1	1
Louis Tay	0	0	0	0	1	0	1
Rita de Cássia Correa	0	0	0	0	1	0	1
Sandip Sinharay	0	0	0	1	0	0	1
Shana Moothedath	0	0	0	0	1	0	1
Suttida Rakkapao	0	0	0	0	1	0	1
Tianheng Wang	0	1	0	0	0	0	1
Ting-Wei Chiu	1	0	0	0	0	0	1
Zeki Kaya	0	0	1	0	0	0	1

* Values up to June.

Source: Search data, 2017.

Table 2 shows a balance in the number of publications among authors who published in the field of Three-parameter Logistic Model (ML3) in the period from 2012 to 2017. Each author has published only one article on the topic. Although no exponent has been identified for productivity in the ML3 area, this type of analysis is very important and needs to be addressed in a bibliometric study in accordance with Lotka's Law [7]. The productivity of scientific authors is verified more formally by calculating the H-index, that is, this index measures the impact of the scientists on their peers based on their most cited articles. In this sense, although a balance was observed in the number of articles published among the authors, the most prominent H-index found were the ones from scientists Sandip Sinharay (H = 16) and Louis Tay (H = 15).

Another aspect investigated in the bibliometrics held was the quantity of authors by scientific production. The curiosity was based on the assumption that it would be necessary at least two researchers for the accomplishment of a bibliometrics, being one with experience in one area of knowledge and another, a beginner, oriented by the first one.

Table 3 - Number of authors per article on ML3 from January 2012 to June 2017.

Number of authors	2012	2013	2014	2015	2016	2017*	Total
One author	0	0	0	1	0	0	1
Two authors	1	0	2	0	0	1	4
Three authors	0	1	0	1	3	0	5
Four authors	0	1	0	0	0	0	1
Five authors	0	0	0	0	1	0	1

* Values up to June.

Source: Search data, 2017.

According to the values of Table 3, that the publications appearing in greater quantity with 3 authors was verified, in sequence with two authors, and finishing 1.4 and five authors. Thus, the articles with 3 authors

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corresponded to 41.67% of the total of publications, articles with two authors represented 33.33% of the total articles published, followed by articles with 1.4 and 5 authors with 8.33% that adding represent 25% of the total articles published in the period.

Another aspect investigated in the present bibliometrics was the journals with greater amount of publications on ML3. Table 4 presents the results of this analysis.

Table.4: Journals with the largest number of ML3 publications - From January, 2012 to June, 2017.

Journals	2012	2013	2014	2015	2016	2017*	Total
Applied Measurement in Education	0	0	0	0	0	1	1
Biomedical Optics Express	0	1	0	0	0	0	1
European Journal of Statistics and Probability	0	0	1	0	0	0	1
Perspectives in Education	0	0	0	0	1	0	1
Physical Review Physics Education Research	0	0	0	0	1	0	1
Journal of Education and Research in Accounting	0	0	0	0	1	0	1
SAGE Journals Applied Psychological Measurement	0	0	0	1	0	0	1
SAGE Journals Educational and Psychological Measurement	1	1	0	0	1	0	3
SAGE Journals Journal of Educational and Behavioral Statistics	0	0	0	1	0	0	1
Turkish Online Journal of Distance Education-TOJDE	0	0	1	0	0	0	1

* Values up to June.

Source: Search data, 2017.

According to Table 4, data show that only the *Educational and Psychological Measurement* journal had the number of publications above the average, with three articles published in the years of 2012, 2013 and 2016, representing 25% of the publications. *Educational and Psychological Measurement* is a publication of SAGE JOURNALS. Sara Miller McCune founded SAGE in 1965 in order to Support the dissemination of usable knowledge and to educate a global community. SAGE is one of the leading publishers of innovative and quality content, covering a wide range of subject areas. Corroborating the quality of the publisher, Table 4 shows two more magazines of its catalog to *Applied Psychological Measurement* and the *Journal of Educational and Behavioral Statistics*, with two other articles published. Thus, the sum of the other magazines or newspapers represents 58.3% of the total of publications.

Regarding the quality of the journals, one can see a variation of the impact factor of 0,885 (*SAGE Journals Educational and Psychological Measurement* e *SAGE Journals Applied Psychological Measurement*) to 3,337 (*Biomedical Optics Express*). The impact factor of four journals was not found (Perspectives in Education, Physical Review Physics Education Research, Turkish Online Journal of Distance Education-TOJDE and European Journal of Statistics and Probability).

Another aspect investigated in the present study was the most productive countries. The results of this investigation are shown in Table 5.

Table.5: Most productive countries in ML3 publications from January, 2012 to June, 2017.

Countries	2012	2013	2014	2015	2016	2017*	Total
Brazil	0	0	0	0	1	0	1
Canada	1	0	0	0	1	0	2
USA	0	2	0	2	0	1	5
India	0	0	0	0	1	0	1
Nigeria	0	0	1	0	0	0	1
Tailand	0	0	0	0	1	0	1
Turkey	0	0	1	0	0	0	1

* Values up to June.

Source: Search data, 2017.

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Table 5 clearly shows that the United States of America is the country with the highest number of productions, with five publications, representing 41.67% of the amount of total research published in the analyzed period. Canada was the second most productive country with two articles and 16.67% of the total articles published in the period evaluated. The other countries, Brazil, India, Nigeria, Thailand and Turkey with one article each, accounted for 41.67% of the total articles published in the period evaluated. Thus, the most productive countries were the USA and Canada. Renowned universities in the areas of research and structure suitable for scientific production can justify this data.

The most productive research institutions were also investigated. Table 6 presents a summary of the results obtained.

Table.6: Most productive institutions in ML3 publications from January 2012 to June 2017.

Institution	2012	2013	2014	2015	2016	2017*	Total
Clemson University	0	0	0	1	0	0	1
Gazi Üniversitesi	0	0	1	0	0	0	1
Indian Institute of Technology	0	0	0	0	1	0	1
Pacific Metrics Corporation	0	0	0	1	0	0	1
Prince of Songkla University	0	0	0	0	1	0	1
The University of Texas at Austin	0	1	0	0	0	0	1
Universidade Federal de Santa Catarina	0	0	0	0	1	0	1
University of Connecticut	0	1	0	0	0	0	1
University of Iowa	0	0	0	0	0	1	1
University of Port Harcourt	0	0	1	0	0	0	1
Yorkville University	1	0	0	0	1	0	2

* Values up to June.

Source: Search data, 2017.

One could verify, from Table 6, that the Yorkville University from Canada was the institution that most stood out, to include two articles, representing 16.67% of the total articles published on the subject investigated in the period assessed.

Finally, the key words that were highlighted in the scientific articles were evaluated. In this analysis, the 12 articles were collected regardless of the year of publication. Table 7 presents the results.

Table 7. Number of keywords in ML3 publications from January 2012 to June 2017.

Keywords	Total
Item	7
Model	6
Theory	6
Response	6
Three-parameter	2
Tomography	2
Logistic	2
Optical	2
Test	2
Other words	49

Source: Search data, 2017.

With respect to the keywords, the most frequent ones were: item (n = 7), model (n = 6), theory (n = 6), response (n = 6), three-parameter (n = 2), tomography (n = 2), logistic (n = 2), optical (n = 2) and test (n = 2). The other words (n = 49) appeared only once each. One can realize from the number of keywords found that the Item Response Theory (IRT), more specifically the Three-parameter Logistic Model (ML3), presents a broad spectrum of applications.

VI. CONCLUSION

This article has as main objective to present a bibliometric study of articles published between the years of 2012 and June 2017 on the Three-parameter Logistic Model (ML3). The articles were classified and evaluated by year, author, and number of authors by scientific production, journals and newspapers with the highest amount of articles published, most productive countries and institutions with the highest number of articles published on the subject.

One can notice that largest number of publications occurred in the year 2016; The USA had the largest number of scientific articles published in the area; the most profitable institution was the Canadian Yorkville University; and no author exponent in the area of Three-

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parameter Logistic Model (ML3) was found by the number of published articles. However, the authors Sandip Sinharay and Louis Tay stood out by H-index. Another important finding was that, although journal impact factors ranged from 0.885 to 3.337, this indicator was not found in four journals.

With this research, one can conclude that there is a gap to be explored by researchers in the area of Production Engineering regarding the Item Response Theory, which are the Three-parameter Logistic Models. This subject is very important for Production Engineering, as stated by Tezza and Bornia (2009), and can assist in the control and management of resources and processes, such as the positioning of individuals or processes of different groups on a common scale, even if these individuals have responded to different items, allowing identification of opportunities for improvement or even benchmarking. This subject can also allow a more accurate evaluation of the items' properties and their results, allowing greater precision in the application of statistical techniques. It can also assist in the adequate understanding of instruments' psychometric properties; enable the development of more efficient indicators to evaluate individual differences in processes, practices, systems or individuals; and to conclude, it can provide more robust results.

This study presents as limitation the small number of articles on the theme, which did not allow a general mapping on the topic. The authors suggest that further research on the subject be included in papers published in annals of events, monographs, theses and dissertations, books, book chapters and patents.

This research was very important to reveal a gap in the field of research in the area of Production Engineering, which must be occupied in order to contribute to the growth of this field.

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Experimental Investigation of the Effects of Hydrogen Addition with Diesel on Performance and Emission of a Single Cylinder Diesel Engine

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Abstract-- *Need of the hour in present day scenario is to cope with energy crisis and human life in India and around the globe which is associated with depletion in the percentage of petroleum products and increase in the share of pollution caused due to emissions from diesel operated engines. This work tries to address these two major concern with the use of alternative fuel for diesel engine .A lot of research is going on the use of alternative and innovative fuels in the word, among those one of the most promising alternative ought to be hydrogen for being a clean and non carbon in nature. However various ongoing researches shown hydrogen blending to be proved to show positive effect on performance and emission of a diesel engine, which has to be carried forwarded. In this work a flow rate of 4 lpm, 6 lpm and 8 lpm respectively blend of hydrogen proportion where used along which diesel at loading at a constant speed of 1500 rpm to determine various engine performance parameters such as brake thermal efficiency, brake specific fuel consumption ,brake power, indicated thermal efficiency, mechanical efficiency, volumetric efficiency, torque output and power output. along with these various emission parameters such as percentage of CO,HC ,NOx gas temperature with varying blend proportion are also observed and compared.*

Keywords—alternate fuel, brake power, emission, exhaust gas, fuel efficiency hydrogen, pollution control.

I. INTRODUCTION

Present world is facing two major problems economically, ecologically and politically. The first one is associated with the fast depletion of fossil fuel majorly petroleum and its allies, and the other problem is degradation of human health due to harmful emission of diesel engines. With the emergence of diesel as a powerful fuel for transportation sector researches were focused on maximum use of this fuel for obtaining its use in transportation sector. With the passage of time a record and sharp depletion of diesel and its products, research focus shifted towards enhancement of performance of engine many modifications on the engine and other parts where done to gain maximum output from this fossil fuel with increase in the usage of diesel oil there emerges the problem of harmful emission from diesel operated engines. Various organisations and institutes around the globe realised this problem and various awareness programs where being carried out for its control along with research works.

Now, the aim of researchers is to have a shift from conventional fossil fuels to alternative fuels with keeping in mind about the reduction in the harmful emission from the diesel engine. This work aims to carry forward the ongoing research works of enhancement of diesel engine performance along with reduction in emissions with the help of using a non carbon fuel i.e. Hydrogen (H2) in varying percentage as blend with diesel fuel in a single cylinder diesel engine. A blend of Hydrogen in flow of 4lpm, 6 lpm, 8 lpm, in proportion where used along which diesel at loading and constant speed of 1500rpm to determine various engine performance parameters such as brake thermal efficiency (BTE), brake specific fuel consumption (Bsfc), brake power (BP), indicated thermal efficiency (ITE), mechanical efficiency, volumetric efficiency, torque output and power output. Along with these various emission parameters such as percentage of CO, HC, NOx gas temperature with varying blend proportion are also observed and plotted as shown in graphical forms. The present work will try to provide detail information on alternative fuels which can be used as a promising fuel for replacing diesel or at least reduce on the dependence on diesel as the lone fuel for transportation sector and heavy engine vehicles with reduction in the harmful emission emerging from the diesel engines. Steep depletion in the reserves of fossil fuel has created a need of shifting to fuels which are fossil fuel independent. This can only be achieved by innovation researches in the field of renewable sources of energy.

1.1 HYDROGEN AS AN ALTERNATE

Hydrogen is the fuel of the long run. An infatuated research worker of alternative understands the importance

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of a shift to a hydrogen economy. Hydrogen is associated energy carrier that may be utilized in combustion engine or fuel cells producing nearly no green house emission on combustion generally the sole emission is vapour. Hydrogen production and storage is presently undergoing intensive analysis. Solar hydrogen system will give the suggests that of a completely emissions free technique of producing hydrogen

An alternative fuel should be technically feasible, economically viable, simply convert to a different energy kind once combusted, be safe to use, and be probably harmless to the surroundings. Hydrogen gas is that the most abundant element on earth. Though hydrogen doesn't exist freely in nature, it are often made from a variety of sources like steam reformation of natural gas, gasification of coal, and electrolysis of water. Hydrogen gas will employed in traditional gasoline-powered internal combustion engines (ICE) with negligible conversions. However, vehicles with polymer electrolyte membrane (PEM) fuel cells offer a bigger efficiency. Hydrogen gas combusts with oxygen to provide vapour. Even the production of hydrogen gas is often emissions-free with the utilization of renewable energy sources.

Table: Fuel properties of natural gas and hydrogen

Fuel properties	**Natural gas**	**Hydrogen**
Density in 1atm at 300 kg/m	0.745	0.082
Stoichiometric air to fuel ratio (vol%)	9.396	2.387
Stoichiometric air to fuel ratio (wt %)	0.062	0.029
Laminar flame speed (m/sec)	0.380	2.900
Quenching distance mm-1	1.900	0.600
Mass lower heating value MJ/kg	43.726	119.220
Volumetric heating value MJ/kg	32.970	10.220
Octane number	120.00	_
C/H ratio	0.251	0.000

II. LITERATURE REVIEW

V. Juric and D. Zupanovic stated that there is an inclination of significant growth in the use of diesel fuel from 1980s to the current decade and afterwards. There is a possibility of diesel to touch the half mark of the market share by the end of 2030.the rational for this exaggerated usage lies primarily in their higher profit because of readily availability and higher economic efficiency [1].Lee Schipper et al. In the report submitted to Asian development bank sustainable development illustrate that the transport sector contributed twenty third of the overall greenhouse gas (CO2) emissions within the world consistent with the most recent estimates of the International Energy Agency (IEA). Within road transport, vehicles and light-weight trucks turn out run out hour of emissions, but in low- and middle-income developing countries, freight trucks (and in some cases, even buses) consume additional fuel and emit additional greenhouse gas than the same light-duty vehicles. Transport-related greenhouse gas emissions from developing countries can contribute in increasing proportion to international greenhouse gas emissions unless mitigating measures are implemented shortly. These developments are often understood by the fact that maximum growth in greenhouse gas emissions would be in developing countries of Asia. There is now a growing international accord that future targets for greenhouse gas reductions within the post- 2012 Climate Policy Framework won't be achieved unless greenhouse gas contribution from the transport sector in developing countries is fittingly addressed [2].In the contrast to Indian states detailed estimated emission data was provided by T.V. Ramachandra and Shwetmala which provide the information that total amount of greenhouse gas emitted from transport sector in India was 258.10 Teragram Tg in a year. Among this, only the road transportation contributed more than 94 % and in the form of CO2 and CO its 53.3%.The largest contributor state was Maharashtra constituting about 11.8%,after which follows T.N (10.8%) , Gujarat (9.6 %) , U.P (7.1 %) , Rajasthan (6.22%) and Karnataka (6.19 %) .These six states constituted about 52 % of the emission on Indian road [3].Topias et al. Elaborated about the particulate materials which are very tiny particles produced due to incomplete burning in the combustion chamber. These PM are in 'trade off' to the NOx produced because they depend on the combustion chamber temperature .These have a lot of ill effects on health ,PM are actually complex mixture of solid, fully volatile ,partially volatile, organic and in organic compounds [4].Gurumurthy Shebbar in his paper elaborated a number of methods, techniques, modification for control and reduction of NOx during operation of internal combustion engine [5]. These included Early In-Cylinder Injection, which can be achieved by injection of fuel, potion wise or entirely by using a separate injector or the same one during the fuel intake or during early stage of compression stroke. Modulated Kinetics ,in this the injection of fuel is done directly into combustion chamber or after the top dead centre .Wall impingement remains a problem here which can be avoided with the control of combustion phasing.According to a report by hill's group [6], if the continuous depletion of crude oil is continued, its

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production is going to decline faster than we generally assume. it further states that 25 % of the world's energy proving reserves will be orders of magnitude much more costly than it was for the first 25 % part [7] .R.W Bentley talks about political and physical risk of global conventional oil supply, political risk because the addition of conventional production from all countries within the world, except the 5 main Middle-East suppliers, is close to the utmost set by physical resource limits. the physical risk is because the Middle-East countries have solely very little spare operational capability, and this may be progressively known as upon as production declines elsewhere If demand is maintained, and if giant investments in Middle East capacity aren't created, the planet can face the prospect of oil shortages within the close to term[8] .United States of America constituting the 5.5 % of the world consumes 35% of the consumption of global energy whereas Asia, Africa and Latin America which has 70% of world population, have a consumption of the world, this can be concluded as energy consumption by one American is equal to 40 Indians and which will be equivalent to ninety Nigerians [9].this data make a sense for emphasis to move to the alternative sources of energy by the Indian sub continent.Though steam reformation of methane is presently the most important route to hydrogen production, the emissions concerned may also be controlled way more expeditiously than our current system of transportation fuel [10].S K Sharma et al. Discussed about the technical feasibility of hydrogen filled internal combustion engine [11] . F A de Bruijin concluded that hydrogen from wind and P V is lone option, where no electricity can be used directly; also states hydrogen does not fall under ideal storage medium of energy and it lead to significant losses of energy in transportation [12].The government of India report on hydrogen fuel vehicle transportation emphasis on safety measures and enhancement of infrastructure in the country for further growth of use of Hydrogen as an alternative fuel for transportation sector, it also found the hydrogen fuel as cleaner of the other alternative sources of energy which can be used as fuel for transportation sector or vehicles [13].There are good prospects to boost the combustion method among the engine cylinder through the suitable provision of chemical action surfaces. In general it's finished that hydrogen operated dual fuel engine shows associate improvement in performance and reduction in emissions except NOx which may be controlled effectively with selective chemical action reduction technique that is compatible for hydrogen–dual fuelled engines [14]Electrolysis of distilled water can be used for the generation of hydrogen in which an electric current in supplied to closed distilled water container for its electrolysis process [15]. For a faster and effective reaction KOH powder can be added in the kit which would act as a catalyst to enhance the rate of hydrogen production.As hydrogen is not available directly in nature as a fuel, it has to be produced by different means and processes various Hydrogen production methods were discussed by O Bicakova and P Starka [16]Aritrra chatterjee emphasised on efficient and commercially valuable and safe production, storage and distribution of hydrogen to make it a feasible fuel for transportation sector and vehicles [17].In SI engine ignition timing plays an important role when hydrogen blending is applied to it, during combustion in SI engine with hydrogen blend brake mean effective pressure increases because of rapid combustion of hydrogen allows very little loss of heat to the surrounding, thus increasing local temperature and hence brake mean effective pressure [18]The structure of a hydrogen fuelled engine is not much different from that of a conventional internal combustion engine but if a gasoline engine without any modification uses hydrogen as fuel some trouble such as smaller power output, abnormal combustion in the form of backfire, pre ignition, high pressure rise rate and even knock and high NOx emission would occur. So the fuel supply system of hydrogen engine and its combustion system needed suitable modification [19].By using hydrogen in proportion to CNG [20], it is observed than an increase in proportion to brake thermal efficiency (BTE), and decrement in CO and HC with increase in hydrogen percentage and it showed the blending of hydrogen could be a lot beneficial for increasing the lean burning limit and have a trade off system between CO, HC and emission of NOx.Along with numerous experimental methods on hydrogen blending, mathematical methods are also used for studies. Samir M Abdul Hakeem and Haroun A.K. Shahad worked on numerical approach [21] to have a better understanding of hydrogen blending in diesel engine, FORTRAN language computer program is developed and the performance of SI engine is calculated with only gasoline and with different ratios of gasoline hydrogen mixture.An indirect injection, multi cylinder diesel engine inducted with continuous hydrogen into the inlet manifold can led to a better approach to optimize engine performance and emission reduction [22] .Fuel for Compression Ignition C I engine can be diesel, biodiesel or vegetable oils. There are two options for the intake of Hydrogen in CI engine ,one is that Hydrogen can be introduced directly along with air into the intake manifold or there could be direct injection of hydrogen into the cylinder as that done in case of diesel fuel [23].Hydrogen gas blends are being not only widely tested with gasoline and diesel, but at the same time with other fuels such as ULSD (ultra low sulphur diesel) and PME (palm methyl ether) with a B50 and other proportions with different ratios of hydrogen [24], which are showing positive prospects like increased

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brake thermal efficiency and reduced brake specific fuel consumption along with reduction in CO and CO2.There is compatibility of hydrogen gas with both spark ignition system engine and the compression ignition system engine without any modifications induced in these internal combustion engines [25], the hydrogen blending studied to found desirable effects on performance and emission except oxides of nitrogen NOxExperimental results shown a steep down effects on pollution emission by the blending of hydrogen in diesel engine because of the improved and complete combustion process [26], it may be focused that a noticeable decrement in smoke levels is observed even on higher loads by hydrogen blending in diesel engine.Subas B G et al. Studied the hydrogen blended engine's formation and emission of NOx by two methods i.e. by experimental method on experimental rig and other by the help of simulation software. In both the cases he found an increment in NOx formation [27].they concluded a minor difference of about 7% in the results by the two different methods. It can be drawn that the major issue on the use of hydrogen or hydrogen blend in internal combustion engine is the higher formation NOx which is very harmful in nature for ecology and human life which has to be addressed. By the results and conclusions from numerous studies, the major problem emerged to be increased production of NOx during the emission from hydrogen blended fuel, the main cause for the formation of oxides of nitrogen is sought to be high cylinder temperature during its combustion [28], there should be focus on this problem, many techniques have been tried and tested for the reduction of NOx from the hydrogen blended engine including exhaust gas recirculation (EGR) technique [29], desirable results are achieved with some conditions like extra set up for EGR .the EGR technique is used widely for NOx reduction and reduced pumping losses but the major problem associated with it is that it shows detrimental effects on the stability of combustion in combustion chamber Hydrogen blending to the internal combustion engine can also lead to betterment of smoke emission with full load or part load, hydrogen blend with the range of (20-25 %) found to be optimal where the smoke opacity was least with high engine performance [30]. Although It is found both at the exhaust level and In-cylinder, the addition of hydrogen increases the formation of nitrogen oxide NOx as measured by In-cylinder gas sampling [31]

III. EXPERIMENT SETUP

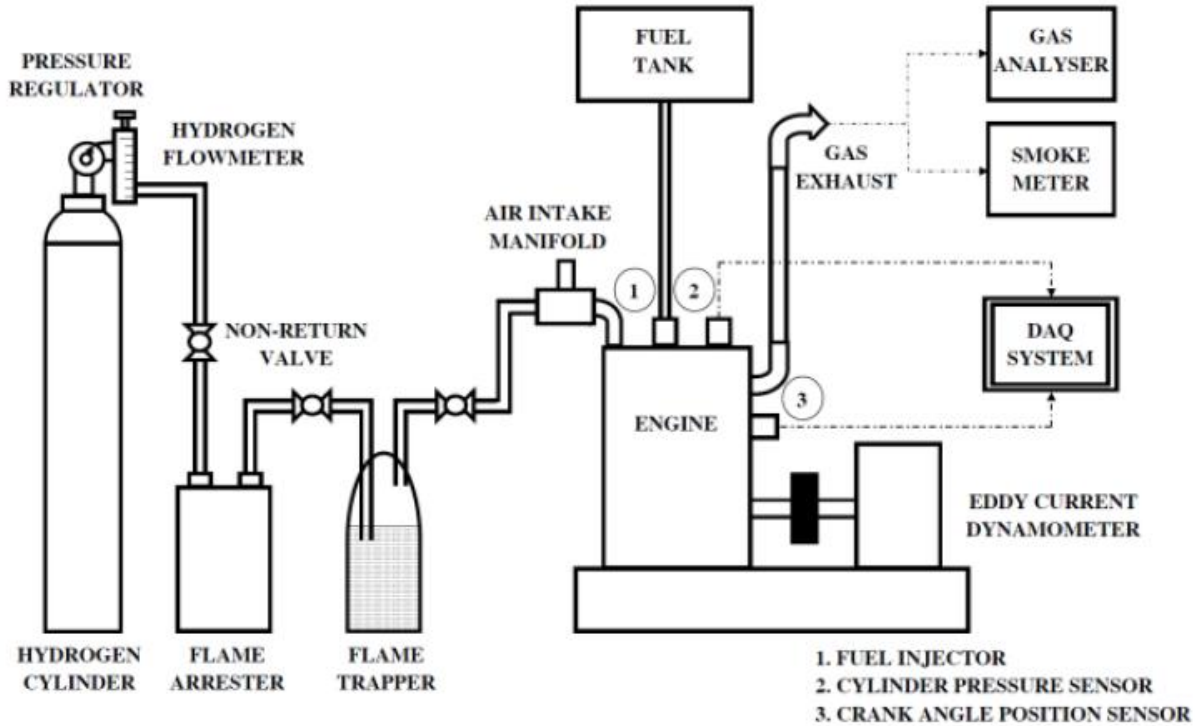

Fig.1: Schemetic diagram for experimental setup

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Fig.2: Actual set up for experiment

Experiments were conducted in a single cylinder, four stroke, water-cooled, diesel engine (Make: Kirloskar AV-1). The engine was coupled to an eddy current dynamometer. The engine was run at a constant speed of 1500 rpm. The specifications of the engine used are given in Table

Table: Engine Specifications

Engine Make	Kirloskar AV-1
Type	Vertical, Single cylinder, water cooled,
Max. power	3.7 kW at 1500 rpm
Displacement	550 CC
Bore x Stroke	80 mm x 110 mm
Compression ratio	16.5:1
Fuel injection timing	21deg bTDC
Loading device	Eddy current dynamometer

A crank angle encoder was fitted to the crank shaft to measure the crank angle. The cylinder pressure was measured by a piezoelectric pressure transducer (Make: Kistler, Type 6056A) mounted on the cylinder head. The pressure signal was sent to data acquisition system and combustion data like cylinder pressure and heat release rate (HRR) were obtained.The oxides of nitrogen (NOx), carbon monoxide (CO) and hydrocarbon (HC) emissions were measured with non dispersive infrared analyzers (NDIR) (Make: HORIBA-Japan). The gas analyzers were calibrated with standard gases before test. Initially, the engine was operated with neat diesel fuel to obtain reference data. Further, the engine was tested with dual fuel mode like addition of hydrogen with inlet air in addition to pilot diesel injection. The hydrogen gas was inducted in the inlet manifold in different flow rate namely 4lpm, 6lpm and 8 lpm respectively. The hydrogen flow line consists of hydrogen cylinder, pressure regulator, flame arrester, flow meter and flow control valve shown in figure.

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Fig.3: Hydrogen Gas Induction Set up

The pressure of hydrogen stored in a high-pressure storage tank was reduced from 250 bar to a pressure 2 bar using a pressure regulator. Hydrogen was then passed through a flame arrestor and flame trap which arrest any backfire of the engine. It also acts as a non return valve. Then the hydrogen is passed through the digital gas flow meter, of range 0–10 lpm. The combustion, performance and emission characteristics were evaluated for different hydrogen flow rates and compared with neat diesel fuel operation.

IV. RESULTS AND DISCUSSIONS

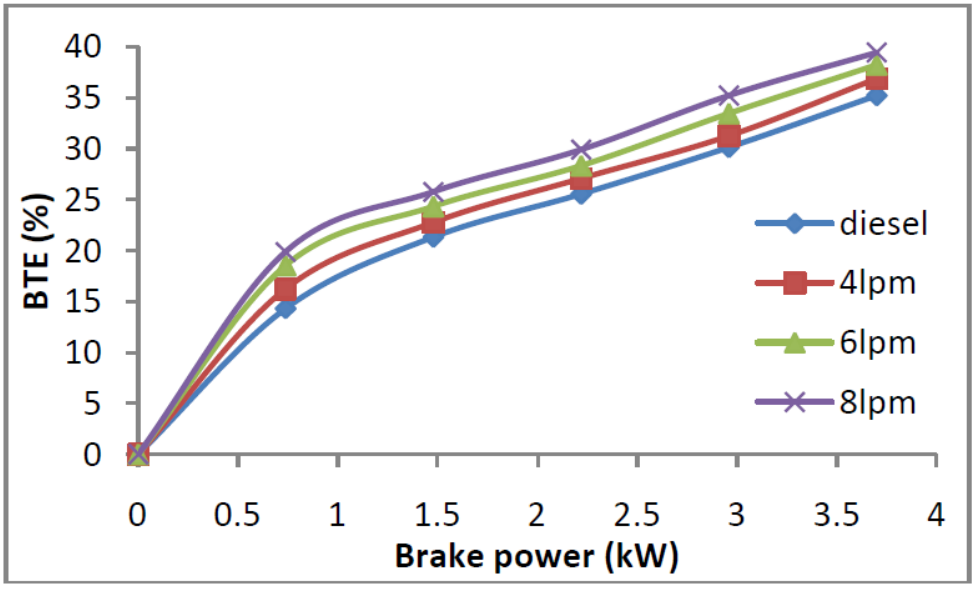

Fig.4: Variation of BTE and Brake Power with Pure Diesel and Dual Fuel

BTE (brake thermal efficiency) is plotted against the brake power for neat diesel and hydrogen added diesel. Brake thermal efficiency is one of the key in factors in getting the engine performance and it is defined as fuel consumption rate to generate unit power .It can be observed that increase in flow rate of hydrogen in fuel increases the BTE and brake power. Increase in hydrogen flow rate causing increase in both BTE and brake power.

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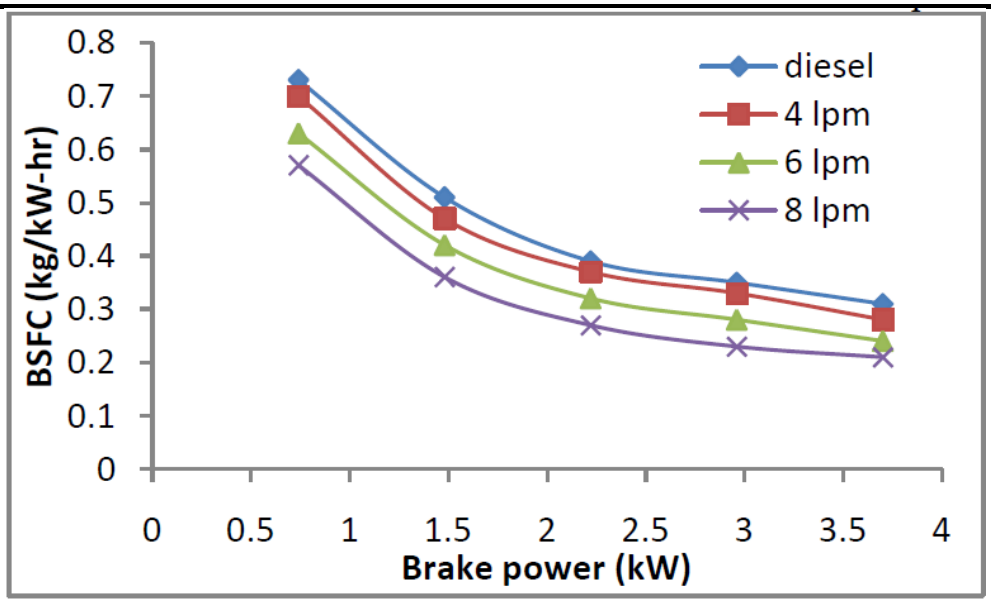

Fig.5: Variation of BSFC and Brake Power for Pure Diesel and Dual Fuel

Brake specific fuel consumption is plotted against brake power for neat diesel and hydrogen added diesel. A considerable decrease can be seen with neat diesel operation and hydrogen added diesel with 8 lpm .

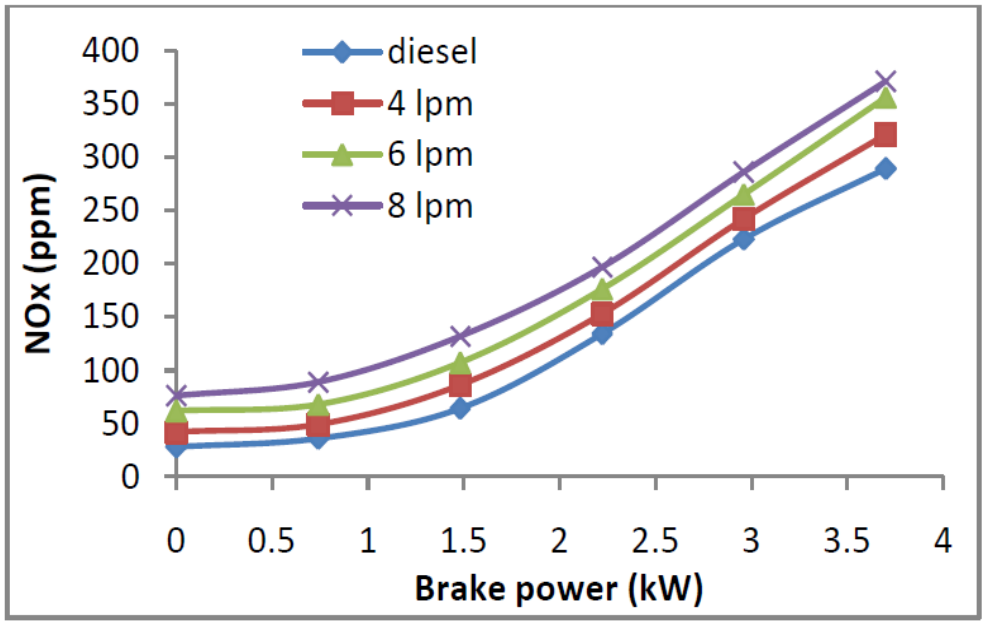

Fig.6: Variation of NOx emission and Brake Power with Neat diesel and Dual fuel

Emission of NOx is noted with respect to brake power for diesel fuel and dual fuel. it can be observed that as the flow rate of hydrogen is increased the formation of NOx is on the rise due to high in cylinder temperature is created by rapid combustion of hydrogen fuel.

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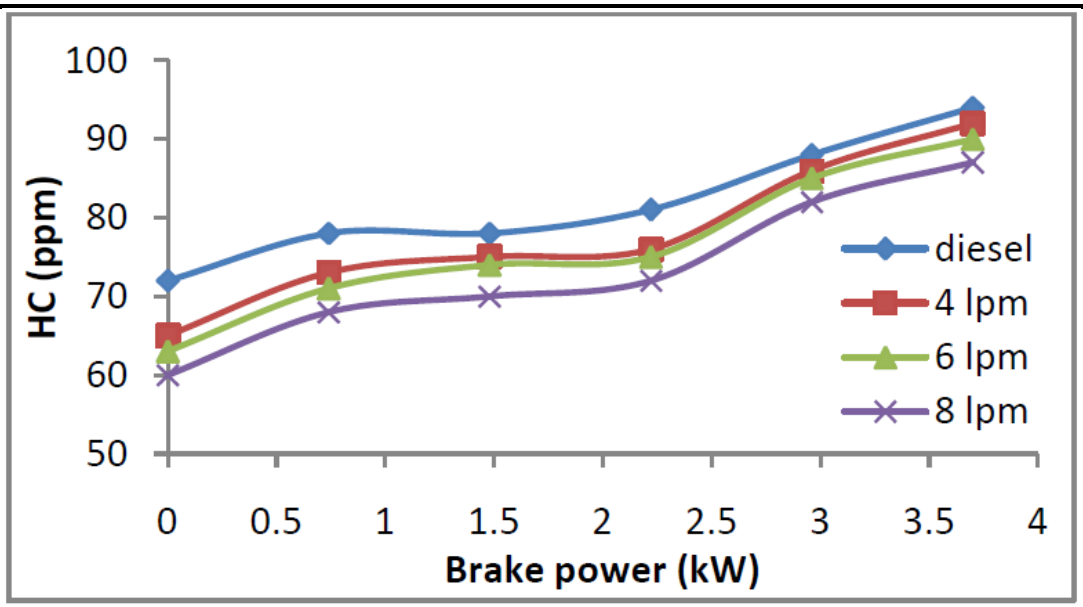

Fig.7: Variation of HC and Brake Power with neat diesel and dual fuel

HC emission is observed with respect to brake power. With boost in hydrogen addition the creation of OH- radicals are speed up and which results in decrease in HC emissions with the increase in hydrogen amount. The small quench distance of hydrogen between position of the flame extinguishment and cylinder wall helps in reducing HC emissions with the increase in hydrogen amount.

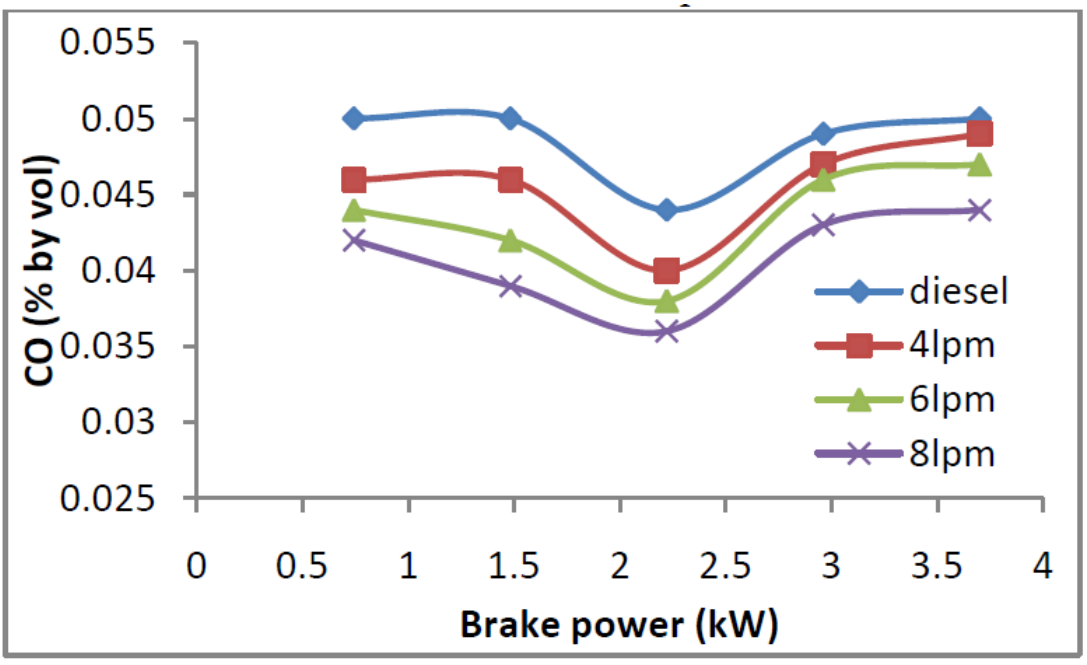

Fig.8: Variation of CO emission and Brake Power with neat diesel and dual fuel

CO emission is noted with respect to brake power.a the graph clearly shows that neat diesel have the maximum CO volume percentage and by addition of hydrogen substiquently the volume percentage is decreased further and have a maximum decresre in CO volume at 8 lpm can be observed

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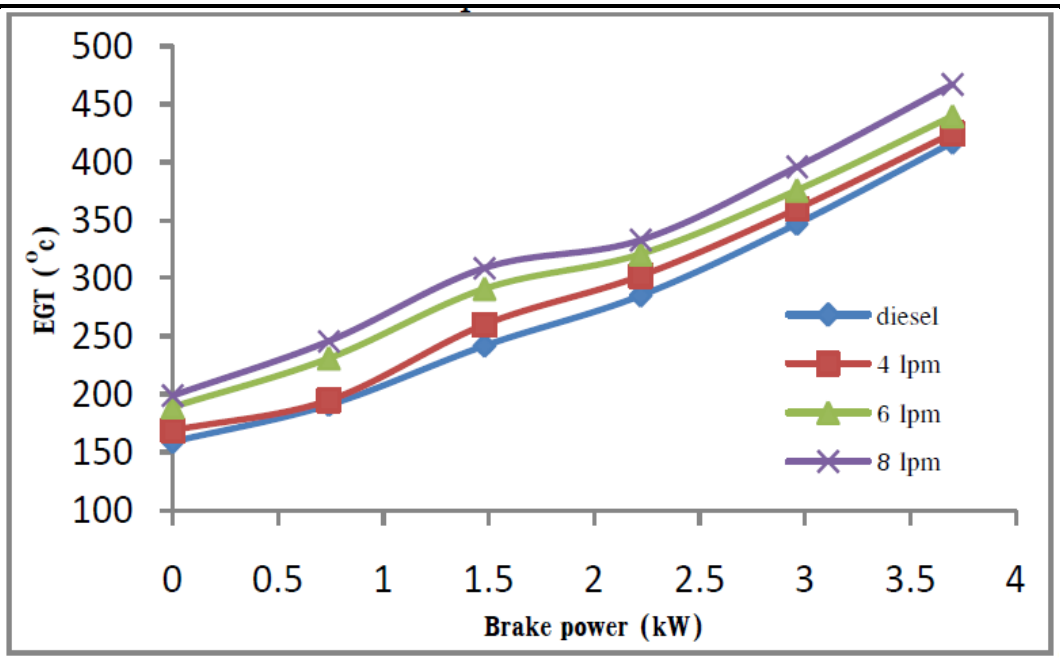

Fig.9: Rake Power vs. Exhaust Gas Temperature graph

In this graph it can be observed that on addition of hydrogen with diesel there is gradual increase in exhaust gas temperature along with the brake power.

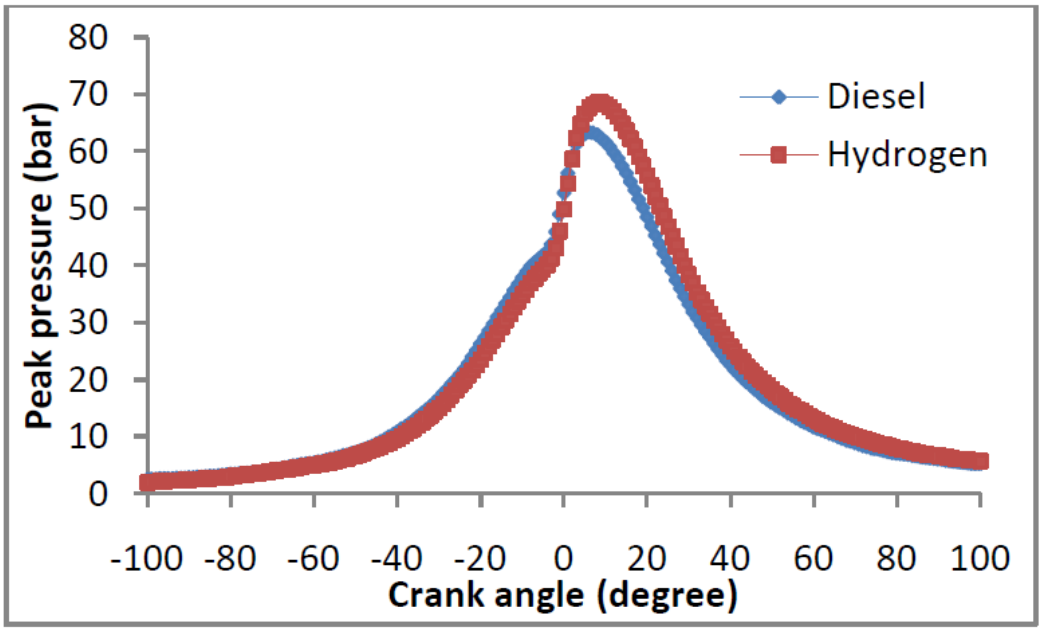

Fig.10: Crank Angle vs. Peak Pressure graph

This graph indicate the relation between crank angle and peak pressure in bar for both diesel and hydrogen, it can be read that peak pressure for hydrogen fuel is more than that of neat diesel in relation to crank angle.

V. CONCLUSIONS

Based on the experiments conducted on a hydrogen-enriched air-inducted diesel (dual fuel) engine system, the following conclusions are drawn:

- The Brake thermal efficiency of the hydrogen with diesel fuel operation was quite higher than the diesel fuel operation over the entire brake power range. In 8 lpm flow rate of hydrogen brake thermal efficiency is increased due to addition of hydrogen fuel.
- Brake Specific fuel consumption decreases with increase in hydrogen percentage over the entire range of operation.
- There is a decremented difference in HC and CO with the 8lpm flow rate of hydrogen in comparison to neat diesel.

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VI. FUTURE SCOPE

This work addressed the right alternative for the diesel fuel in the future, more work can be performed for betterment in this regard like to control the EGT and percentage of Oxides of Nitrogen, neat nitrogen and hydrogen gas can be simultaneously introduced along with diesel.

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Finite element Analysis of Honeycomb filled Metallic Tubes Subjected to Axial Loading

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Abstract— *A comprehensive study of buckling behavior of polygonal tubes with honeycomb filler under axial loading is presented in this paper. Honeycomb filled tubes have got a lot more attention due to their strong and stiff behavior with enhanced energy absorption capacity. For simulating the buckling behavior events of finite element models eigen value buckling code was used using the Abaqus/Explicit. This paper firstly investigates the buckling behavior of polygonal tubes without honeycomb filler and then the antipodal with honeycomb filler. The calculated buckling response of polygonal tubes is shown to better resembled when honeycomb filler is used.*

Keywords— axial loading, buckling load, finite element analysis, honeycomb filler, hollow tubes.

I. INTRODUCTION

Nowadays lots of research is explored for the protection of structures against blast and impact loadings. For protecting people and stuff from calamities detailed studies have been conducted to make the structure stand as a bulwark. Columns being a primitive part of the preponderance of structures makes the prognosis of their capacity imperative for inclusive structural efficiency. Thin-walled structures have been widely used due to its lightweight, ease of fabrication, low price, and a very high strength to weight ratio over the comparable solid structures. The efficiency and protean of thin-walled metallic tubes makes it the most common for construction and mechanical applications. The behavior of the tubes is solely dependent on the cross-sectional shapes. When the cross-section is changed or combined the behavior of the tube also changes [1], therefore it is a herculean task for designers and engineers to find out the best configuration for a circumstantial exercise. Due to individualize characteristics of the different cross-section, numerous probe is conducted by researchers including rectangular, hexagonal, triangular, pentagonal, octagonal, 12-sided star, 16-sided star, lateral corrugations to name a few [2-5]. Z. fan conducted quasi-static axial compression test on thin-walled tubes with different cross-sections. It was found that by increasing the number of corners of polygon its energy absorbing capacity also increases but to a certain extent [6]. The previous study shows that the buckling load was of the thin-walled metallic tubes were increased when the cross sections were combined [7] and corrugation was introduced [8]. In addition to these, metallic honeycomb is also used widely as an extension for its high energy dissipating mechanism and an excellent strength to mass ratio. This begets the need for extensive literature on honeycomb by diversified theoretical, experimental and numerical means. Hexagonal cell honeycomb is generally paid a lot more attention [9].

Wierzbicki conducted axial crushing of hexagonal honeycomb using the super folding element theory for finding the strength and the results were in good agreement with the experimental results [10]. From the work of different researchers, it was easily found that the honeycomb, if used as a filler, can absorb a lot of energy (quasi-static and dynamic) when subjected to axial loadings. However, the dynamic compressive strength of honeycomb is found better than the antipodal quasi-static one [11-14]. The axial crushing resistance of honeycomb filled square tube was studied by Santosa [17]. The results were concluded that the mean crushing strength of honeycomb filled square tubes were enhanced in comparison with the empty tubes.

The present study starts with the buckling analysis of thin-walled metallic tubes of different cross-sectional shapes followed by the honeycomb filled metallic tubes for getting an insight of the effect of honeycomb filler.

Nomenclature

CT	Circular tube	OT	Octagonal tube
ST	Square tube	HF	Honeycomb filled
RT	Rectangular tube	E	Empty
HT	Hexagonal tube		

II. GEOMETRIC MODELING

2.1. Structure of honeycomb filler

Honeycomb is a two-dimensional cellular material. The present study is done on hexagonal shaped honeycomb. The width of the cell wall and thickness of honeycomb filler were fixed as 13.86 and 0.50 mm respectively. The length of the filler in the axial direction was same as that

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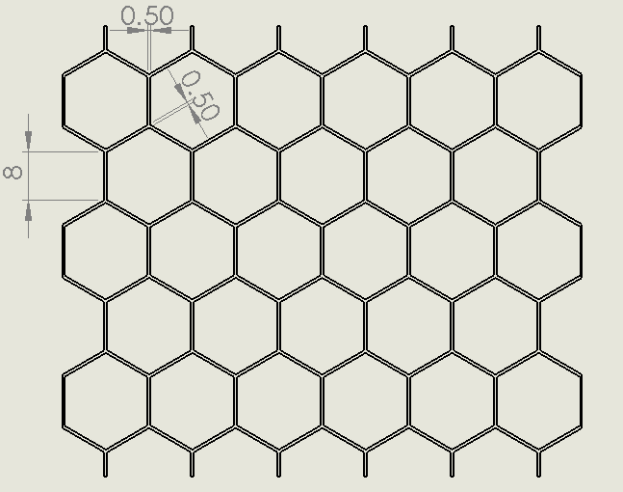

Fig. 1: Sketch of honeycomb filler

of the tube. A detailed sketch of the filler is shown in Fig. 1.

2.2. Structure of metallic tubes

Thin walled tubes with different cross-sectional shapes were used. The perimeter of all the geometric configurations was same which was 190 mm. Five cross sections were taken namely circular, rectangular, square, hexagonal and octagonal. Thickness and length of all the tubes were kept constant at 1 mm and 600 mm respectively. Geometry and dimensions of empty tubes and honeycomb filled tubes are presented in Table 1.

Table 1. The geometry of tubes under study

Profile	Specimen	Dimension (mm)	Profile
Circular	ECT	Diam. = 60.5	
	HFCT		
Square	EST	47.5 × 47.5	
	HFST		
Rectangle	ERT	55 × 40	
	HFRT		
Hexagon	EHT	31.66 (each side)	
	HFHT		
Octagon	EOT	23.75 (each side)	
	HFOT		

III. FINITE ELEMENT MODELING

3.1. Material model

The material for the tubes as well as honeycomb filler was low carbon steel (A36), which was assumed to be elastic, isotropic and homogeneous. It has the mass density $\rho = 7.85$ g/cc and Poison's ratio $\nu = 0.3$. The value of Young's modulus was taken as $E = 210$ Gpa. Strain rate effect was not considered.

3.2. Finite element model

In order to explore the buckling characteristics of different geometric configurations and the effect of honeycomb filler, the analysis was divided into two sets. Firstly empty metallic tubes with different cross sections were analyzed followed by the honeycomb filled metallic tubes. Critical load of the different specimens was examined using Abaqus/Explicit. Eigenvalue buckling was carried out using three eigenvalues and six eigenvectors. The tube was kept between two rigid plates, the bottom of the tube was fixed while the load in the axial direction was applied to the opposite free end. An element size of 6 mm was used for meshing the tubes as well as honeycomb filler. The tubes and honeycomb were meshed by C3D8R 8 node linear brick elements while the plates were meshed by using R3D4 a 4 node 3D bilinear rigid quadrilateral elements.

IV. RESULT AND DISCUSSION

In this section, the critical load for the thin-walled metallic tubes with different cross-sectional shapes with and without honeycomb filler is presented. Each configuration was analyzed with simple loading condition, keeping one end free while applying load on the other end. Eigenvalue buckling approach was used for calculating the results which are based on classical Euler buckling concept. The method follows textbook approach for predicting the eigenvalues of an elastic structure under a given set of loading conditions and constraints. Three eigenmodes were calculated with six signal vectors. The values of the test are formulated in Table 2.

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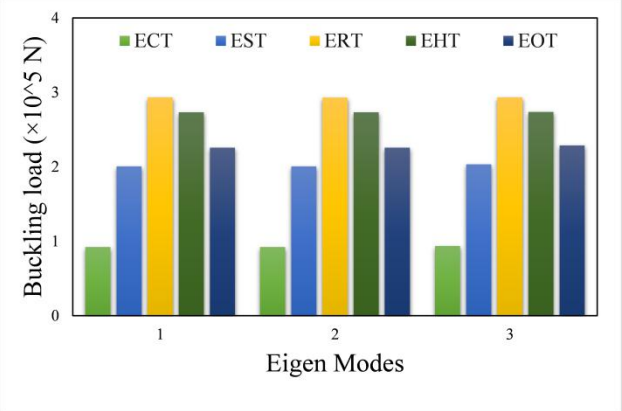

Fig. 2: Buckling load of empty metallic tubes

Fig. 2 shows the buckling behavior of empty metallic tubes with different cross-sectional shapes. The shapes were altered from circular to polygonal shapes. The shapes were altered with an even number of corners. Buckling load for the conventional circular tube was kept as a benchmark for comparing the behavior of all other tubes. It was noticed that the buckling load was maximum in the case of rectangular cross-section as the increase in critical load clocked to 196%. However, when the corners were increased progressively there was a decrease in the buckling load but still much greater than the circular section. All the structures were stable in all the three eigenmodes as the change in load hardly crossed 1% barrier.

The next phase of simulation was carried out by filling the tubes with honeycomb filler. The load variations of honeycomb filled tubes are shown in Fig. 3. A significant increase in buckling load was observed. The highest rise in buckling load occurred when the rectangular shaped honeycomb filled tube was used (HFRT). HFHT was also very close to the highest one. The eigenmodes in this section were also stable. Buckling load here also was found to be decreasing with the increase in a number of corners.

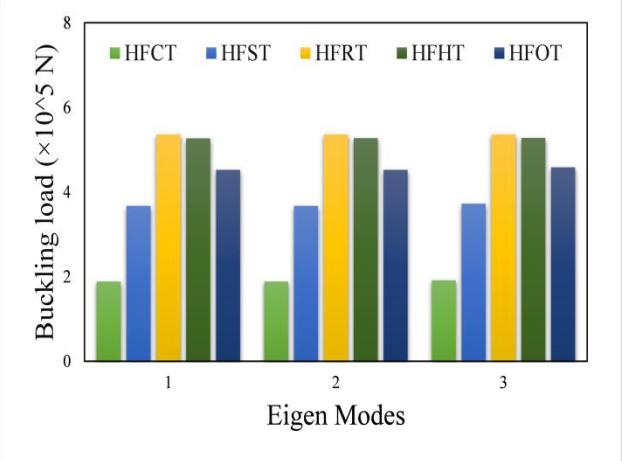

Fig. 3: Buckling load of honeycomb filled metallic tubes

Among the tubes, a comparison was made for finding the effect of honeycomb filler on cross-sectional shape. The circular tube was at the top of the list while rectangular was at the bottom. From this assessment, it was found that the honeycomb filling was least effective in rectangular and square cross-sectional tubes. Change in buckling load with honeycomb filler was lowest in HFRT and HFST.

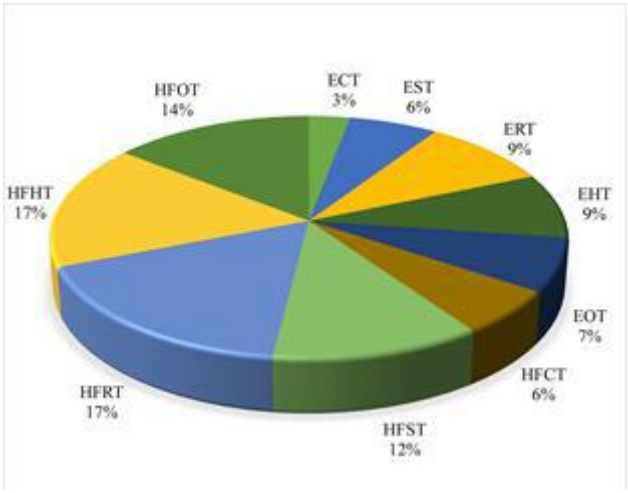

Fig. 4: Comparison of buckling load for different specimen

The effectiveness was increasing with the increase in a number of corners. The most effective configuration was the circular tube followed by octagonal tube. A comparative representation of all the tubes is presented in the form of the pie chart in Fig. 4.

Table 2. Buckling load for different specimens

Specimen	Buckling load (×10^5 N)		
	Mode 1	Mode 2	Mode 3
ECT	0.9221	0.9224	0.9357
EST	2.0045	2.0045	2.0334
ERT	2.9312	2.9304	2.9321
EHT	2.7325	2.7327	2.7357
EOT	2.2569	2.2570	2.2864
HFCT	1.8846	1.8851	1.9124
HFST	3.6720	3.6720	3.7249
HFRT	5.3617	5.3620	5.3651
HFHT	5.2721	5.2726	5.2788
HFOT	4.5257	4.5259	4.5849

V. CONCLUSION

The buckling load for the empty and honeycomb filled metallic tubes were explored at quasi-static axial loading numerically using eigenvalue buckling method (classical Eulerian approach). The response of the tube was observed to be varying with a change in cross-sectional shape and honeycomb filling. Following conclusions can be drawn:

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- Buckling load was minimum for the circular tube in both empty and honeycomb filled metallic tubes respectively.
- Highest buckling load was observed in the rectangular section for both empty and honeycomb filled tubes respectively.
- All the tubes were stable in all three eigenmodes.
- The circular and hexagonal cross-section was most effective after honeycomb filler in terms of buckling load variation.
- Since the honeycomb filled tubes look promising structure, hence further comprehensive studies are needed.

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The transaction "Al Ina" and its relationship with economic growth

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Abstract— *The sale "Al Ina" is a transaction prohibited by the Islamic religion, this article is a contribution to the mathematical-economic demonstration that this transaction aggravates the deterioration of the economy by the creation of negative added-values.*

Keywords— Transaction "Al Ina", Islamic, demonstration, mathematical-economic, added-values.

INTRODUCTION

The Transaction "Al In": is that a man buys a commodity from a dealer at a deferred price and, immediately then sells it to him for less than the price in cash.There are two individuals: The first individual I_1 sells the good to the second individual I_2 at a deferred price P_1 on a deadline, and redeems the same property immediately with a lower price P_2 without actually touching the good.Thus, the difference between the two prices constitutes a usury operation. (Al-Zuhayli Wahba, 2002).

We try to show that this transaction prohibited by the isslamic religion negatively affects economic growth. For that, we first study this transaction in its simple case, ie the presence of two participants, and then we widen the study for the presence of three individuals and more

I- Case of two participants

In time T_1**:** That is to say, when the two individuals fix the price of the sale, the sale is not authentic.Posing:

Q : the quantity doing the role of the sale

P_0 : the purchase price of the good or its cost of production (the price with which the good is bought or produced)

P_1: the non-authentic selling price of I_1 to I_2

Then, after this transaction, the Added-Value created is zero because:

$$\mathrm{VAE}_1 = (0-0)$$
$$= 0$$

Therefore that in timeT_1, the transaction produces nothing for the economy. This implies the cleared recipe of the transaction in time T_1 is : $RT_1 = 0$.

In time T2, when the two individuals decide to repeat the reverse sale operation with a lower priceP_2.

P_2 The non-authentic resale price of the good byI_2 toI_1 .To be able to talk about "Al Ina", P_2 must be less thanP_1 .

Thus, This implies the cleared recipe of the transaction in time T_2 is : $RT_2 = 0$

For this case, we can evoke two scenarios:

Scenario1: We can consider that the individual I_1 applies the authentic selling price P_1.

Scenario2: We can be considered that he keeps his good with the same cost P_0 .

a) First scenario : the individual I_1 applies the authentic selling price P_1

For the first scenario, we will have:

The individual I_1 receives the same good. Therefore, he commit a recipe is equal to

$$\mathrm{RT}_1 = \mathrm{QP}_1$$

The individual I_2 receives the same good, Which implies, he commit a recipe is equal to

$$\mathrm{RT}_2 = \mathrm{QP}_2$$

The added-value created by this transaction is:

$$VAE_2 = QP_2 - QP_1 = [Q(P_2 - P_1)] < 0$$

As long as, $P_2 < P_1$, the value $[Q(P_2 - P_1)]$ is negative

In other words, these transactions negatively affect value added.Thus, if we do not ban the sale "AL Ina", we risk deteriorating economic growth.

After these two transactions, the sum of the two added-values can be calculated as follows:

$$\sum_{i=1}^{2} VAE_i = VAE_1 + VAE_2 = 0 + Q(P_2 - P_1)$$
$$= Q(P_2 - P_1) < 0$$

b) Second scenario: The individual I_1 keeps his good with the same cost P_0 .

If we opt for the second scenario, we will have:

The individual I_1 receives a recipe equal: $\mathrm{RT}_1 = \mathrm{QP}_0$

The individual I_2 receives a recipe equal: $\mathrm{RT}_2 = \mathrm{QP}_2$

The added-value created by this transaction:

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$$VAE_2 = QP_2 - QP_0 = [Q(P_2 - P_0)] > 0$$

As long as $P_2 > P_0$, the value $[Q(P_2 - P_1)]$ is positive.

In other words, these transactions positively affect value added.

After these two transactions, the sum of the two added-values can be calculated as follows:

$$\sum_{i=1}^{2} VAE_i = VAE_1 + VAE_2 = 0 + Q(P_2 - P_0)$$

$$= Q(P_2 - P_0) > 0$$

In conclusion and in any case, any "AL Ina" transaction that prohibited by the Islamic religion, strongly contributes to the degradation and deterioration of economic growth.

II- **Case of three individuals**

If ever I_1 decides to repeat the same transaction with another individual I_3, there would be two scenarios: Repetition with the same prices or Repetition with different prices:

2-1- Repetition with the same prices :

Posing:

Q : the quantity sold

P_0 : the purchase price of the good or its cost of production

P_1 : the selling price of I_1 to I_3

P_2 the redemption from I_3 to I_1

In time T_1, The added value results from this transaction is zero: $VAE_1 = 0$

In time T_2 ,we will have two situations, either we compare P_2 at the first price P_0 or at the second price P_1

a) Comparing P_2 to, P_0, this gives:

$$VAE_2 = QP_2 - QP_0$$

$$= Q(P_2 - P_0)$$

The price P_2 is less than the price P_1 but it can exceed or be less than cost P_0

- If $P_2 < P_0$, we will have: $VAE_2 = QP_2 - QP_0 = Q(P_2 - P_0) < 0$
  in this case, we conclude that the added value always remains negative
- If $P_2 > P_0$ we will have: $VAE_2 = QP_2 - QP_0 = Q(P_2 - P_0) > 0$
  Thus , at this level, the added value becomes positive.
  Therefore, the sum of the added values created by this second transaction "Al Ina" is:

$$\sum_{i=1}^{2} VAE = VAE_1 + VAE_2$$

$$\sum_{i=1}^{2} VAE_i = VAE_1 + VAE_2 = 0 + Q(P_2 - P_0)$$

$$= Q(P_2 - P_0) < 0$$

The sum of the added values after the three transactions I_1, I_2, and I_3 becomes:

- ✓ For the case of $P_2 < P_0$ we will have :

$$\sum_{i=1}^{3} VAE_i = Q(P_2 - P_0) + Q(P_2 - P_0)$$

$$= 2Q(P_2 - P_0) < 0$$

In this case, after these three transactions, we conclude that the degradation of value added is worsening.

- ✓ For the case of $P_2 > P_0$ we will have :

$$\sum_{i=1}^{3} VAE_i = Q(P_2 - P_0) + Q(P_2 - P_0)$$

$$= 2Q(P_2 - P_0) > 0$$

On the other hand, in the case where $P_2 > P_0$, the sum of the three added values is positive;

b) Comparing P_2 to P_1, this gives:

In all cases, we have P2 superior than P1, this implies:

$$VAE_2 = Q(P_2 - P_1) < 0$$

Therefore, the value added at this stage remains negative.

Thus, the sum of the added values created by this second transaction "AL Ina" is:

$$\sum_{i=1}^{2} VAE = VAE_1 + VAE_2$$

$$\sum_{i=1}^{2} VAE = 0 + Q(P_2 - P_0)$$

$$= Q(P_2 - P_0) < 0$$

Also, the sum of the added values always remains negative

And, The sum of the added values after the three transactions I_1, I_2, I_3 becomes :

$$\sum_{i=1}^{3} VAE_i = Q(P_2 - P_0) + Q(P_2 - P_0)$$

$$= 2Q(P_2 - P_0) < 0$$

After the three transactions, the degradation of the added value gets worse.

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We conclude that these transactions negatively affect value added, in other words, if we do not prohibit the sale "Al Ina", we risk deteriorating economic growth.

Therefore, it is a transaction in the form of double "Al Ina", based on this double transaction, we can calculate the sum of the added values created by the four transactions made by the three individuals as follows:

We know so far that: $P_2 < P_1$

and $P_0 < P_1$

However, we nothing known about the position of P_0 with respect to P_2.

We return to the three cases mentioned above:

$P_0 = P_2$,$P_0 < P_2$ and $P_0 > P_2$

If $P_0 = P_2$, the added value is null

If $P_0 > P_2$, the added value is negative

If $P_0 < P_2$,the added value is positive

The only case where the added value is positive is the last but it is low as long as $P_2 < P_1$

If the operation repeated for the third time with a fourth individual, we will have:

If the operation repeated for the third time with a fourth individual, we will have:

$$\sum_{i=1}^{4} VAE_i = \sum_{i=1}^{2} \mathrm{VAE}_i + \sum_{i=1}^{2} \mathrm{VAE}_i + \sum_{i=1}^{2} \mathrm{VAE}_i$$
$$= \mathrm{Q}(\mathrm{P}_2 - P_0) + \mathrm{Q}(\mathrm{P}_2 - P_0) + \mathrm{Q}(\mathrm{P}_2 - P_0)$$
$$= \mathrm{QP}_2 - \mathrm{Q}P_0 + \mathrm{QP}_2 - \mathrm{Q}P_0 + \mathrm{QP}_2 - \mathrm{Q}P_0$$
$$= 3\mathrm{QP}_2 - 3\mathrm{Q}P_0$$
$$= 3\mathrm{Q}(\mathrm{P}_2 - P_0)$$

That is to say that for N times the added value deteriorates up to:

$$\sum_{i=1}^{4} VAE_i = \sum_{i=1}^{2} \mathrm{VAE}_i + \sum_{i=1}^{2} \mathrm{VAE}_i + \ldots\ldots\ldots\ldots \sum_{i=1}^{2} \mathrm{VAE}_i$$
$$= NQ(\mathrm{P}_2 - P_0)$$

2-2- The case of different prices:

After the first transaction, the individual I_1 gained in terms of price $P_1 - P_2$.

We can note this unit gain G.

The management of the transaction "AL Ina" with I_3 can take two forms:The consideration of G gain, or The non-consideration of G gain

If I_1 takes into account the "gain" G, it means that the individual I_1 fixes for the individual I_3 a price $P_3 = P_1 - G$ and recovers the good after at a price $P_4 = P_2$ and this to safeguard the same level "Gain".

- In time T_1 : the added value created is $\mathrm{VAE}_1 = 0$
- In time T_2 :

The individual I_1 receives the same good $\mathrm{RT}_1 = \mathrm{QP}_4$

The individual I_3 receives $\mathrm{RT}_3 = \mathrm{QP}_3$

The added value created by this transaction is:

$$\mathrm{VAE}_2 = \mathrm{QP}_3 - \mathrm{QP}_4$$
$$= \mathrm{Q}(\mathrm{P}_3 - \mathrm{P}_4)$$
$$= \mathrm{Q}(\mathrm{P}_1 - G) - \mathrm{QP}_4$$
$$= \mathrm{Q}(\mathrm{P}_1 - G) - \mathrm{QP}_2$$
$$= \mathrm{Q}(\mathrm{P}_1 - G - \mathrm{P}_2)$$

For $G = P_1 - P_2$, We have :

$$\mathrm{VAE}_2 = \mathrm{Q}(\mathrm{P}_1 - G - \mathrm{P}_2)$$
$$= \mathrm{Q}(\mathrm{P}_1 - \mathrm{P}_2 - G)$$
$$= \mathrm{Q}(G - G)$$
$$= 0$$

At this phase, the added value is null

The sum of the two added values would be:

$$\sum_{i=1}^{2} VAE_i = VAE_1 + VAE_2 = -QP_3 + 0 = -QP_3 < 0$$

Thus, the whole operation leads to a negative added value

If I_1 repeat the operation without taking into account the first "gain", and if the price of the good is clear on the market, I_1 is obliged to remain at the level of P_1 and thus, he will proceed to the sale of the good with a price P_1 and the recovered at a priceP_4 lower than P_1.

- In time T_1, Added value created is $\mathrm{VAE}_1 = 0$

Therefore, in time T_1 , the transaction not produce value added to the economy.

- In time T_2 The individual I_1 receives the same good, i.e: $\mathrm{RT}_1 = \mathrm{QP}_4$

The individual I_3 receives $\mathrm{RT}_3 = \mathrm{QP}_1$

The added value created by this transaction is:

$$VAE_2 = QP_1 - QP_4 < 0$$

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Therefore, the transaction creates a negative added value

The sum of the two added values would be:

$$\sum_{P=1}^{2} VAE_i = VAE_i + VAE_i$$
$$= -QP_4 + Q(P_1 - P_4)$$
$$= -QP_4 + Q\,P_1 - QP_4$$
$$= Q(P_1 - 2P_4) < 0$$

CONCLUSION

Through this article we have borrowed the mathematical tool to demonstrate the negative effect of the transaction Al Ina on the evolution of a given economy. Thus, this logical demonstration has shown that allowing this kind of transaction may seriously deteriorate the evolution of the economy, because any transaction "Al Ina" creates a negative added value in this economy.

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The Effect of Distribution Channels Toward Sales Level at Ud Martabe Tarutung

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Abstract— *The Research dealt with the Effect of Distribution Channels toward Sales Level at UD Martabe Tarutung. The formulation of the problem is: How the distributions channels affect the sales level at UD. Martabe Tarutung. The research was conducted by using quantitative research design. The research method used is: descriptive method, with technique Trend Analysis. The population of this study is all part UD. Martabe Tarutung and taken from sales data and distribution channels costs for 5 years in 2012-2016, and the subject of the study is marketing manager and staff who are willing to provide the required data. The result of this study showed that Distribution channels have positive effect (direction) Toward Sales Level at UD. Martabe Tarutung.*

Keywords— Distribution Channels, Sales Volume.

I. INTRODUCTION

Marketing is an important activity in business. The quality of a business depends to the company's marketing. Through marketing will create the economic value of a product. And the economic value will determine the price of goods and services for individuals or consumers. A Factors that affect economic value are: production, marketing and consumption. Marketing is the relationship between production and consumption. Without marketing the consumers is difficulty to achieve satisfactory consumption goals. The quality of a company depends to the manager's expertise in marketing and the ability to combine functions in marketing, finance, and other related fields. A factor that important in facilitating the distribute of goods and services from producers to consumers is the marketing distribution. The marketing distribution is the path through which the goods distribute from producer to consumer. UD. Martabe Tarutung is a peanut company in Tarutung city. Its products distribute to Medan and Jakarta.

II. LITERATURE REVIEW

Marketing

The American Marketing Association offers this managerial definition (Kotler, 2002): stated Marketing (management) is the process of planning and executing the conception, pricing, promotion, and distribution of ideas, goods, and services to create exchanges that satisfy individual and organizational goals. Coping with exchange processes part of this definitioncalls for a consider able amount of work and skill. We see marketing management as the art and science of applying core marketing concepts to choose target markets and get, keep, and grow customers through creating, delivering, and communicating superior customer value. We can distinguish between a social and a managerial definition for marketing. According to a social definition, marketing is a societal process by which individuals and groups obtain what they need and want through creating, offering, and exchang- ing products and services of value freely with others. As a managerial definition, marketing has often been described as "the art of selling products. a leading management theorist, says that "the aim of marketing is to make selling superfluous. The aim of marketing is to know and understand the customer so well that the product or service fits him and sells itself. Ideally, marketing should result in a customer who is ready to buy.

Marketing Mix

Marketers use numerous tools to elicit the desired responses from their target markets. These tools constitute a marketing mix: Marketing mix is the set of marketing tools that the firm uses to pursue its marketing objectives in the target market. As shown in McCarthy classified these tools into four broad groups that he called the four Ps of marketing: product, price, place, and promotion. Marketing mix decisions must be made to influence the trade channels as well as the final consumers. Typically, the firm can change its price, sales-force size, and advertising expenditures in the short run. However, it can develop new products and modify its distribution channels only in the long run. Now the marketing mix is defined as set of controllable marketing tools that a company uses to create a desired response in the targeted market. (Kotler P., Armstrong, Wong, & Saunders, 2008). Set of these tools is generally referred to as 4P's of Marketing, being Product, Price, Promotion and Place.

Distribution Channels

Kotler and Susanto (2001: 683) stated that a distribution channel of a series of independent organizations involved in the process of making products or services available for

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use or consumption. Tjiptono (2002: 187) states that a distribution channel is a route or series of intermediaries, whether managed by marketers or independent in delivering goods from producer to consumer. It can be concluded that the distribution channel is a series of activities to channel products from company to consumer by organization or marketer.

The Institutions of participating in distribution channels are:

a) Intermediary trader
b) Intermediary agent
c) Wholesalers
d) Retailer

Sales Volume

Basu Swastha (2004: 403) states that sales are interactions between face toface individuals who aim to create, improve, control, or maintain a useful exchange relationship for others. According Anoraga (2004: 523) states that sales volume is the amount of sales achieved or will be achieved by a company within a certain period. Radiosunu (2000: 23) sales volume is some amount of goods produced or goods sold from a particular product within a certain time. From the above definition can be concluded that the sale is an effort made by humans to deliver goods for those who need the money reward in accordance with the price determined by mutual agreement. Sales volume is addition / reduction of the amount of goods produced by the company within a certain period of time

III. RESEARCH METHODOLOGY

The collected data analyzed through A trend analysis method. A trend analysis is an aspect of technical analysis that tries to predict the future movement of a stock based on past data. Trend analysis is based on the idea that what has happened in the past gives traders an idea of what will happen in the future.

In general linear equations of time series analysis are:

$$Y = a + b X.$$

Where :

Y : Trend Variabe (Sales Volume)

X : variable time / year (Distribution Channels in this case data taken from Channel Cost of Distribution).

Whereas to find the value of constants (a) and parameter (b) are:

$$a = \frac{\Sigma Y}{n}$$

$$b = \frac{\Sigma XY}{x^2}$$

The population of this study is all part UD. Martabe Tarutung taken from sales data and distribution of channel costs for 5 years in 2012-2016, and subjects are marketing managers and staff who are willing to provide the required data.

IV. RESULT AND DISCUSSION

Tarutung Located in North Tapanuli Utara has been known as a producer of fried nuts. One of the businesses in the city that sold in the package of UD. Martabe Tarutung and it is located at Jl. Balige, KM 12 Silangkitang, Tarutung was established in 1990. The business is managed by S. Panjaitan. These fried nuts are packed in plastic and canned form. UD. Martabe Tarutung distributed peanuts to Medan and Jakarta. Delivery to Medan area is done once a month with cost RP. 500,000. And the amount of goods sent as many as 30 packages. Delivery to Jakarta area done once a month with postage Rp. 800,000. The amount of goods sent as many as 30 Packages.

Analysis Channel Costs Distribution and Sales UD Martabe in Tarutung

The following is data taken from UD. Martabe Tarutung , the distribution and sales channel cost data as follows:

Table.4.1: The distribution and sales channel cost data of UD .Martabe

Years	Biaya Distribusi	Sales
2012	67.800.000	1.000.000.000
2013	83.400.000	1.200.000.000
2014	67.800.000	1.100.000.000
2015	72.600.000	1.000.000.000
2016	72.600.000	1.000.000.000
Total	364.200.000	5.300.000.000

From the above data the graph trend analysis of are the distribution and sales costs:

a. In 2012

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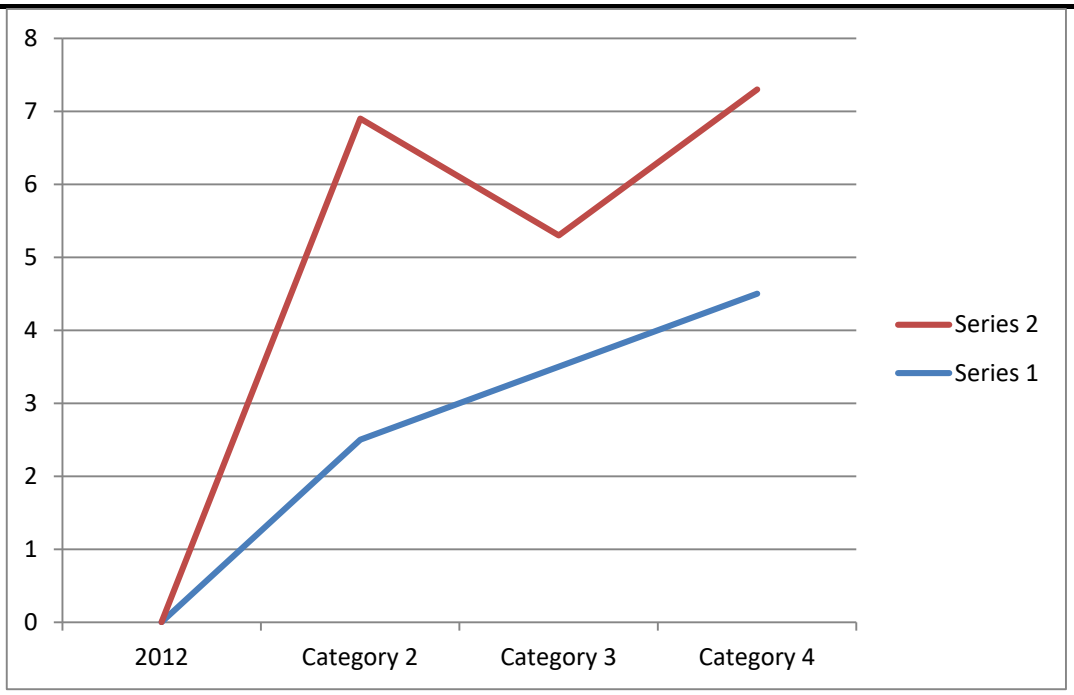
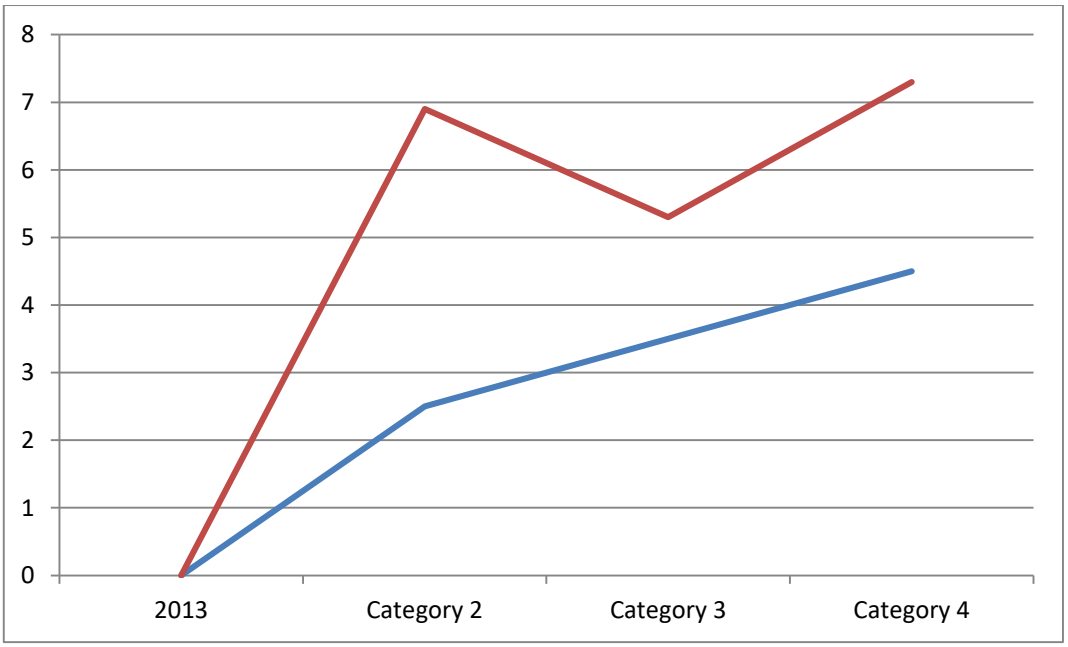


Graph. 4.1: Distribution trends Analysis and sales cost in 2012

The graph above shows that the trend between distribution and sales costs in 2012 tends to increase. The sales trend shows a significant improvement. This shows that UD. Martabe Tarutung has used the distribution channel well.

b. In 2013



Graph. 4.2: Distribution trends Analysis and sales cost in 2013

The chart above shows that the trend between distribution and sales costs in 2013 tends to increase. The sales trend shows a significant improvement It shows that UD. Martabe Tarutung has used the distribution channel well.

c. In 2014

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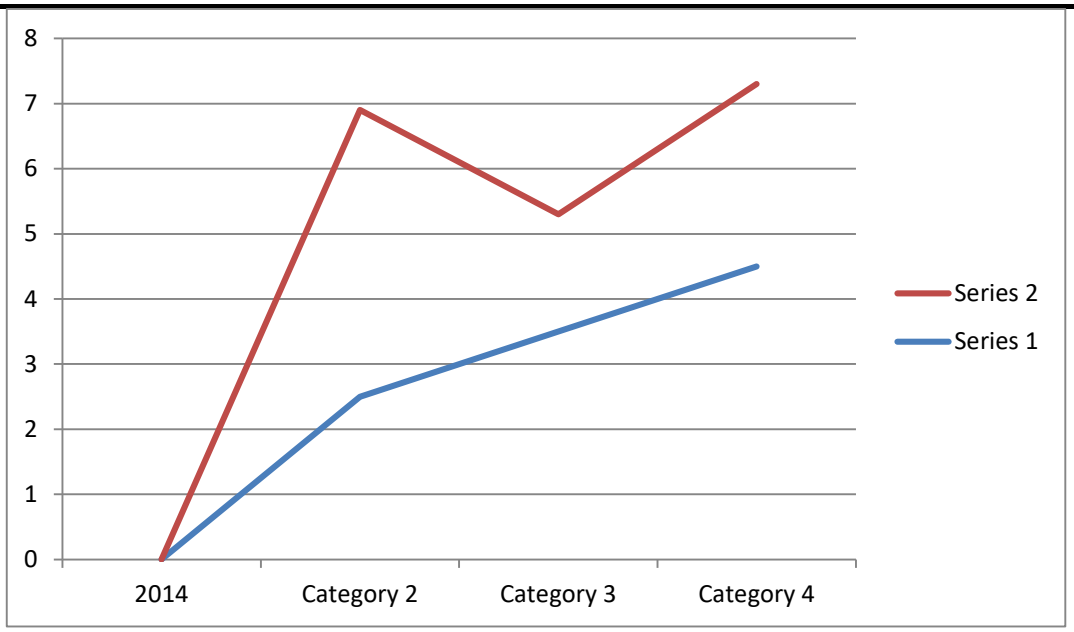
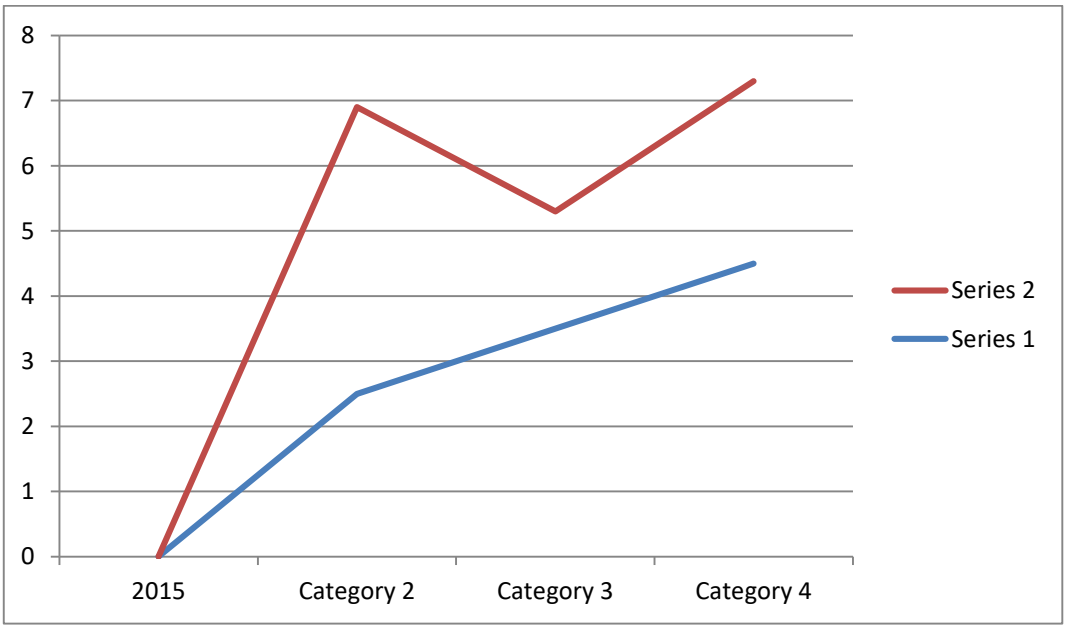


Graph. 4.3: Distribution trends analysis and sales cost in 2014

The graph above shows that the trend between distribution and sales costs in 2014 tends to increase. Although in 2014 decreased in 2013. Seen from the trend between distribution and sales costs still tend to increase. This shows that UD. Martabe Tarutung has used the distribution channel well.

d. In 2015



Graph. 4.4: Distribution trends analysis and sales cost in 2015

The graph above shows that the trend between distribution and sales costs in 2015 tends to increase. The sales trend shows a significant improvement It shows that UD. Martabe Tarutung has used the distribution channel well.

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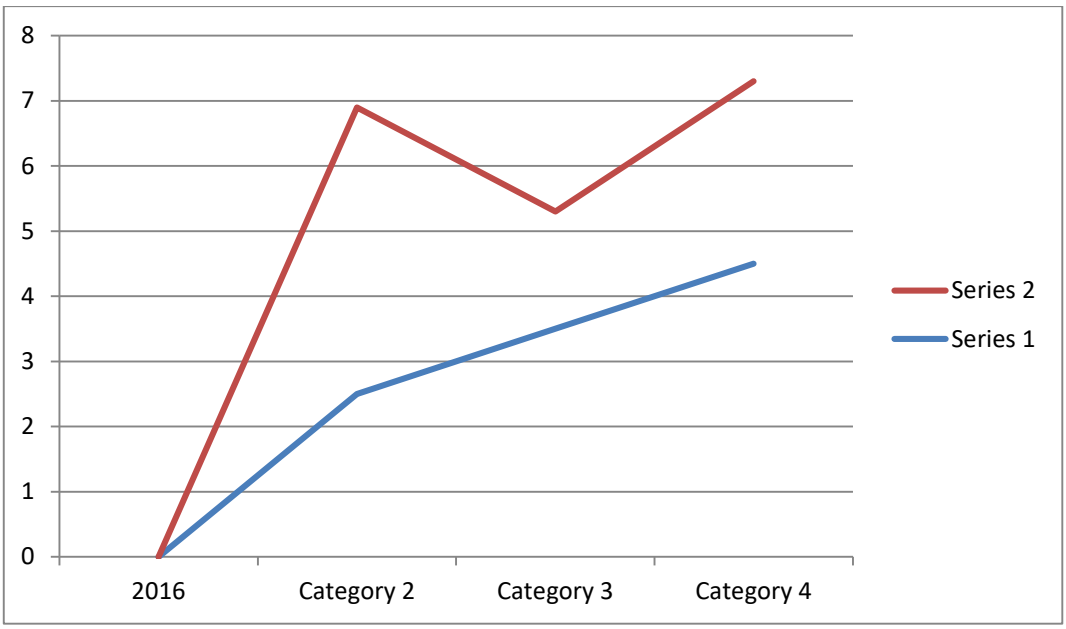
e. In 2016

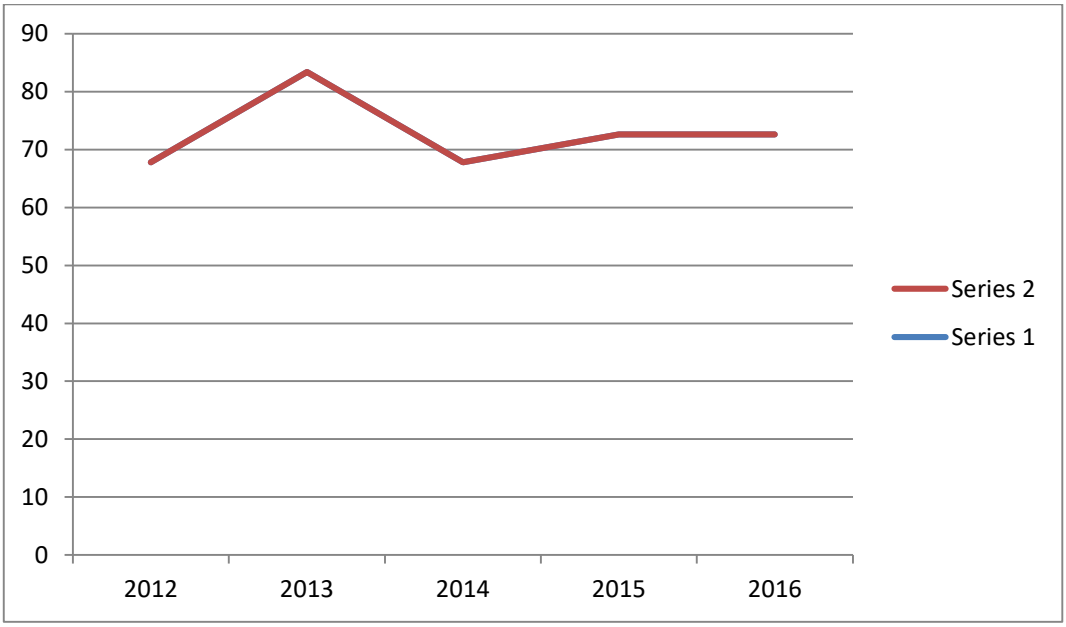


Graph. 4.5: Distribution trends analysis and sales cost in 2015

The chart above shows that the trend between distribution and cost of sales in 2016 tends to increase. Although the number of figures in 2016 is decrease compared to 2015.

However, from the trend between the distribution and cost of sales is still likely to increase. This shows that UD. Martabe Tarutung has used the distribution channel well.

To see the trend between the cost of distribution and sales together in 2012-2016, and then we can see in the following graph



Graph. 4.6: Distribution trends analysis and sales cost in 2012- 2016

V. CONCLUSION

From the graph above shows the trend between the cost of distribution and sales is unidirectional. Can be seen sales trends follow the trend of distribution costs. This shows that distribution costs are in line with sales at UD. Martabe Tarutung.

Trends and Prediction of Distribution Costs

Based on Table 4.1 The UD distribution channels and sales cost data the authors do the calculations to determine the trend and sales prediction as described below:

Years	Sales (Y)	X	X^2	XY
2012	1.000.000.000	0	0	0
2013	1.200.000.000	1	1	1.200.000.000
2014	1.100.000.000	2	4	2.200.000.000
2015	1.000.000.000	3	9	3.000.000.000
2016	1.000.000.000	4	16	4.000.000.000

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Total	5.300.000.000		30	10.400.000.000

VI. CONCLUSION

Based on the results of the study described in Chapter IV, the following conclusions are drawn:

1. Trends distribution costs and joint sales in 2012-2016. Shows the trend distribution and sales costs are not unidirectional. Can be seen that trend of distribution costs follow the sales trend. This shows that distribution costs are in the same direction (positive) with sales at UD. Martabe in Tarutung.
2. The Estimated sales at UD Martabe peanuts in 2017 (X = 5) is: Rp. 2,793,333,330

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Evolution of Patient Dose in Chest Radiotherapy Planning

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Abstract— *Radiographic image has been used for patient positioning, target localization radiation beam alignment, and subsequent verification of treatment delivery in radiotherapy. Radiographic imaging as all medical use of ionizing radiation can give significant exposure to the patient.*

The aim of this study was to determine the radiological dose for chest imaging. Imaging dose during course of radiotherapy add dose to high therapeutic dose therefore this raises the issue of the balance between the benefit of these additional imaging exposures and the associated risk of radiation induced cancer arising from them. Therefore, estimation of imaging doses and possibility of its risk is necessary to provide adequate justification of this exposure.

In this dissertation the main investigated type of the X-ray simulation were chest AP and PA, the total number of patients was 10 (62 radiographs). The fluctuation of the entrance surface dose (ESD) was relatively ranging from 0.35 µGy to 8.43 µGy for AP projection, and from 0.12 µGy to 0.46 µGy for PA projection.

The mean values of ESD were found to be within guidance limits which was proposed in some countries (CEC 2004, and Germany 2003).

Keywords— Chest Radiotherapy, ESD, X-ray.

I. INTRODUCTION

X-ray examinations play an important role in diagnostic as well as for treatment of some diseases. Radiographic imaging has significant role for patient positioning, target localization, and external beam alignment in radiotherapy. Although widely varied in modality and method, all radiographic techniques have one thing in common, they can give a significant radiation dose to the patient. As with all medical uses of ionizing radiation, the general view is that this exposure should be carefully managed. The philosophy for dose management adopted by the diagnostic imaging community is summarized by ALARA. But unlike the general situation with diagnostic imaging, X-ray simulation adds the imaging dose to an already high level of therapeutic radiation. The imaging dose that received as part of a radiotherapy treatment has long been regarded as negligible , and thus , it has been quantified in a fairly loose manner. The introduction of more intensive imaging procedures in radiotherapy context now obligates the evaluation of therapeutic and imaging dose in a more balanced manner (AAPM, 2007).

The biological effects of radiation depends on the absorbed dose and expressed in Gray (Gy). The absorbed dose of radiation can be measured and/or , calculated and form abasic evaluation of the probability of radiation induced effects.

The Patient dose has often been described by the Entrance Skin Dose (ESD) as measured in the Centre of the X-ray beam. As a result because of the simplicity of its measurement, ESD is considered was widely as the index to be assessed and monitored. ESD is measured directly by using Thermo-Luminescence Dosimeter (TLD) placed on the skin of the patient or indirectly from the measurements of dose-area product using a large area Transmission Ionization Chamber (TIC) placed between the patient and the X-ray tube. The use of TLD method in ESD assessment is a time consuming process. On the other hand, TIC method does not provide direct measurement of skin dose and mathematical equations are needed to convert TIC reading into Skin dose.

II. MATERIALS AND METHODS

2.1 Material

This experiment was carried out in the National Cancer Institute (NCI) - Wad madani - Gezira state. Patient anthropometrical data (age, weight, and height) and exposure parameter (kVp, mAs and FSD) were used and were collected from simulator room at the time of each examination.

The Terasix simulator is adapted and equipped to suit the respective purpose. The simulator is derived analogically

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from radiation instruments. Which is consisted of gantry head equipped with a diagnostic X-ray tube (Industry Application Elettroniche IAE - RTM90HS/C52), focal spot size (0.6/1.2), total filtration 2mm Al), and an X-ray television chain (Toshiba Electron Tubes & Devices) opposite that tube**.**

2.2 Methods

Radiotherapy treatment of the Chest tumors was achieved through the use of parallel opposed fields anteriorly and posteriorly , beside the simulation process to get the reference image. Data analysis was performed using the SPSS version 16 software.

2.3 Entrance skin dose

To calculate the ESD X-ray exposure parameters were record for each patient undergo chest radiotherapy simulation, those parameters was peak tube voltage (kVp), exposure current time product (mAs) and focus to patient skin distance (FSD). The ESD is defined as absorbed dose to air at point of intersection of the x-ray beam axis with the entrance surface of the patient, including back scatter factor (NRBP, 1992). The equation used to calculate ESD expressed as follows (Mohamadain et al, 2015):

$$ESD = op \times \left({}^{kV}/_{80}\right)^2 \times \left({}^{100}/_{FSD}\right)^2 \times mAs \times BS$$

Where: OP is output of X-ray tube (mGy/mAs), kV is a peak tube voltage recorded for each examination, mAs is a tube current time product, FSD is the focus to patient skin distance, and BSF is back scatter factor.

The Output in mR/mAs was measured at a distance of 100 cm from the x-ray tube using RAD-CHECK PLUS; model 06-526 exposure meter (Nuclear Associates, Victoreen Division, NY, USA). In order to convert output from mR/mAs to output in mGy/mAs dosimeter readings were multiply by 0.0088 to apply conversion. BSF for radiation qualities typically used in diagnostic radiology has a value that range from 1.2 to 1.4. EC recommend the use of an average value of 1.35 for the BSF which was used in this study (CEC, 2004).

The tube output was measured in a scatter free geometry, for a peak tube voltage of 80 kVp, exposure current-time product of 18 mAs and a focus-to detector distance of 100 cm.

X-ray simulator (TERASIX) equipped with optical distance indicator (ODI) to indicate focus to skin distance (FSD), Exposure parameters were registered and dose calculations were performed on a sample of 62 radiographs, for adult patients with age > 20 years. Microsoft excel was used for ESD calculations.

III. RESULTS AND DISCUSSION

Before estimating the patient doses tube output have been measured which is represent one of the most important QC tests. This test must yield a straight line relationship between $(kVp)^2$ and output (mR/mAs). The results then were used to calculate ESD for different projections. Table.1 show measurement of output at different kVp settings at (18 mAs and 100 cm SDD). The plotted output vs. kVp was found to be linear as shown in (Figure.1).

Table.1: Output vs tube voltage

kVp	**Output (mR)**	$(kVp)^2$	**Output/mAs (mR/mAs)**
40	15	1600	0.83
50	23.5	2500	1.3
60	33.8	3600	1.88
70	46	4900	2.6
80	60	6400	3.34
90	76.2	8100	4.23
100	94	10000	5.22

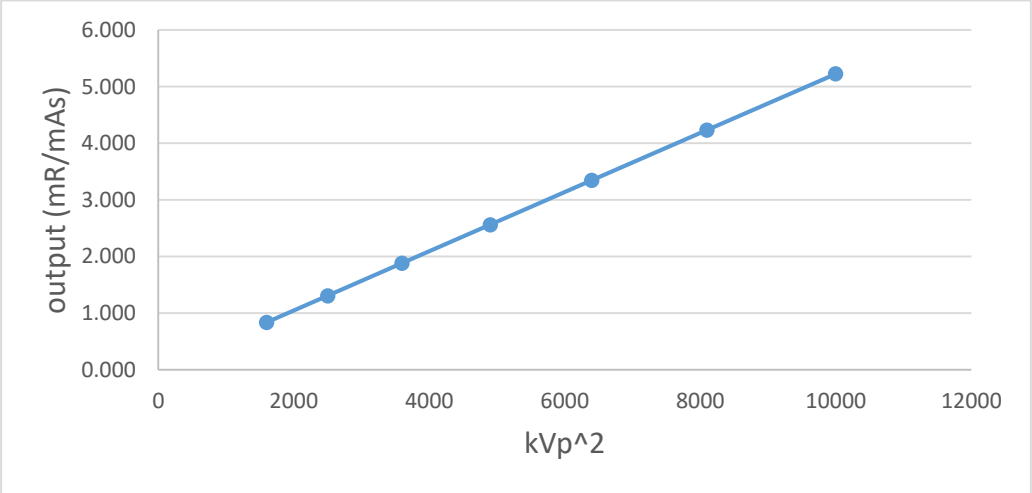

Fig..1: Relation between $(kVp)^2$ and output

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3.1 ESD calculations

The results of patient data and exposure parameters were tabulated in table.2, the results of ESD calculation and their comparison with previous studies were presented in tables (3 &4). Histograms for ESD results also were indicated (figures.2 &3).

Table.2: The mean and range of patient data and exposure parameters

Radiograph	Projection	Patient age (yrs)	Height (cm)	Weight (kg)	Tube voltage (kVp)	mAs	FSD (cm)
Chest	AP	61.5 (45-80)	159.6 (151-178)	48.3 (34-69)	79.5 (62-93)	35.4 (11.6-144)	90
	PA				78 (62- 91)	6.96 (4- 8.3)	90

Table.3: The descriptive statistics for ESDs

Radiograph	Projection	Mean ESD mGy					
		Mean	Median	Min	Max	1st quartile	3rd quartile
Chest	AP	1.7	1.3	0.35	8.43	1.05	1.8
	PA	0.33	0.34	0.12	0.46	0.26	0.40

Table.4: Comparison of mean ESDs estimated in this work to that reported as DRL in some countries (previous studies)

Examination	This work	UK	CEC	Germany
ESD mGy				
Date of study	2016	2009	2004	2003
Chest PA	0.33	0.15	0.3	0.3

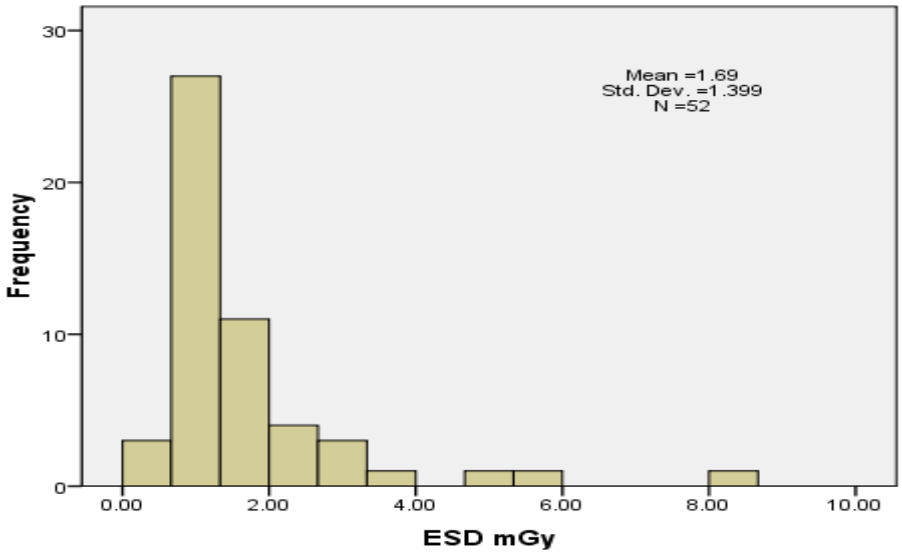

Fig..2: Histogram for ESD per radiograph for AP projection

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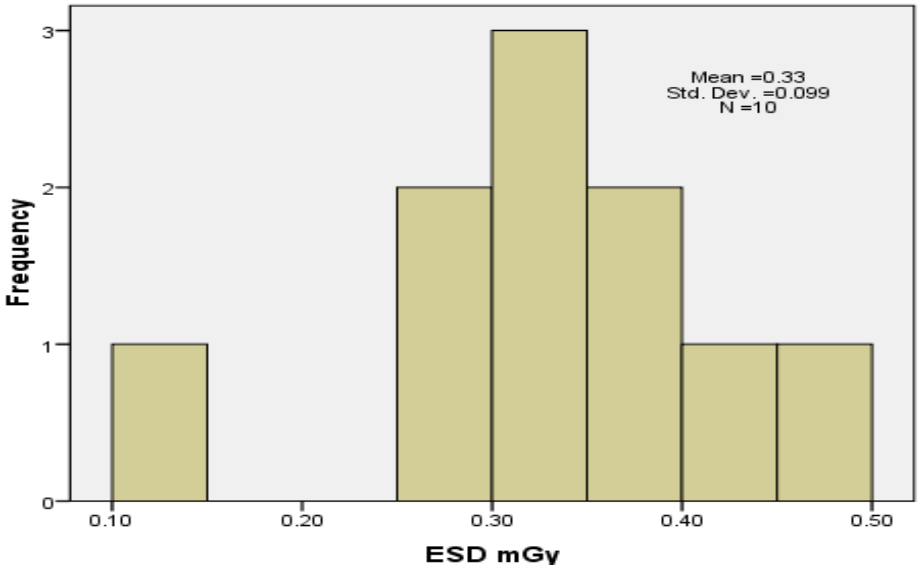

Fig.3: Histogram for ESD per radiograph for PA projection

In this study the Entrance Skin Doses (ESDs) for Chest were measured during fluoroscopic examinations of selected cancer patients in simulator at National Cancer Institute (NCI) - Wad madani. the total number of patients was 10 (62 radiographs) undergo radiotherapy for the chest tumor. Radiotherapy fields arrangement which considered here was parallel opposed fields, the average number of radiographs for individual patient for AP projection was 5 radiographs. The reason for this multiple exposure was to get the optimum patient set-up. For, the other field PA usually single exposure required to get reference image (single radiograph per patient).

The kVp range was (62 - 93), and mAs range was (4 - 144). The mean FSD was used (SAD technique) was 90cm, and it depend on patient separation. These large variations in exposure parameters may be attributed to variation in patient's size and also as a result of using automatic exposure control. ESD values varied from 0.35 mGy to 8.43 µGy for AP projection and 0.12 µGy to 0.46 µGy for PA projection presented in Table -3.

The mean ESD values were compared with some international DRLs **(**Hart et al 2009, CEC 2004, and Bundesamt fur Strahlenschutz 2003), for PA projection only as shown in Table.4, the mean ESD evaluated values were found to be within the corresponding DRLs recommended in publications by CEC 2004 and Germany 2003, and higher than that established by UK 2009. The reason of relatively high ESDs calculated resulting from using of short FSD distance (90 cm) in simulation process compare to that stablished by CEC (140 - 200 cm). (CEC 2004).

The variations in ESDs may be attributed to several factors differences in patient weights, exposure parameters, and focus-to-skin distance. Equipment performance can be a major factor contribute positively to the results.

3.2 Conclusion

Patient dosimetry is often applied as an instrument for optimization of radiological techniques, and improveing of radiation protection to the patients, interhospital, interregional and international comparisons provide insight in the radiation exposure of patients. We conclude that the mean ESDs were found to be within DRLs established in (CEC 2004, and Germany 2003), equipment performance and use of digital X-ray systems were contribute positively to these results. The findings in present work may encourage further doses survey to involve all other projections used in radiotherapy.

For further reduce imaging dose without reducing image information required narrowing fields of view. Use of modern imaging modalities also may reduce the patient imaging dose in the course of radiotherapy. The required of high contrast image elevate the exposure level to the patient, the beam alignment information derived from images used for tumor targeting is depend on imaging frequency rather than image quality, increase in the number of images may add more imaging doses than that eliminated by improve field alignment therefor the staff well identify the point at optimum balance between the imaging dose and alignment error.

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Techno Economic Review on Casting Design Steam Turbine Emergency Stop Valve (ESV) Housing

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Abstract*—The development of computer aided design (CAE) technology, especially casting simulation software (Magmasoft v5), can be utilized maximally as a tool to verify the design of castings that have been made to be able to meet the elements of QCD (quality, cost, delivery) and compete in the market. This study aims to obtain an optimal ESV housing casting design by reviewing and modifying the casting design in terms of both quality and economics. The process of design optimization with casting simulation is an important step in the design and development of casting products to improve casting yield and casting quality. The optimal design of castings is obtained by improving the design through pouring system using bottom pouring and optimizing the riser design. The results of this study obtained Design # 2 as a design choice of pouring system because it can improve the quality of casting products. Design # 2 optimized again into Design # 4 as the optimum design and able to increase the yield casting by 5.11% from the previous design (Design # 2). The result of techno economic analysis shows that by allocating 4% budget for design cost can contribute to decrease of production cost of foundry ESV housing up to 54,95%.*

Keywords— Design optimization, Casting simulation, Yield casting, Techno-economic.

I. INTRODUCTION

The development of computer aided design (CAE) technology, rapidly growing and becoming an integral part of industry development activities. One industry that uses CAE applications is the casting industry. Economically, the use of casting simulation is important because some advantages include: improve product quality, because casting simulation can reduce the defect of casting product, increase yield, so it can reduce feeder volume and gating channels per casting, modification to design can rapidly done, thereby reducing casting directly by trial & error. This computational method of product development is very advantageous than conventional methods (trial & error) [1]. The current casting simulation software has been widely accepted as an important tool in the design and development process of casting products that can improve casting yield and casting quality [2] [3]. Increased of casting yield can reduce cost of material, so it will be savings cost that can make the product of the cast can compete in the market [4].

Casting yield is the weight ratio of the cast product to the total weight of the casting (the weight of the cast product added with the total weight of the gating system). Increase in casting value reflects the efficiency in the casting process which results in reduced material use and reduced production costs. The riser / feeder is the heaviest component of the guttering channel (gating system) which serves to supply additional metal liquid into the mold during shrinkage in the clotting process. Depreciation is affected by the effect of contraction that occurs during freezing, either at [5]:

1. Liquid contraction (pouring temperature to liquids temperature)
2. Solidifying contraction (liquids to solids temperature)
3. .Solid contraction (solids temperature to room temperature)

So in designing of gating system should consider the existence of shrinkage factor (shrinkage allowance). In **Table 1** Shrinkage Allowance values can be shown as the amount of Shrinkage Allowance value on several main material types.

Table.1: Shrinkage Allowance [5]

Material / Metal	***Shrinkage Allowance* (% / [mm/mt])**
Cast iron	0.78 – 1.3 / [10]
Aluminum alloys	1.3 / [15]
Bronze	1.0 – 1.6 / [16]
Steel	2.6 / [21]

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Therefore, in designing of riser channel must be done optimally, because by adding the riser dimension will add casting weight and then decrease casting yield. However, if the opposite or not appropriate, it can reduce the quality of castings because of the inability to compensate for the impact of depreciation. So it is important to consider in designing of right riser either in size, shape, type, amount or placement to get quality and efficient results [6]. By casting simulation software, it can be used as a means to facilitate the design of computing and reduce the risk of trial and error in the real product.

The casting simulation is also capable of providing an overview of the casting process phenomenon which is a combination of freezing, heat transfer and fluid flow [7]. A quality and defect-free cast (soundness) can be achieved by setting the parameters [8]. So that the application of casting simulation can produce an effective cast design and identify the location of defects in the geometry of castings [9]. In general, the numerical simulation combines three fundamental equations, the law conservation of mass, momentum and energy [7]. In addition to these three equations, the law of fluid flow should also take into the laws of Bernoulli, Reynold Number and Navier-Stokes. Since this casting simulation is a complex phenomenon, the assumptions and limitations used in the casting simulation must be considered in order to obtain a representative result [9]. On the other hand, the casting simulation is just a representation of the modeling, so it can not represent the actual product of the castings, because the arrangement of the casting simulation process parameters must be close to the real condition and the result of the simulation needs to be done in more depth analysis [10].

In this research, a techno-economic study of casting simulation will be done on the manufacture of emergency stop valve (ESV), which is one of the component parts in the steam turbine as a throttle valve. ESV should be able to stop the vapor flow quickly and completely, either automatically or manually when needed. ESV components are enclosed by an ESV housing that to maintain pressure from leakage and protection part from foreign objects. In the manufacturing process, ESV housing is divided into 4 parts, the top, middle, bevel and lower casing. The middle ESV housing failed when casting process occurs frequently. The Geometry of ESV can be seen in Figure 1. The ESV housing material is made of high-pressure, high-temperature JIS G5151 Grade SCPH2 steel. While the manufacturing process of ESV Housing steam turbine is done by using the casting method (sand casting) and its completion with machining process. The reason to study about techno-economic of casting simulation in manufacturing process is several failures in casting ESV housing at the beginning of the prototype. Indication of failure is the existence from defective castings (crack and porosity of casting products). The failure of casting process is probably due to errors in the design of the channel system and the raiser system. By using casting simulation is expected to reduce the amount of casting by trial error, also minimize the occurrence of casting defects.

The design optimization process of ESV housing, which has been preceded by a casting simulation using Magmasoft v5 with required quality must meet the standards for JIS G5151 Grade SCPH2 and ASTM A 609 quality level 2. This research, will be focused on optimizing the design of the castings (improvement), which used existing design with an orientation of increasing yield casting values and a review of the techno-economic analysis for the ESV housing casting process.

Fig.1: ESV Housing

II. RESEARCH METHOD

The development of this research is focused in design of ESV housing casting products that have been produced with the aim of increasing casting yield and for conducting a techno-economic review study with quality castings referring to the required standards of JIS G5151 Grade SCPH2 and ASTM A 609 quality level 2 materials. The optimization design of castings (improvement) is already done by using the method of comparison both technically and economically (techno-economic) between product in early castings to the results of design optimization using casting simulation software, Magmasoft V5.

Through the use of Magmasoft software v5 shrinkage effects that occur can be predicted, so it can facilitate in optimizing the design without using actual casting products to get optimal design results. Reducing the riser height in the riser area can increase the yield casting as illustrated in Figure 1.

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The research was conducted with an orientation on increasing casting yield and quality by comparing the first rejected design and two alternative design that already improved and optimization from the best design alternatives. Optimization through this decrease of riser height method is ~ 30%, based on previous simulation ,the result of analysis showing potential riser area to be optimized, because the impact of shrinkage that occurs in the riser area is still far from the castings, as can be shown in Figure 2 Potential Area for Upper Yield Casting below.

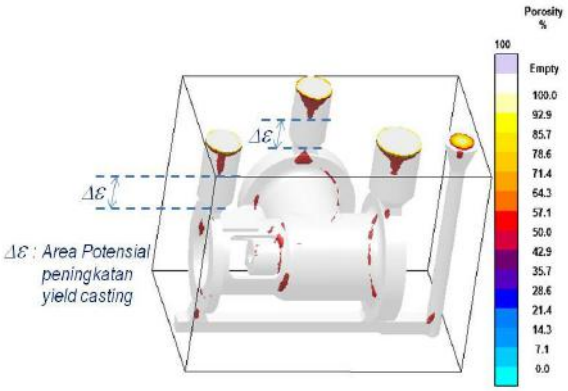


Fig.2. Potential areas to increase Yield Casting

Step of this research is:

a. Design optimization, design and simulation casting for:
   - ❑ Design #1 :Result of first casting (*rejected*)
   - ❑ Design #2:alternative first improvement design
   - ❑ Design #3:alternative first improvement design
   - ❑ Design #4:optimization of repair design

b. Study of Techno Economic
   This study is based on cost of material usage that calculated from this equation [11].

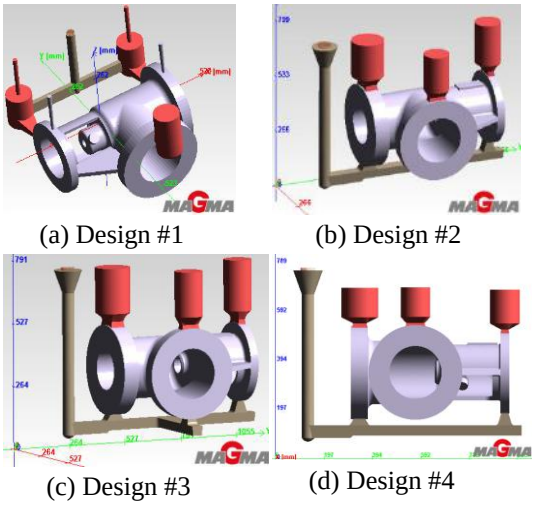
$$C_{metal} = C_{unit\ metal} \times W_{cast} \times f_m \times f_p \times f_f \times f_r \quad \textbf{(1)}$$

C_{metal} :Metal or material Cost (Rp)
$C_{unit\ metal}$:Unit price of material (Rp /Kg)
W_{cast} :weight of *casting* (Kg)
f_m :Materials loss during melting factor (1,01 – 1,12)
f_p :Materials loss during pouring factor (1,01 – 1,07)
f_f :Materials loss during finishing factor (1,01 – 1,07)
f_r :Rejection factor (Steel: 1,00 – 1,12)

Parameter and boundary condition are described :

a. CAD Software :CATIA V5 R19
b. CAE Software :Magmasoft v5
c. Solver :Solidification
d. Method :Gravity casting
e. Materials :ASTM A216 ≈JIS G5151 Grade SCPH2
f. Mold :Green sand
g. Casting Temp :1.680^{o}C
h. Casting Time :30 sec

III. RESULT AND ANALYSIS



(a) Design #1 (b) Design #2

(c) Design #3 (d) Design #4

Fig.3: 3D Gating System Design

In this study there are four designs to be analyzed, as shown in Figure 3 3D Gating System Design. Design # 1 was an initial design that had been cast without preceded using Magmasoft simulation analysis and failed. Then the analysis and comparison between non-destructive test results - Ultrasonic Test (NDT-UT) of castings product with Magmasoft simulation results, as shown in Figure 4 Comparison of NDT-UT vs. Magmasoft.

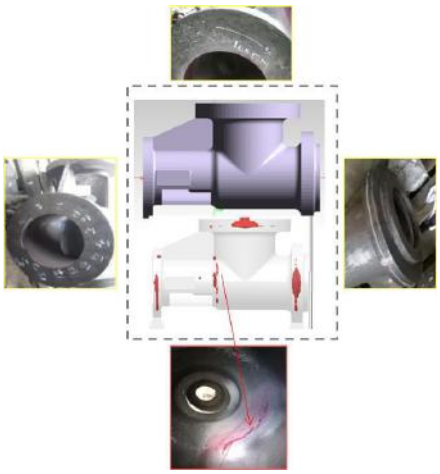


Fig.4: Comparison between NDT-UT vs Magmasoft

From the comparative analysis can be seen that the suitability location of porosity between NDT-UT and Magmasoft simulation, in the third area of radial flange direction and area of center of body valve. Porosity is a type of defect that commonly encountered in the presence of cavities in casting products that can be caused by:

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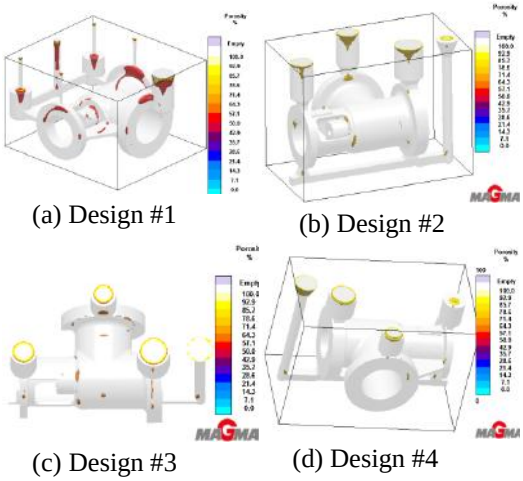
- The gas content in the melting process
- Air and gas trapped during charging
- The metal shrinkage when freezing
- And combinations-combinations

The initial analysis results about pattern need to be changed with consideration of flow improvement to minimize turbulence during liquid metal filling by changing side pouring to bottom pouring and cast-ability design improvement by providing additional machining allowance in flange area. In addition, different wall thickness variations lead to varying cooling rates, to compensate shrinkage and to seek directional solidification need an adequate riser system.

The concept of design change is added into Design # 2 (using 2 in-gate) and Design # 3 (using 3 in-gate). In general, the results of Design # 2 and Design # 3 are almost the same in quality but Design # 2 has higher yield casting, so Design # 2 is chosen to be optimized to increase casting yield to be Design # 4.

3.1 Design Analysis And Simulation

Based on the simulation results with solidification criteria - porosity as shown in **Figure 5**, the four designs of ESV housing have defect potential trend in same area that is in the flange and middle body valve connection area



(a) Design #1 (b) Design #2

(c) Design #3 (d) Design #4

Fig.5: Result of design simulation and porosity

In the quality of the simulation results, the maximum potential defects are shown in Design # 1 and at least in Design # 4. In Design # 4 has a better quality of casting results based on the color gradation in the range of 80-90%. The results of the research optimized the design of ESV housing castings, as compared to the increase in yield casting from each design experiment can be shown in Figure 6. Design # 1 is the highest efficiency (yield casting) but the lowest quality. Therefore, other design alternatives are sought, Design # 2, # 3 and # 4 have a larger product weight due to the addition of machining allowance for product quality repair efforts. When compared, Design # 4 is more efficient with product weight 181.3 kg, weight gating system 72.37 kg and casting yield value of 71.47%. The results of a survey conducted in the American casting industry that the value of casting yield for steel castings with a mass of about 55% weight and the value can be increased for smelting the lighter steel [12]. So the yield casting value for this ESV housing is still relevant for the casting process..

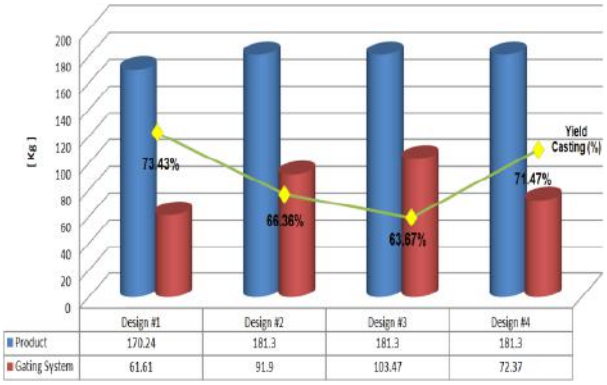


Fig.6: Comparison of Yield Casting

The Magmasoft software makes it easy to design in trying various gating system designs to get the most optimum design in terms of quality and efficiency. The result of design and simulation analysis, Design # 4 is the most optimum design. In addition, the ability of the simulated casting software Magmasoft to predict areas of potential defect can be used as input at the time of the casting process, for example by the use of chill and chromium sand on the walls of the casing which is critical to help freezing process.

3.2 Analysis of Techno-Economic

The details of casting process cost consist of several elements ranging from material purchase, design, production, testing to profit, which depends on the process being applied [13]. This can be illustrated as shown in Figure 7 below.

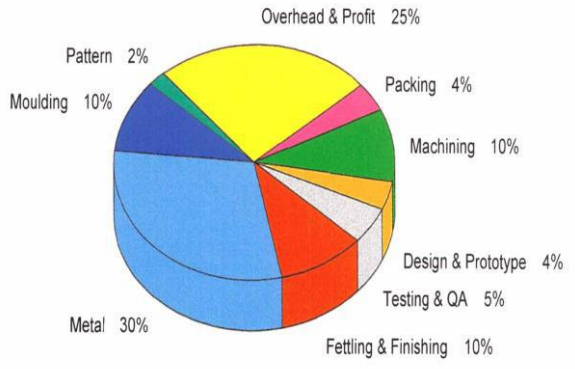


Fig.7: Detail of casting cost[13]

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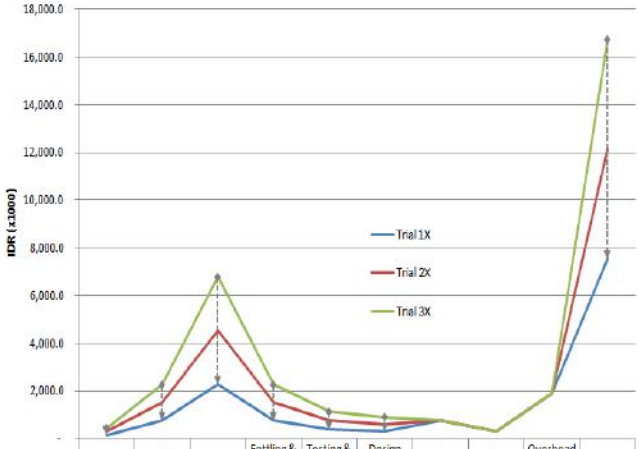
If assumed that without a simulated casting process, it requires more than one casting time to compensate the risk factor of failure. Repetition can be done for 2 or 3 times experiment, especially for the cost of making pattern, molding, metal, finishing (as cast), testing, design - prototype. Systematically the results of techno-economic analysis for ESV housing casting can be illustrated as shown in Figure 8.



	Pattern	Moulding	Metal	Fettling & Finishing	Testing & QA	Design Prototype	Machining	Packaging	Overhead & Profit	Total Cost
Trial 1X	150.7	753.5	2,260.6	753.5	376.8	301.4	753.5	301.4	1,883.9	7,535.5
Trial 2X	301.4	1,507.1	4,521.3	1,507.1	753.5	602.8	753.5	301.4	1,883.9	12,132.1
Trial 3X	452.1	2,260.6	6,781.9	2,260.6	1,130.3	904.3	753.5	301.4	1,883.9	16,728.7

Fig.8: comparison of casting cost

The total cost of casting can be deal with 3 times are about 16.728 million rupiah, while if the simulation design optimization process succeeded in making the cast product 1 times the casting execution then only requires production cost of 7,535 million rupiah. So by allocating casting design cost of 4% optimally able to contribute to total production cost up to 54, 95%.

IV. CONCLUSION

Optimization and design selection using the casting simulation method (Magmasoft) can produce a design castings that can improve casting quality and yield casting. The simulation results can also be used as inputs in conducting preventive actions to prevent potential defects occurring during the casting process execution. Design # 4 is the design of choices that lower the potential for defects and lower production costs by 54, 95%.

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Estimating the Maximum Outflow Discharge from Dam Breach using the Scaling Method

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Abstract**—** *The aim of this paper is to investigate the scaling effect in modeling of the earthen dam breach process during the overtopping or piping. Small scale models are inexpensive but in most cases yield unreal results. In scaling the earthen dam breach phenomenon, the effect of grains detachment should be taken into account. In this article attempt is made to consider the effect of grains detachment in an appropriate way in the scaling method. For this purpose the results of real failed dams are utilized. A number of dams with a high height and a number of dams with low height were selected and it was assumed that the laboratory dams are replaced by the small dams. Then the ratio of their corresponding heights is taken as the scaling factor and the scale of grains detachment is calculated. Calculation of the maximum outflow discharge from dam based on this ratio yields an appropriate estimate of this parameter.*

Keywords**— dam, breach, outflow discharge, scaling, detuchment.**

I. INTRODUCTION

Investigation of the dam preach process is mainly performed in the form of estimating the ultimate breach parameters or based on the instantaneous modeling of the process and estimation of the outflow hydrograph from the dam. Various researchers in the past have searched on these two fields. The soil Conservation Service in 1981 presented some relationships for maximum outflow discharge from the dam breach [1]. MacDonald and Langridge-Monopolis in 1984, using the results of 42 dam failures, and taking advantage of a series of 42 logarithmic diagrams presented the breach parameters values [2]. Sigh and Snorrason in the same year, studying 20 failed dams presented some ranges for the breach width and time [3]. Costa in 1985, using the results of 31 failed dams, presented a relationship based on the dam reservoir volume and the height of water behind dam for calculation of the maximum outflow from the breach [4]. FERC in 1987, using the results of damaged dams, estimated a range for the breach width, wall side slope and the breach time [5]. In this respect Froehlich in 1987, United State Bureau of Reclamation (USBR) in 1988, Singh and Scarlatos in 1988, Von Thun and Gillette in 1990, have estimated similar ranges for the parameters of breach width, breach side slope and breach time [5-9]. Froehlich in 1995 and Webby in 1996, studying the failed dams, presented a relationship for the maximum outflow discharge from a dam breach [10, 11]. Concerning the physical modeling of breaching in the earthen dam, Cristofano in 1965, solved a mathematical model based on the following assumptions: the breach geometric shape is trapezoidal and a has constant bottom width, the side slopes of breach walls depends on the angle of repose of materials, The bottom slope of the breach canal is equal to the internal friction angle of the materials and the model is based on the empirical coefficients [12]. Harris and Wagner in 1967 (HW model), considered the following assumptions: When overtopping happens, erosion takes place and continues till reaching the bed invert. The Schoklitsch sediment transport equation is used, and the breach shape is assumed to be parabolic [13]. Fread in 1977, developed the DAMBRK model using the following assumptions: Breaching starts from the dam crest and uniformly extends to the downstream till the ultimate breach is formed. This model also models the flood routing [14]. Brown and Rogers (BRDSM) in 1981 extended the HW model adding piping failure mode to this model [15]. Ponce and Tsivoglou in 1981, assumed the following: they used Peter-Meyer and Muller sediment transport equations, used the one dimensional unsteady flow and the one dimensional sediment continuity equations, Manning coefficient is used for the discharge flow computations and the breach width is taken variable with respect to the flow within the breach [16]. Singh and scarlatos in 1987 proposed the BEED model using the following assumptions: they used the Einstein-Brown and Bagnold equations, used the slope stability theory (Chugaev, 1965), considered the failure mode only as the dam crest overtopping and applied empirical coefficients for the outflow discharge from the breach [17]. The SIM1 and SIM2 Flow model was developed in the same year for flood routing at the downstream and also obtaining breach characteristics. Among the main assumptions it could be refered to two of them: it assumes certain shapes for the breach, such as triangular, rectangular, trapezoidal shapes and it uses the Schoklitsch sediment transport equation [18]. Fread in 1988, developed the BREACH model for failure by

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overtopping and also piping considering the following assumptions: considered the Smart sediment transport equation. Used the weir discharge formula to predict the maximum outflow discharge, assumed the flow to be quasi-steady. The breach shape was determined according to the slope stability theory. The soil type could be different in the core and shell, lining of the downstream slope could be covered with plantation and the numerical solution does not have the numerical stability problem [19]. V.P.Singh and Scarlatos in 1988 presented an analytic model, which assumed the breach shape as the three geometric shapes of rectangular, triangular or trapezoidal. They assumed the erosion process once as linear and once as nonlinear and obtained for each case the parametric equations with constant coefficients. [8]. Broich in 1998 presented a mathematical model named DEICH. Broich verified his model by an experimental specimen and stated that he needs more specimens. In his model he used the broad-crested weir formula to calculate the outflow discharge. For the breach growth process he used the Exner sediment transport equation and assumed that the ratio of bed slope to that of wall is always constant [20]. Mohamed et al. in 1999, presented a new method for non- cohesive homogeneous earthen dams. They assumed that in the breach process, the bottom portion is eroded and enlarged but the upper portion enlarges only under the slope fall. They verified their assumptions by the experiments and a real case [21]. Kratochvil et al. in 1999 proposed a numerical method for failure due to overtopping. For determining the failure parameters a series of constant unknown coefficients were considered by them and determined using the statistical analysis. They recommended that for application of this model it should be compared to other available methods and models [22]. Tingsanchali and Chinnarasari in 2001 presented a one dimensional model for the earthen dam failure. They have used the Smart sediment transport equation for erosion and the method of slices for stability of the breach wall. They also estimated the outflow discharge from Buffalo Creek Dam with a good accuracy [23]. Ponce et al. in 2003, presented a non-dimensional analytic model. The main aim was to obtain the discharge value at different points of the downstream dam [24]. Wang and Bowels in 2006, formulated a numerical model where their assumptions as: the earthen dam could be of homogenous and non-cohesive materials, the 3D slope stability model of Hunger was used which is the 3D form of the Bishop method. To calculate the flow velocity, the shallow water equations are used. The Smart sediment transport equation is considered. The topography of dam body is taken into account and the dam breach could start from a number of points [25]. The background and assumptions which are assumed by various researchers for simultaneous solution of the hydraulic equations, slope stability and sediment transport show that an appropriate model is not presented for the issue of earthen dam breach. As Morris et al. implied to this subject in an article entitled "Why there has been no progress concerning the earthen dam breach problem" [26]. The recent research show that considering the river sediment transport equations, results into extensive errors in estimating the outflow hydrograph from the dam breach [27]. To study the dam breach process, studying the laboratory scale is inevitable. The important and basic problem in modeling in small scales is change in the behavior of aggregates. The previous extensive studies have been based on the cohesion and internal friction angle in the soil. In the recent years various mathematical models have been presented for calculation of dam breach parameters and outflow hydrograph, where for each of them the governing equations corresponding to that phenomenon are considered. These equations are: water flow continuity equation, flow dynamic equation, sediment material continuity equation, sediment transport equation and the wall and bottom of breach stability equations. For each of the above mentioned cases there are some uncertainties. For example there is not much error corresponding to the water flow continuity equation while the uncertainty concerning two different sediment transport equations might reach 100%. Therefore use of any certain equation for each of the mentioned cases might divert the problem from its real state. So that experts in this field each have referred to special cases in their models or have used certain equations or assumptions which are justified in their situation but nevertheless none have reached an ideal solution [28]. Among the most important problems associated with these are the assumptions related to the sediment transport process and the corresponding equations. The recent research demonstrate that sediment erosion is not similar to that of the rivers and occurs as detachment. This issue has had significant impact on the breach process and here attempt is made that by focusing on this issue the maximum outflow discharge from the dam be estimated. For this purpose the scaling method is adopted based on the Froude number. For validation of the results and investigating the method's capability, has been used the real dam failure data.

II. SCALING METHOD

In the laboratory investigation of any phenomenon, the most important factor is identification of the effective parameters on that phenomenon and their scaling. Considering that the breach phenomenon in the earthen dam is a free surface flow then the dimensionless number, Froude number, would be effective on it.

$$Fr = \frac{u}{\sqrt{gh}} \qquad (1)$$

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Where u is the flow velocity, g is the acceleration of gravity, h is the hydraulic depth. Furthermore, regarding the flows with Reynolds number higher than 2000 the viscosity effect would not be effective. Therefore considering the dimensionless number dominating the problem (Fr) in table 1, the scaling parameters values needed are given.

Table.1: Dimensions of the earthen dam breach parameters

Parameter	Fr	h	u	A	Q	V	T
scale	1	L	$L^{0.5}$	L^{2}	$L^{2.5}$	L^{3}	$L^{0.5}$

Based on the recent research [29], the amount of erosion is based on the detachment of the grains. Most of the previous models have used the relationships for the sediment transport in rivers. The amount of grain detachment could be calculated considering the Hanson & Cook equation based on expression 2 [30]:

$$\varepsilon = k_{\mathrm{d}}(\tau - \tau_{\mathrm{c}}) \qquad (2)$$

ε is the volume of detached grains in the unit of time, τ is the applied shear stress, τ_c is the critical shear stress, k_{d} and is the detachment coefficient. The τ_c value in the prototype and laboratory models is approximately zero or it could be stated that the difference between τ and τ_c is very much [31]. As the main determining factor in the dam breach is the detachment coefficient, its value should be appropriately scaled so that its value in the laboratory scale becomes larger (more rapid erosion). Table 2 shows this coefficient dimension.

Table.2: Dimension of the grains detachment coefficient

Parameter	τ	ε	k_{d}
scale	L	$\frac{L^3}{\mathrm{L}^2 * \mathrm{L}^{0.5}} = L^{0.5}$	$L^{-0.5}$

III. DISCUSSION

Considering a real dam and modeling it in the laboratory scale with the coefficient of 100, indicates that its materials should have a detachment equal to$100^{-0.5}$ (0.1):

$$\frac{L_{\mathrm{p}}}{\mathrm{L_m}} = 100, \quad \frac{k_{\mathrm{d_p}}}{k_{\mathrm{d_m}}} = \frac{1}{10}, \quad k_{\mathrm{d_m}} = 10k_{\mathrm{d_p}} \quad (3)$$

Some researchers investigate the detachment coefficient (k_{d}) based on the erosion index (I) according to equation 4:

$$I = -\log(k_{\mathrm{d}}) \qquad (4)$$

The erosion index (I) varies between 0 and 6, where values close to zero indicate a soil with a high erosion rate. The aim of the present research is application of the estimated k_{d} and predicting the maximum outflow discharge from a historical damaged dam and estimation of the maximum discharge of another damaged dam based on the scaling method.

A number of dams are selected wherein the height ratio and k_{d} values are calculated and in case of compatibility, the outflow discharge is predicted and finally by comparing to its real value the amount of error is measured. Table 3 shows the real and predicted maximum outflow discharge values for a number of sample dams.

Table.3: Estimation of the maximum outflow discharge from the dam and its corresponding error

Dam name	k	H_M	Q	Dam name	k	H_H	Q	H_M/H_H	Q_{si}	Error
Teton	M	93	6512 0	Schaeffer	H	30.5	4500	3.049	7305 8	+12%
castlewood	M	21.3	3570	Kelly Barnes	H	1.6	680	1.84	3107	-13%
swift	M	57.6	2494 7	Apishapa	H	34.1	6850	0.98	2540 1	-2%
swift	M	57.6	2494 7	Schaeffer	H	30.5	4500	1.889	2205 6	+13%

The results show that concerning the issue of laboratory modeling in the dam breach phenomenon, contrary to the existing models which calculate the outflow hydrograph from the dam based on the sediment transport in rivers, the dimensions and erosion rate are considered based on k_{d}.

IV. CONCLUTION

The numerical models mostly estimate the outflow hydrograph from the dam breach based on the sediment transport equations in the rivers. In this research, for estimation of the maximum outflow discharge from the dam the criterion of grains detachment is used for the sediment transport estimation. For this purpose in the scaling method and regarding the dimensional analysis, the grains size is changed based on the detachment coefficient. For validation of the method, the corresponding data of the failed dams are used. The results indicate that this method presents an appropriate estimate of the maximum outflow discharge from the dam.

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Teenager Perception the Apsari Park Aesthetic (Review on Vegetation Arrangement)

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Abstract— *Surabaya community always busy with routine, including the teenagers. Many teenagers visited Apsari Park to refresh the mind. The visitors are dominated by teenager. The attraction from Apsari park is the diversity of vegetation. This study aims to analyze the teenager's perception about vegetation arrangement at Apsari park. Study design through theoretical studies. We used quantitative research method and multi-stage analysis. Data were collected by random sampling and structured interview. The research process was carried out by distributing questionnaires. The results can be a guidance in managing the design of vegetation and create a government policy about the City Parks.*

Kewwords— perception, teenagers, aesthetic, Apsari park, vegetation.

I. INTRODUCTION

City Park, according to its function as stated in the Regulation of the Public Work Minister of the Republic of Indonesia No. 05/PRT/M/2008), is an open land that serves as a means of social and aesthetic as recreational activities, educational or other activities on the city level. Thus, City Parks are the object that become the target of communities and urban teenagers. It is because City Parks have the aspects of aesthetic value and convenience with a wide variety of facilities for instance, a variety of vegetation. Such as the concept of vegetation aesthetic, the concept of comfort and safety, as well as City Park facilities as the approachment, then it will improve the quality of city parks, either from the standpoint of aesthetics, convenience, recreation, relaxation, shade, cleanliness, as well as a comfortable and safe atmosphere for visitors, including teenagers and children [1]. City park which is clean, healthy, fresh and green serves to support the quality of open urban space, including aesthetic quality, so that teenagers can make a positive attitude as a perception on the city parks [2]. Although in quantity City Parks volume in several major cities are still far below the standard, it does not reduce the interest of young people visiting City Park [2]. Surabaya has 54 active city parks with a total area of 303.561 m^2. One of the parks is Apsari park with a total area of 5.300 m^2 [3]. Involve the community, including young people, because the result of urban development will affect the community itself [4]. The forest vegetation group that forms the city park is an approach and implementation that is intended to achieve the purpose of protection, recreation, aesthetics, and other functions for urban communities[4].

Open green space that has a plaza with all the amenities such as benches, tables, fountains, toilet, and cafe or a shaded rest area is actually an ideal and flexible garden/park idea [5]. City Park is a place to gaina cool, freshness, tranquil and beautiful atmosphere for urban communities, including young people. Citypark has become teenagers' needs for facilities used as the completion of aesthetics and recreational areas [5]. City park facilities are made up of hard components such as street paving, pots or vases, playgrounds, garden lamps, statues, fountains, as well asnatural components such as vegetation in the form of grasses, shrubs, ornamental plants, shade plants, naturally flowing water, air, wind and small animals who live there [6]. City park which filled with diverse vegetation has a function to support the quality of urban open spaces, including the aesthetic qualities, so that the teens can capture and deliver a positive attitude as a form of perception on the City Parks [7].

In many countries such as United Kingdom, Norway, Germany and Switzerland, the diversity of vegetation and various types of facilities owned by city parks are the most favored option by the public. [8]. In Northern England and Western Norway, the diversity of vegetation grown with various color of flowers and various types of grass owned by outer space or landscape is actually the people's preference [8]. Collaboration of

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facilities for some different activities in City Park, such as sport, social, cultural, aesthetic, recreational and comfort aspects are the main criteria of a City Park as expected by the city residents, including teenagers. Teenagers and children admit that they enjoy the beauty and use various facilities in City Parks which are located close to their schools [9]. According to the regulations of the Minister of Public Works No: 05/Prt/M/2008, explained, that City Park is part of Green/ Open Space. While the green/ open space is a space in the city or the wider area, either in the form of an elongated area (track) or clustered with the use of more open and without buildings [10]. The City park is a place where vegetation grows, both of which grow naturally, as well as those planted [10]. The concept of qualified and adequate City Parks, can be conducted with a combination approach of several concepts [11], Diversity of vegetation and other facilities which arranged tidy, may have an aesthetics role because it is essential for the maintenance of the ecological authenticity City Parks which have the kind of vegetation that suit with local needs [11].

City Parks will develop continuously, along with the city itself, but it can not avoid the development from the exploitation efforts of natural resources with a variety of reasons that would lead to the disruption of ecosystem balance [12]. Simonds consider the needs of green open space in an urban area as shown in Table 1.

Table.1: The standard area of green/open space with a number of occupants according to Simonds (1983)

Area	Number of people/area	Open space (m^2/people)	Use
Settlement	1.200	12	- Yard/house garden - Small-scale environmental park - Playground
Community	10.000	20	- large-scale environmental park - sport field corridor of neighborhood open space
City	100.000	40	- city park - green track - sport field - corridor between building - community open space
Region/Regional	1.000.000	80	- recreation park - city circle line forests, towns (including open space city)

Source: Director General of Spatial Planning, Department of Public Work, 2008

Surabaya City Government reform the open space that are considered ineffective to become the city parks. A number of open space owned by the city of Surabaya have been built into beautiful city park, including Apsari Park The city park has been rebuilt and equipped with a wide variety of vegetation, for both as protected trees and vegetation as an ornamental garden. Almost every corner of the city, including the remote parts not spared from City Parks renovation so that the city of Surabaya gets the title "a thousand gardens" city.

Observations in the field shows facts, that visitors of Apsari park dominated by teenagers, either alone or together with a group. Young visitors at the City Parks come from various backgrounds. The presence of the teenagers to Apsari Park in Surabaya, due to fresh and exciting atmosphere of the various types of vegetation, with a form adapted to their respective functions.

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Apsari Park, Viewed from the map of the Surabaya City, located at the main road, namely Jalan Pemuda/Pemuda street. The city park is always crowded by teenagers. The teenagers who visited to city park admits there was an aesthetic value which they can felt where in the park. The aesthetic value they felt come from a variety of existing facilities, including the presence and arrangement of various kinds of vegetation, although these perceptions arise from each individual for instance; vegetation color, the size and shape of the manicured vegetation.

II. METHODS

The study was carried out by using quantitative research with the sampling method. Sampling was conducted using simple random technique. This method was chosen because the research analysis tends descriptive and general. The procedures of the study are as follows: a). Find/discover the aesthetic variables of vegetation arrangement on Apsari Park with capture 100 of the teenager respondents; b). Spread questionnaires with variables that have been found; c). Setting the number of samples to an existing variable with 175 samples; d). Determining the object (teenagers) as respondents and e). Sorting the whole sample according to the variables that have been found, to find out which are the most dominant variable.

In order to get teenagers perception of aesthetic variables on the Apsari Park vegetation arrangement, we conduct interview with 100 teenager visitor of Surabaya Apsari Park, with details of category; university student, senior high school student, employee or a junior high school student The results are show in Table 2.

Table.2: Aesthetic perception on Surabaya Apsari Park according to the teenagers in accordance with the arrangement of vegetation

No.	Perception variable of teenage aesthetic on the Apsari Park vegetation arrangement	Number of voters
1	Theme	27
2	Point of intrest	35
3	Rythme	12
4	Scale	10
5.	Ballance	11
6	No option	5
Total		100

Source: Observation was done during July 2017 at the Aspsari park, Surabaya

To accelerate observation at Apsari Park, then it is necessary the equipment which will be used in the observation process. From the four of vegetation arrangement variables which have been found as teenagers perception on Apsari Park Aesthetic,

In this study, we used quantitative method to evaluate the given problem. Random sampling and Structured Interview was carried out for data collection. This study was used multi-stage analysis and discussion based on the analysis and evaluation of the data**.** To help the line of research, then need the following equipment;

a) The format of the questionnaire. Questionnaire is a sheet format that has been provided, then distributed to 450 people of teenagers respondents who visited Apsari Park with intention to determine their perception about the aesthetic arrangement of vegetation at Apsari Park.

b) Photo camera. Camera used to record the situation of Apsari Park vegetation arrangement, either as protected trees, ornamental plants, grouping by type or by placing.

c) Tools and notebooks. Tools and notebooks used to record things that are important and useful in helping the process of data analysis. The tool and notebooks can be a ballpoint and a notebook or another.

d) Computer devices. Used to write all the material and incorporate photos or images recorded at Bungkul Park into the research reports, during the study.

e) Printer. This tool is used to print the results of the research report, either in the form of text or images and photos of observations result at Apsari Park.

f) Scanner. Used to transfer text, image or photo into a report that can not be copied directly, with the process of photograph reproduced in the computer, then transferred to the research report.

In this study, the terms “green space” and “public open space” were used interchangeably and presumed to be synonymous.

III. RESULT AND DISCUSSION

In the Law No.26 The year of 2007, about spatial planning, Regional Spatial Layout Planning/ (RTRW), the city is required to have a public open space of at least 30% from total area of the city. This is in accordance with

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the rules issued by the United Nations. Plan of the provision and utilization of public open space, in detail according to Regional Spatial Layout Planning /RTRW, then from 30% public open space based on the area of the city divided into 20% allocated to the public and the remaining 10% is intended for private. . City parks are generally used by people as an aesthetic accomplishment, fresh air fulfillment, recreation, relaxation, a place to eliminate boredom, a place to mingle with family or friends - as well as a variety of other activities. [13]. Shading which is formed by canopy trees (vegetation) will affect the air temperature in a street corridor, including streets in the open space area for public and city parks, because the shadows will reduce the effects of solar radiation and results in a comfortable temperature of the street corridor. That means one of the aspects which affect the comfort ofcityparkis the air temperature of thecity parks[14]

City Park is a region or area of land surface dominated by cultivated vegetation for certain habitat protection functions, or environment facilities in urban areas, or network security infrastructure or agricultural cultivation. According to its function as stated in the Regulation of the Minister of Public Works No. 05/PRT/M/2008) City Park, is an open land that serves as a means of social and aesthetic as recreational, educational or other activities on the city level. One of the aspectswhich is often forgotten in the provision of open space in urban areas, (in this case, including City park), is the addition of user activities in the open urban space. The condition provides a signal that the facilities on the open government-owned space will be interpreted differently by the users [15].

Surabaya is located in the province of East Java Indonesia geographically located at latitude 7,21º and has a height between 4 and 8 meters above sea level, and has the air temperature between 29º to 34 ºC. Surabaya City Government has made improvements to the Apsari Park since a few years ago. The location of this tomb is on the back of today's Apsari Park area (Figure 01 and 02).

Fig.1: Apsari Park view.
Source: Google eart Juni 2017

Fig.2: Apsari Park front view Source:Google eart Juni 2017
Source: Google eart Juni 2017

Multi-stage analysis was carried out to obtain one of the variables that has the number of polling more than half of the respondents. It is intended to reinforce the research results. If the process of collecting the pooling questionnaire lasted more than one stage, then the pooling results from the previous stages still be calculated with the intention of the collection of pooling variables are not protracted. Each stage will be distributed a questionnaire with an odd number, with the intent to avoiding the same number of pooling.

First Stage. Distributing one hundred and seventy-five questionnaires then conducted the pooling on the questionnaire data based on the number of variables, as many as five variables. Next calculate and recapitulate the number of pooling from each variable of City Park vegetation arrangement aesthetic perception which filled by respondent. Based on the sequence pooling number perception from these respondents on each variable, will come out pooling sequence first to fourth. From this sequence, then the last sequence considered disqualified, so that only three variables remain. These three variables used as a variable in the second stage.

Second Stage. The remaining three variables from the first stage, then distributed again questionnaire that contains three variables to the respondents of different teenagers at Aspari Park as many as one hundred and seventy-five pieces, with the same process the result of these pooling questionnaire sorted again into three groups according to the number of existing variables. Result from the sorting of these three variable will come out the first sequence to third sequence. If the first sequence variable does not have the number of pooling more than half of the respondents, then continued to the third sequence.

Third Stage. In the third stage, remain five variables, so can be confirmed one of them will have a value of pooling more than 50%. These variables which will come out as a reference to build conclusion of the study. The results of the pooling variable by teenager respondents are shown in Table 3, Table 4, Table 5. and Table 6.

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Table.3: The pooling result from teenager's respondent at the first stage with 175 respondent

Location : Surabaya, Apsari Park
Gender : Young man and young women
Age : 15 until 20 years old
Education : Junior High School until University Student

No	Variable based on Vegetation arrangement	Voters Category			
		University Student	Senior High School/Equal	Junior High School/employee	Total
1	Theme	18	10	12	40
2	**Point of intrest**	**26**	**15**	**11**	**52**
3	Rythme	14	9	9	32
4	Scale	8	6	9	23
5	Ballance	11	10	7	28
	Total	**77**	**50**	**48**	**175**

Source: Observation was done during July 2017 at the Apsari park, Surabaya

Table.4: Pooling result from teenager respondent at second stage with 175 respondents

Location : Surabaya Apsari Park
Gender : Young man and young women
Age : 15 until 20 years old
Education : Junior High School until University Student

No	Variable based on Vegetation arrangement	Voters Category				
		University Student	Senior High School/Equal	Junior high School/employee	Stage I	Total
1	Theme	27	13	15	40	95
2	**Point of intrest**	**22**	**16**	**19**	**52**	**109**
3	Rythme	9	13	10	32	64
4	Scale	DISQUALIFIED				
5	Ballance	10	13	8	28	59
	Total	**68**	**55**	**52**	**152**	**327**

Source: Observation was done during August 2017 at the Apsari park, Surabaya

Tabel.5: Pooling result from teenager respondent at the third stage with 175 respondents

Location : Surabaya Apsari Park
Gender : Young man and young women
Age : 15 until 20 years old
Education : Junior High School until University Student

No	Variable based on Vegetation arrangement	Voters Category				
		University Student	Senior High School/Equal	Junior high School/employee	Stage II	Total
1	Theme	19	21	13	95	148
2	**Point of intress**	**23**	**22**	**21**	**109**	**175**
3	Rythme	20	17	19	64	120
4	Scale	DISQUALIFIED				
5	Ballance	DISQUALIFIED				
	Total	**62**	**60**	**53**	**268**	**443**

Source: Observation was done during September 2017 at the Apsari park, Surabaya

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Tabel.6: Pooling result from teenager respondent at the third stage with 175 respondents

Location : Surabaya Apsari Park
Gender : Young man and young women
Age : 15 until 20 years old
Education : Junior High School until University Student

No	Variable based on Vegetation arrangement	Voters Category				
		University Student	Senior High School/Equal	Junior high School/employee	Stage III	Total
1	Theme	26	25	29	148	228
2	**Point of intrest**	**34**	**35**	**26**	**175**	**270**
3	Rythme	DISQUALIFIED				
4	Scale	DISQUALIFIED				
5	Ballance	DISQUALIFIED				
	Total	**60**	**60**	**55**	**323**	**498**

Source: Observation was done during October 2017 at the Apsari park, Surabaya

Fig.3

Fig.4

Figure 03 and 04. Attention Points.

Rows of Trees that appear dominant, both shape and color, indicatevery clear point of attention.
Source: Private document, September 2017.

IV. CONCLUSION

The conditions of Green/Open Space, in which including City Park in the city of Surabaya, as well as other cities in Indonesia are still does not meet the standard requirements specified by the law No. 26 the year of 2007 and the UN provisions which specify that the green space on the city area of at least 30% from the whole area of the city, which consists of 20% for public and 10% allocation to private.

Apsari Park as one of the City Parks in Surabaya, majority visited by teenager from age 15 to 20 years. They are consist of university students, students and young people as employees of the company.

In accordance with these result, then the variable of vegetation arrangement as **Point of intrest**, is the teenagers perception on Surabaya Apsari Park Aesthetic, when viewed from the perspective of the vegetation arrangement. It was chosen by 270 respondents means that equal with 54.217%, already more than 50%. (exceeding 50% + 1)

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Public Management Focused to the Smart City

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Abstract— *This study focuses on municipal management through information and communication technology in Smart City modeling. It presents a model for management of a Smart City with information technology resources to demonstrate the process of structuring integrated systems, analyze the benefits that this will bring by modeling local government activities, and introduce innovative measures for local government restructuring. It applies the simulated case study method and related procedures in a qualitative research approach, based on creativity and innovation. It reports the process of structuring integrated systems and analyses the benefits of a model of a Smart City. The Smart City will make the living conditions of the population much more pleasant and will reduce budgetary costs by deploying smart services. Eco-innovation, as set out in the Oslo Manual, extends to public businesses and is confirmed by the organizational innovation of civic processes. The solution in today's conditions is to manage cities using information technology and communication, where millions of citizens may enjoy the maximum benefit of a project of this kind. This study providing a framework for a smart city about its technology, innovation, and public affairs.*

Keywords— Governability; Innovation; Knowledge; Management.

I. INTRODUCTION

This study involves knowledge creation and the modeling of a Smart City, using information and communication technology applied to municipal administration. The global concern is undoubtedly for governments and their structures to solve management problems quickly and return with the solutions expected by citizens paying taxes. This is sufficient justification for bringing study and qualified research to the constructions of creative idealists. A Smart City is one that uses oriented means to achieve its proposed management effectively and fast, disseminating information in accordance with current expectations. This task is structured by topics and sub-topics which are addressed after the introduction – a theoretical and conceptual review followed by the methodology used, results, conclusion, and references.

II. OBJECTIVES

The overall objective is to present a model for running a Smart City with the resources of information technology. As specific objectives, it is proposed: (1) to demonstrate the process of structuring integrated systems;(2) analyze the benefits that this modeling will bring to local government activities; and (3) introduce innovative measures for local government restructuring.

The question to be answered here is: What are the basic features of a city built on information technology and ecological wisdom? The answer lies in the results presented below, including the developments reported and the specific figures and tables on the subject.

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III. THEORETICAL AND CONCEPTUAL REVIEW

The preparation of this task is based on Systems Theory and brings together the concepts of information technology, communication, municipal government, the Smart City idea and eco-innovation. Systems Theory, according to Chiavenato (2014), deals with practical solutions in the production and conceptual formulations to be applied empirically; it assumes the existence of integration between the natural and social sciences, and the orientation of this integration towards a systems theory, covering not only physical studies of scientific knowledge in the social sciences, but the development of cross-unifying principles of the science involved, and an integrative drive in science education.

3.1 Concepts of information and communication technology

The research in Paludo (2013) indicates that information technology is a strategy to support infrastructure and continuous improvement in management and governance. This strategy involves principles and guidelines for e-government which focus on the promotion of citizenship. The digital applications included in the association may have support-free software; actions in the public interest can be used as instruments of articulation between the public administration through its various bodies and the citizens using the public services offered. Therefore, information technology offers a cognitive design for the integration of public policies at the various levels of the governments and authorities involved in public administration.

Information technology offers operational communication; without this, the users interested in public services will not reading the design or configuration of the information system. Paludo (2013) conceptualizes communication as a process of transmitting information between individuals and the organs of a structure that share structured data, since everyone who accesses these data can understand the informational transaction; so, it is only by understanding the origin of the reports and interpreting them that communication becomes possible. In order to perfect this communication, it said author needs a featured setting for the information about emitter and source, the message that is sent between these two, an encoder or means of converting the message data, the transmitter or apparatus by which the message travels, the channel which is the medium between the source and the destination, the decoder that makes the information understandable, the receiver, and the destination, which refers to the person receiving the message. The feedback is a properly understandable return message, whereas the noise is the outside interference of the message.

3.2 Concepts of municipal government

The concept considered in this study is focused on the New Public Management, introduced by the United States as an alternative to amplify the existing standards of government management, as is clear from the reading by Denhardt (2015). This study clarifies the concept of new public management as a pragmatic finding, which comes without specific alternatives; so, it is much friendlier to the discovery of anomalies in the traditional concepts of public management. About municipal administration, this concept is pragmatic about the knowledge of these anomalies in local public administration, in order to provide the appropriate setting in the field of administration, with alternatives now contextualized to meet the conditions of municipal government.

3.3 Smart City concept

The Smart City concept that best approximates to this study is that offered by Coelho (2015). The author relies on the testimony of the quality of life, mass migration pressure, and efficiency in essential services that must not be obstructed; it should be adapted to new ideas that improve living conditions. It would thus meet the attributes of what the authors call the Smart City for your project, focusing on a future designated by the challenge to individuals in their daily lives from the evolution of technology. For the purposes of this study, the Smart City is a concept through which to interpret the configuration of integrated municipal services, bringing your citizens the facilities offered by technology for your well-being and the quality of life in your location.

3.4 Concept of eco-innovation

This paper adopts the concept of innovation as proposed by Schumpeter and Dias (2014), which is considered to be the approach of eco-innovation, referring to the description of products and processes offered with the application of knowledge to improve ecology and secure sustainable development. The author turns to environmental innovation, environmental ecology, eco-efficiency, eco-design, environmental design and sustainable design that call for sustainable innovation. Another concept could be that the focus of this research is the meeting of the features of civic relationships with the scenario that expects facilities for living from public services, with minimal wear and maximum terms of performance.

The Schumpeterian concept of innovation is related to creative destruction, which will result in imbalance in the emergence of new model; this may unbalance traditional structures with consequences for the intensity of use of resources that are already scarce. Thus, a multi-media series will feed a complex structure that significantly

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consumes energy, uses sophisticated equipment with towers, computer and other apparatuses. In a fragile scenario, this structure will impact negatively, though raising the quality of life for stakeholders.

Another concept to focus on spares the destructive innovation that is related to the impotence of the public to combat the rules of capitalism, whose unbridled dynamics result in information. This is a focused development in Ferry (2015), who discusses the progress of an anonymous logical, mechanical, automated innovation; the author records that the continued need for adaptation prevents any truce in competition, which is now inevitable for public and business organizations. In fact, the author fills an academic gap concerning the reconstruction of the French state in the post-war period and at the present time, due to the reconfiguration compelled by the emergence of partnerships between nations, such as the BRICS (Brazil, Russia, India, China and South Africa).Ferry questions the now globalized development control that is reflected every day in recreation projects which more precisely demand natural resources, since the resurgence of innovation will mean new demands once again revealing the destructive power of innovation. Actually, many innovations run upon against restrictions and limitations, precisely because they challenge many systems and processes in the host agency, and therefore the implementation of innovative programs is always the trade-offs (Stewart, 2014).

IV. METHODOLOGY

This work uses the Case Study Method, supporting the techniques of Design Thinking. Research in Prodanov and Freitas (2013) conceptualizes the Case Study as a comprehensive research strategy that involves the study of one or more objects, allowing a broad and detailed knowledge of the studied phenomenon. This is proposed for the present task, in which objective information will result in a proposal for the intelligent public management of a municipality. The task takes a qualitative approach, and its procedures involve the collection of informational data to be analyzed and criticized in order to exploit the essential creativity of the specification.

The literature review in Biscaia (2013) indicates that Design Thinking is a collaborative process, an approach centered on human needs, designed to solve problems and help people and organizations to be more innovative and creative, for business and society, through inspiration, ideation, prototyping and implementation. Techniques of Design Thinking are useful in integrating innovation with business in general and specifically in public affairs as addressed in this task. They aim at a ratio of government organization and the citizens who benefit from government services. The use of this technology needs to be validated as a strategic success; hence, the related activities are designed to follow the procedure in stages. Torquato, Willerding and Lapolli (2015) propose the phases of immersion, namely, reflective involvement in the search for creative solutions; analysis and synthesis, when they constitute the logical preparations; ideation and the aim of legitimizing the actual operation of the discovery; and finally the prototype, which is the phase of preparing the copy or simulation to be tested, confirmed[not sure if this is what you meant] and validated for effectiveness, as expected practice with a Smart City design.

V. MODELING FOR OPERATING IN AN SMART CITY

As stated by FGV (2016), the European Union defines Smart Cities as systems by which people interact using energy, materials, services and financing to catalyze the benefits of development with the quality of life. The institution states that such flows are intelligently interactive by its engagement in planning urban management strategy to infrastructure, services, information, communication, and social and economic needs. This views on the fragile environment in order to optimize eco-innovation by adding the culture, tradition, wisdom and well-being of all citizens.

The functionality of the Smart City does have to involve modeling to meet the service expectations of local governments and citizens interested in public bodies that offer fast and efficient services. It is a simulated case study with three specific objectives, whose results follow the sub-topics discussed below.

5.1 Demonstration of the process of structuring the integrated systems

The structuring process dealt with in this sub-topic involves the essential elements for the operation of the Smart City. Figure 1 shows the integrated structure which is critical for the Smart City.

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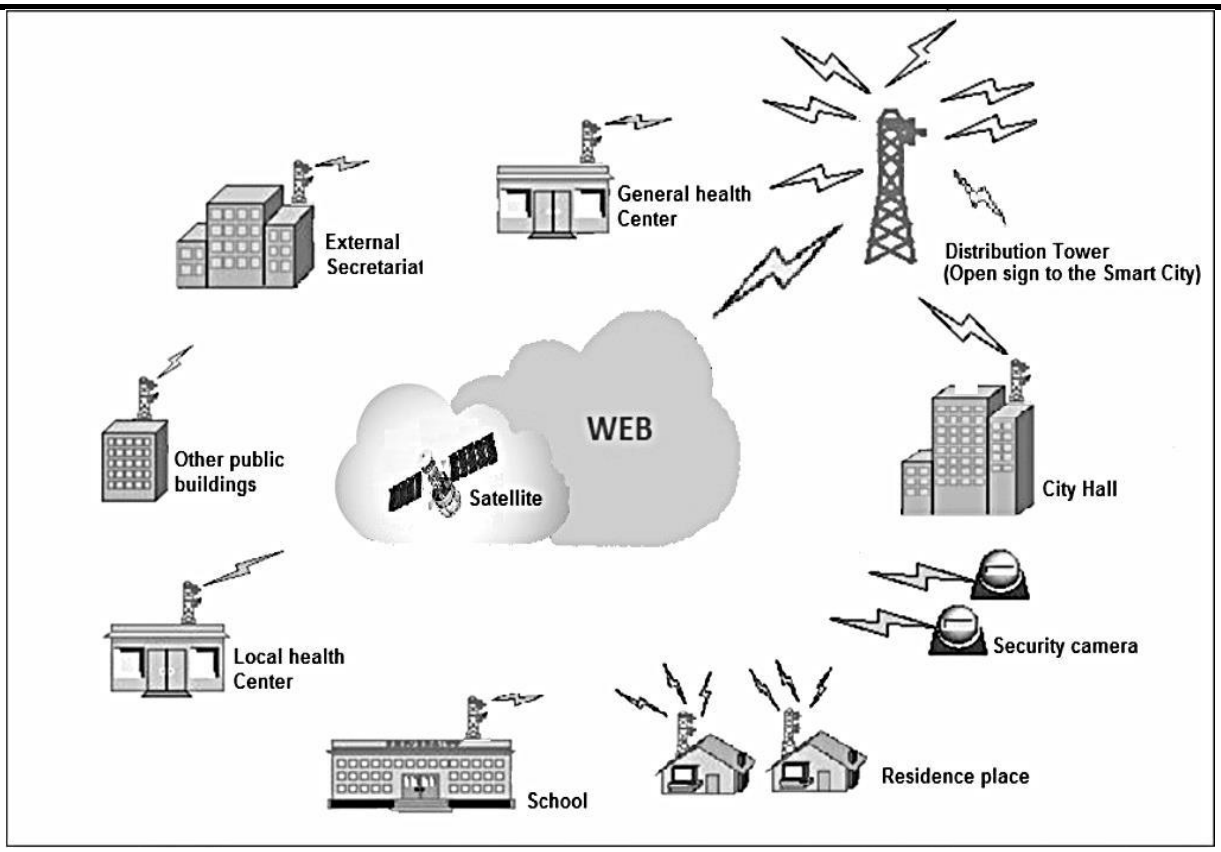

Fig.1: Diagram of the integrated structure proposed for Smart City

Table 1 provides functional description of key components in the structure. Implanting these elements requires a preliminary study of the environmental impact, especially in fragile environments where there are human diversity and biological, cultural and other forms of life which react negatively to the presence of equipment such as this study describes. The Smart City may raise the quality of life, but, as discussed above in the theoretical section, it involves eco-innovation in every context that is assumed by previous research. The implementation structures as specified here must be subject to the decision of a public authority.

Table.1: Specifications of the structure of the Smart City

Elements from the diagram	Descriptive function
Distribution Tower	This connects the satellite with the integrated Smart City. As a technological innovation, it generally requires further studies to support its use, as well as studies of all the other elements listed in this framework.
City Hall	In this building is installed the operational control of the Smart City System. It requires management according to the operating manual and should work with absolute security.
Security câmeras	Their function is to sustain a surveillance system to improve the lives of individuals.
Residences	Their function is to accommodate individuals and their families in overall comfort, providing all the Smart City technology without environmental damage.
School	Its function is to house the interaction of citizens through teaching, research, culture, leisure, and entertainment, contributing to the future success of the population. It contains videoconferencing modules, and `complete equipment for distance learning, virtual libraries, necessary digital services, and other facilities to maintain the users' satisfaction.

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Radio link	Its function is an environmental connection to the distribution tower enabling users to connect to the benefits of the Smart City
Local health center	This connects the health center to the Smart City technologies. It allows users to access such things as emergency care and the prevention and support related to the care offered by a public health service.
Other public buildings	The aim is to set up an administrative body with all the interaction allowed by the Smart City technology.
External secretariat	This maintains the total control of public administration, by `special features of government administration. It focuses on e-government bringing all the improvements and benefits of `Smart City to the users.
General health center	The general management that controls all the benefits offered by the Smart City to individuals work here. It seeks the continuous improvement of its own management in anticipation of innovation.
Satellite	This piece of technological equipment has the function of generating a global connection between Smart Cities in different locations, providing local and global intercity communication.
Web	This is the name of the connection between the members of the worldwide computer network. It enables the users to be interconnected through a pre-configured graphic interface.

5.2 Analysis of the benefits of the Smart City model

In the Smart City modeled here, the data transmission service is of fundamental importance. It connects the e-government organizations internally and connects them with the other institutions involved externally with them. This data transmission allows communication via the web, between a user interested in the available services, and the public institutions or organizations linked to which the citizen can access solutions every day.

The citizens live under one pressure of time, which implies that they seek the quickest and most efficient ways of solving such practical issues as those relating to food, convenience shopping and consumption, their security, gains in knowledge, developmental aspects of education, culture and sports, health and wellbeing, leisure and entertainment; and their mobility and transportation, and other applications that your routines will require. Given these facts, the Smart City will find in information technology for the integrated environment the architects to configure virtual structures that can physically bring solutions. To get these benefits the individual must first have enough resourcefulness to use the data and information from the computer, which is why he needs to access the web system. Guidance and other benefits, provided they are available and well understood by the user, will result from this integrative relationship.

Effective action, since it is supported by strategic parameters, will make a deep impact on the governance scenario in the Smart City. Digital inclusion is the first integrative strategy from information technology; this expectation involves programmers' functional structures for programs and intelligent software. Every public body would have its infrastructure databases compatible with the configuration installed in the Smart City, to provide access for communities and individuals. Because the setting involves both local and global institutions, they will require a free access link previously set up with the public body.

The communication strategy, which involves transmission and access information, comes on the list of benefits. Communication will need the continuous updating of your input, so that the message to be received by individuals arrives on time, or else there will be a loss of value when it comes to decision making. How traffic pressure will react to the volume of hits is one of the questions related to the transmitter structure itself. It must clear the outputs with the required speed and obtain a satisfactory return or feedback as the first benefit to those who use the Smart City.

The modern municipal administration will be responsible for operating the modeling of the Smart City; otherwise, you can decentralize the management of these management outsourcing structures. There will be the pragmatic dynamics to consider, due to the time changes of the logical standards of the management processes; the isonomic certification of the public administration bodies will be the solution of choice. What is called for is a radical paradigm shift, from the previous structure of a bureaucracy seated at physical desks to the virtual functioning of all public structures. This web apparatus will materialize in a way never imagined, once the Smart City gradually replaces the archaic models of municipal management with proper management, without vices and untouched by the corruption that erodes the public purse, it will take away today's institutional deterioration of

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government, due to fraud and will offer instead administrative procedures at unusual speed.

There is no doubting the benefits that the Smart City brings to the relationship of sustainability with eco-innovation. The services offered by the model eliminate the need for cellulose paper, which represents a great advantage because obviates tree felling to meet the input of this industry. The relationship with ecology is healthy, since it is properly used and avoids stress from delays and the inconvenience of waiting. Comfort and convenience can be expected from such facilitative devices as marking time, several schedules [not clear what these refer to] and the like. With the implied innovations in structural design, the environment in which they operate will become much more enjoyable, with less volume of debris thrown away in the wilderness such as commonly occurs in cities where undisciplined individuals live. Until waste collection is regulated by intelligent processes, citizens must plan to impose eco-innovation in the Smart City. Even the current impotence of the government will be influenced by the benefits of eco-innovation, from the use of solar energy, bio-digesters and so on, to the reduced energy consumption that a Smart City could now control. This is the schumpeterian destructive innovation brought to a particular context. So, a list of the actual benefits may be appropriate here (see Table 2 below for the main immediate benefits of the Smart City).

Table.2: Summary of the main benefits for the Smart City

Main benefits	**Reflexes in the daily lives of residents**
1. Social	1.1 Benefits in public security using advanced technology cameras, sensors and micro-drones to patrol. 1.2 Video Networks and monitoring with smart cameras capable of real-time identification. 1.2 Public health services with wireless sensors able to identify and diagnose users in real time. 1.3 Distance learning without locomotion and the development of knowledge or training. 1.4 Traffic control and intelligent transport vehicles capable of flow management and takes account of users per route and alternatives, to avoid congestion.
2. Economic	2.1 Reduced cost of manual labor since all services is operated by smart devices. 2.2 Reduction of budget expenditure by replacing procedures so that paper costs, the maintenance of furniture and equipment and superfluous purchases are eliminated, because the services are web-based. 2.3 Lower costs of telephony, and other uses of energy since communication will operate through a protocol, using a solar energy production apparatus and so on.
3. Environmental	3.1 Reduction in the consumption of utilities because inputs in the Smart Services of Smart City will no longer be made. 3.2 Impact on the environment reduced by replacing the classical management models with eco-friendly ones. 3.3 Implementation of new attitudes that benefit the environment in the face of the backward-looking and preservationist behavior of some who use the Smart City.

5.3 Innovative measures for the restructuring of local government

The traditional service protocols used in public agencies have become outdated by the new power of the web. It is essential for regulating the whole municipal public service with updated laws and regulations. This measure must be approved by local assemblies in order to allow further control by the government. Because bureaucratic structures become virtual, the behavior of internal and external users' needs to be re-shaped to fit the Smart City.

The basis of radical change is organizational innovation, the innovation of public business and innovation processes, as set out in the Oslo Manual. E-government now operates in the Smart City already, to enable this protocol condition to prevail. In Table 3 below are listed the ideal innovations that this indicates.

Table.3: Innovation measures proposed for the Smart City

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Innovation typology	Descriptive of the new conditions
1. Organizational	1.1 Reduction of physical spaces suiting the new demands of storage and virtual reality. 1.2 Electronically increased productivity, dexterity and speed of processes, reducing labor and the demand for workers. 1.3 Include the citizens' organizations, and publishes news about application creation, intelligent design and equipment that can improve organizational processes.
2. Public business	2.1 Allows collected data to be quickly accessed by various institutions. 2.2 Quickly detects failures preventing fraud that damages public property. 2.3 Forecasts non-routine events in the organization promptly, providing the necessary adjustment to reduce the social and economic impact.
3. Process	3.1 Sequences hierarchical organization by virtually monitoring stakeholders. 3.2 Responds promptly to the person concerned. 3.3 Monitors the capability to meet efficiency and suitability standards, for auditing purposes.

VI. CONCLUSION

This work is a pioneer from the point of view of administrative management in the public sector, because it is an integrated model involving technology, information, and communication to meet the requirements of citizens interested in government services. The characteristics are relevant to the operation of Smart City built-in patterns of intelligent living through information technology. There is little doubt that to build a structure like this, people must detach themselves from the traditional Weberian models in the services provided by public organizations. To let millions of people enjoy the maximum benefit that a task like this can provide requires the wise treatment of today's conditions. The possibility of mass unemployment from the reduction in the number of civil servantsis a needless concern; obviously, pensions and public employee reassignments will be needed; there is the possibility that some people who have chosen to resign become entrepreneurs, serving as business owners with the various organs, according to the peculiarities of the work that each goes on to develop.

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Directives for Sustainability Management in the Amazon Forest Economy

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Abstract**—***This paper presents drivers to promote sustainable management in the forest economy in Rondônia, as an alternative to the traditional economic approach to forest resources. Therefore, the study questions how the forest management in the State of Rondônia can contribute as an alternative to the predatory use of the forest, mitigating the impact on the Amazonian socio-biodiversity. The general objective is to generate knowledge about the exploitation of timber and non-timber resources in Rondônia, and has as specific goals to promote the survey of the theme, as indicated in theory and according to practices carried out in the State of Rondônia / Brazil (1); to discuss the main characteristics of forest management with sustainability, promoting its multifaceted characterization in the face of commercial and intercropping (2); and finally, to address the alternative uses of Forest Management, indicating drivers and adaptive the spatial conditions of the Amazon region, specifically Rondônia (3). This research is characterized as qualitative with the method of content analysis; involved the raising of theoretical bases that describe the scenario of study and consultation of specialists, to promote the proficient contextualization, analysis, and inference of the results. It was verified that the drivers for sustainable forest management are alternatives to the predatory use of natural resources, providing the use of multiple conservative mechanisms, interrelating profitability and sustainable development, in favor of the emergence and consolidation of an integrated forest production chain with diversified industrial systems. This work is of interest to the scientific community and rural managers and producers since it offers a contribution to the management of forest resources with sustainability.*

Keywords**— Innovation, Sustainability, Timber Products, Non-timber Products.***

I. INTRODUCTION

Logging in Rondônia is a consolidating market. However, the intensification of predatory anthropogenic actions triggered movements to contain their impacts. Examples of this include the elaboration of legal devices and Environmental Public Policies, whose focus was to confirm sustainable development to the demands of expanding the consumer market. The fact arouses society's interest in viable human alternatives and leads the argument that the management of natural resources from forests can be a solution, since it would meet the economic demands in the face of the irrationality faced in Rondônia, significantly reflecting these dynamics now pointed.

II. OBJECTIVES

The question that guided the investigation was: how can forest management in the State of Rondônia serve as an alternative to the predatory use of forest resources? Therefore, it is the general objective to generate knowledge about the exploitation of wood and non-timber resources in the Amazon Region; and as specific goals carry out survey on logging legally certified in recent years (1), carry out multifaceted characterization in view of the management of tree species consistent in the marketing exercise (2), and

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study the most feasible method and its adaptive conditions space, in the expectation of meeting planetary demands (3).

III. THEORETICAL-CONCEPTUAL REVIEW

In this compartment, information on the theoretical-empirical support employed in the study is provided. Organized in sub-topics, the literature review deals with impacts and model of forest management, its main characteristics in the face of the concept of Sustainability and possible alternative uses of forest management.

3.1 Impacts and Models of Management

Deforestation in Rondônia, Brazil, is a problem that has been triggered since the beginning of colonization with an aggravating situation until the year 2004, as explained by Piontekowski, Matricardi, Pedlowski & Fernandes (2014). The predatory approach to forest resources worsened by a percentage of approximately 41%, resulting from the comparison between 2016 and January 2018, according to the Institute of Man and the Environment of the Amazon [IMAZON] (2018). Concerns about forest use stimulated public support for the expansion of the Forest Management Plan (FMP), described by Takeda (2015) as "[...] an electronic control mechanism for forest products and by-products used in the attempt to curb illegal logging and contain deforestation." The systematization of this approach is expressed in the National Council for the Environment [CONAMA] (1986) as "[...] any change in the physical, chemical and biological properties of the environment that affects the health, safety, and well-being of the pollution, usually resulting from anthropic activities to obtain materials or energies."

Forest management is proposed as a way of promoting timber production and organizing the exploratory activity, making it profitable, ecologically correct and minimizing impacts, according to the different concepts and forms of implementation indicated in Table 1.

Table.1: Characteristics of different models of forest management.

Management Model	Operational concept	Characteristics
Management of native forest	Extractive management of the natural forest.	Concession through public bidding processes of open forests of the State or the Federation.
Management of planted forest	Planting of forest essences for commercial purposes.	Planting and formation of forests in particular areas for commercial exploitation.

Source: Moura & Müller (2011).

According to State Law No. 1143, of December 12, 2002, established in Rondônia, which determines the regulations for the use of native extractive forests, granted through concessions based on sustainable management plans proposed for individuals or legal entities through contracts, or extraction can be carried out through public agencies.

The policy of agricultural management of Planted Forests was instituted in Rondônia by State Law No. 873, dated May 12, 2016, recognizes the contribution of this activity to mitigating climatic effects and promoting the social, environmental and economic development of Brazil, in the perspective of inclusion to producers. The report produced by the Brazilian Tree Institute (IBA) (2017) quantifies 7.84 a million hectares reforested in the country, with 91% of the wood used in the industries coming from forest plantations, as the international market has shown a higher preference for the acquisition of responsible wood. Currently, this industry is the most significant reference in sustainability, innovation, and competitiveness, constituting sources of hundreds of products and by-products present in daily life, as well as possible solutions to the problems of climate change, carbon sequestration, renewable energy source, and deforestation.

3.2 Main Characteristics of Forest Management with Sustainability

The Brazilian Company for Agricultural Research (EMBRAPA) (2015) proposes two lines of follow-up that to be adopted in management practices, one focusing on preservation and another on conservation, the characteristics of which are presented in Table 2 and discussed below.

Table.2: Theoretical perspectives for management implementation

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Forest preservation management	Management of forest conservation
Benefits: - Preservation of species of local flora and fauna - Maintenance of the local ecosystem - Appreciation of environmental services **Goal:** Avoid the urgent loss of some ecosystem threatened with extinction.	**Benefits:** - Use of the species present; - Increase in the alternatives of productive potential; - Commercial valuation of the property; **Goal:** Promote strategies for direct use, generating profit and not degrading.

Source: Danner, Zanette & Ribeiro (2012); Rezende (2012); Sartori, Latron & Fields (2014).

Referring to the first method presented, Danner et al (2012) confronts the hating prohibition of the use of this area, because according to its analysis, this is an indicator that causes loss of stimulus to the owners to maintain an isolated locality and the same time financially devalued the potential of the species present, so they tend to prevent the natural regeneration of plants to eliminate potential problems that take their domain out of this environment.

According to the National Confederation of Industries - [CNI] (2016), the success of the forestry sector depends on a multidisciplinary view that builds links downstream of the productive chain, avoiding the slight degree of articulation in the development of activities and the use of byproducts, sector and reducing economic representativeness.

In Rezende (2012) and Sartori et al. (2014), is understood that the concept of viability is more associated with a set of factors than the diffusion of a single aspect and that the Triple Botton Line concept should be the central focus of the forest management plan. With the observance of the laws that establish the rules of forest management, promoting the creation of opportunities that integrate the community in the development of this activity, incorporating them in the production chain through an interaction mechanism, focusing on the economically viable consolidation of the conservation area forestry

3.3 Alternative Uses of Forest Management

EMBRAPA (2016) describes the importance of forests to the planet; responsibility for carbon storage, regulation of the water cycle, management of biological, ecological and socio-cultural balance. The use of forest resources can be developed considering the control of non-timber products (PNMs), or agroforestry management, whose fundamental requirements are indicated in Table 3.

Table.3: Alternative uses of forest management.

Alternative uses of management	Operationa lconcept	Characteristics
Management of non-timber products	Protection of varieties that make up the ecosystem; promote the ethnomedical use of herbal biocomponents.	Use of tree derivatives, such as nuts, flowers, fruits, fibers, latex, resins, oils and gums.
Agrosilvopastoral Management	Reconcile the preservation and production of food and animals; promote the recovery of degraded areas and the alternative use of the productive regions.	Improvement of the quality of life, increase of the productive capacity of the soil, diversification of the production, gain of profitability, animal welfare.

Source: Makishi, Viegas & Zacareli (2015); Oaks (2016); Lopes, Brito & Moura (2016); Goulart, Olival Arantes (2016) & Souza et al. (2017).

The market for PNMs as a promising export alternative, in addition to supplying local demands, although the lack of incentive through public policies and market organizational structure is pointed out as

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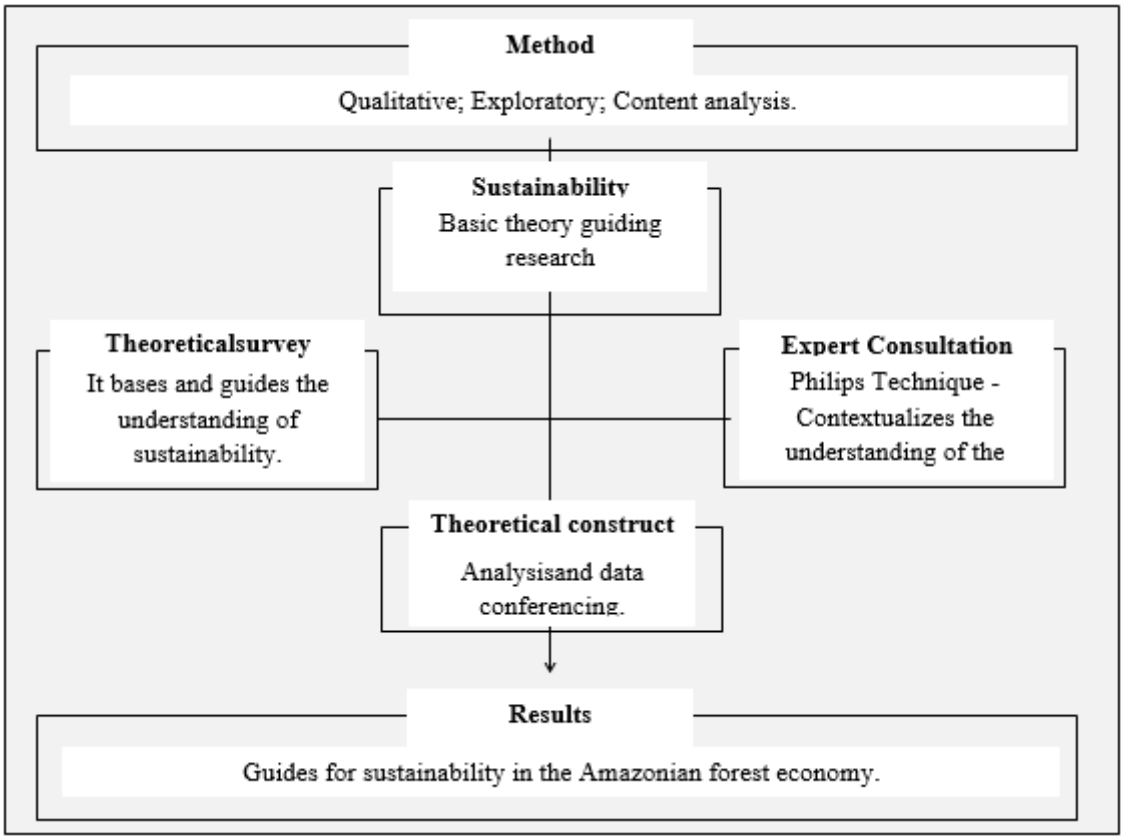
difficulties to be faced. The ethnomedical use of trees as another relevant aspect, estimating that approximately 30% of the medicines used are derived from vegetables both in the traditional secondary method, and 80% of the world population uses plants in health treatment.

Agroforestry management, through the planting of multi-species tree species, replacing the itinerant way of using the properties that are still commonly used in intensive cultivation, resulting in wastes of areas that can be recovered through soil correction methods.

IV. METHODOLOGY

This research involved the establishment of theoretical bases that characterize the scenario of study and consultation of specialists to promote the contextualization proficient for cognitive analysis and inference of the results, according to the methodological design identified in Figure 1, whose descriptive is introduced in the sequence.



Source: Prepared by the authors.

Fig.1: Methodological design of the study.

The approach was qualitative, following Creswell & Clark (2013) that defines it as research that is concerned with making inferences to broaden and give depth to the subject matter. To prepare this task, the Content Analysis Method was used. Moraes (1999) conceptualizes a method of content analysis as a tool that allows the interpretation and description of the documentary content present in texts using both induction and intuition as an investigative strategy to reach the systematic form of quantitative and qualitative understanding, raising the outside of the typical reading level and increasing the knowledge of the message.

This method of approach, according to the said author, constitutes more concrete stages of the investigation, with the more limited purpose regarding the general explanation of the phenomena less abstract. They presuppose a real attitude towards the event and are limited to a particular domain, in the perception of Lakatos & Marconi (2003), the reason why the approach prescribed by these authors is used in this document, with a general survey from papers selected in literary collections.

The collection of the theoretical elements made possible the understanding of the correct way to use the Forests in Rondônia in a sustainable way. This type of intervention on biodiversity offers drivers for the use of permanent preservation areas and commercial planting, so as not to cause damage to the environment or its attributes, much less compromise the quality of life of the next generations; Moreover, the misuse of these natural resources, or their inadequate management, results in all complexity of damages as recorded in the theoretical

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survey inserted in the study.The general survey also serves to provide a basis for the understanding of acceptable sustainability in the exploration of forests in a mutualistic way. According to the author Meira (2008), Philips technique was used to arrive at a result through the fractionation of groups with different information. Employing a semi-structured interview questionnaire, with public agencies related to the forest sector, regarding the impacts on the forest system; consulting professors of the Forestry Engineering course of the Federal University of Rondônia (UNIR), to understand the scientific perspective for the forest scenario; and together with forestry consulting companies, to analyze market trends. All these perspectives offer the optimum state for the proposal of intervention in favor of the application of the principles of sustainability in the face of the local reality.

V. DIRECTIVES FOR THE FOREST ECONOMY WITH SUSTAINABILITY

In the following sub-topics will be treated the results related to legally certified wood, the multifaceted characterization given Planting with tree species and, finally, the innovation proposal and it's adaptive the spatial conditions of the region.

5.1 Survey on Timber Production

The state of Rondônia has developed concession policies for the management of conservation of native forests in conservation units, intending that exploitation privileges the sustainable interrelationship of the man with the environment without neglecting profitability. Regarding the production of wood in these areas, data from the Brazilian Institute of Statistical Geography - [IBGE] (2018), presented in Table 4, describe the production in the period from 2012 to 2016, as well as the value added to this vineyard :

Table.4: Timber production and marketing in the scale of 1000 reais. (Brazilian currency)

Year	Product	Volume	Value of commercialization (R$)
2012	Wood	2.386,04m³	158.237,00
	Firewood	41.485 m³	103.000,00
	Charcoal	44 t	97.000,00
2013	wood	4.003,30 m³	331.231,00
	Firewood	24.579	721.882,00
	Charcoal	-	2.000,00
2014	wood	3.757,35 m³	303.457,00
	Firewood	497.007 m³	16.491,00
	Charcoal	-	2.000,00
2015	wood	3.757,35 m³	303.457,00
	Firewood	497.007	16.491,00
	Charcoal	-	2.000,00
2016	wood	1.439,01 m³	172.879,00
	Firewood	46.541 m³	3.017,00
	Charcoal	-	2.000,00

Source: Adapted from IBGE (2018).

It is observed that the model of forest exploitation has focused on the exploitation of wood products, and in the production of charcoal, the information does not record the volumes produced with precision, as there are several irregularities in the coal industries ranging from informal work to illegal sale. Management with planted forests, regulated by the Secretary of State of Rondônia for Environmental Development (SEDAM) (2011), has contributed to this management model becoming consolidated in the process of recovery of areas degraded by anthropic action.

The data of SEDAM 2018) offer an estimate of R$ 44 million generated by the small producers that invested in this branch in the period from January to September of 2016; the technical authorization analysis shows extraction of just over 27 thousand m³ in logwood of the Teak species. Also, it is observed in Rondônia an area of 17,000 hectares of Teak and the Eucalyptus already reaches 6,060 hectares.

According to the specialists, the timber production in the modalities practiced in Rondônia has the destiny to the national and international market, with emphasis on Europe and countries like China and the United States, and the Brazilian states of Rio de Janeiro, São Paulo, and Mato Grosso. The commercialization has privileged the most abundant species within the Resex's timber PMFs, including *Angelim, Ipê, Garapeira, Faveira, Pinho Cubano, Maracatiara, Cambará, and Roxinho*.

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Already in the planted forests, the essences of commercial interest cultivated are the *Pinus, Eucalyptus, Teak, Pine Cuiabano, Rubber, and Acacia.*

5.2. Multifaceted Characterization in Plantation View with Arboreal Species

The analysis of the practical scenario based on the theoretical support and the experts' perception allows for sizing according to the potentiality of the Rondonian forestry economy, such as those identified in Table 5.

Table.5: Potential for sustainable forest management in Rondônia.

Dimensions	Characteristic
Economic	Management of Planted Forests - Drivers of the Industrial Economy: Wood and derivatives processing; integration with other industrial systems;
Environmental	Management of Preservation - Drivers of Environmental legality: Restoration of the ecosystem degraded by illegal, low-tech or high-impact practices;
Social	Management of non-timber products - Managers to socio-botanical identity: Preservation and encouragement of local practices of use of PNMs according to their medicinal tradition of native forest management.

Source: Prepared by the authors.

The tree species Teca and Eucalyptus, used in the local timber industry, are rich in fiber and have the potential to be used in the pulp and paper industry in the State of Rondônia, which is still a non-existent market. Other native varieties such as bamboo, taquerias, babassu and also organic waste can be used in agriculture for the production of sugar cane and sisal.

The National Institute of Space Research - [INPE] (2017) shows a total deforested area in the state of Rondônia of 83.5 km², involved in this impact is the destruction of APPs, legal reserves and other adverse localities, degraded for the most part to the implantation of livestock. In the cattle ranching scenario, the IBGE (2016) shows the presence of a herd with approximately 13,682,200 cattle, occupying an extension of nearly 10 million hectares with the extensive grazing system, representing the waste of millions of km².

5.3 Drivers for Innovation and Adaptive

The analysis of the study scenario in the face of its potentiality and the current use leads to the identification of the drivers presented in Table 6, allowing the discussion of the necessary adaptive the competitiveness of the forest economy.

Table.6: Drivers for innovation in forest management in Rondônia.

Dimensions	Characteristics	Guides
Economic	Management of Planted Forests - Drivers of the Industrial Economy: Improvement of wood and by-products; integration with other industrial systems;	- Policies to encourage the establishment of the forest production chain to promote and increase integrated local production - Diversification of production with species of commercial interest already adapted to the environment.
Environmental	Management of Preservation - Directives on Environmental legality: Restoration of the ecosystem degraded by illegal practices, little technical or impactful;	- Diversification of the plantation with higher performance species, nature of the Amazonian environment, and that provide economic advantages with the management of non-forest products. - Integration and recovery of productive areas with agroforestry management;

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Social	Management of non-timber products - Managers to the socio-botanical identity: Preservation and encouragement of local practices of use of PNMs according to the traditional tradition of native forest management.	- Policies to encourage the establishment of the productive chain of cosmetics, favoring the legalization and formalization of the extraction of forest essences - Patenting of products and licensing of production in the face of the preservation of local interests in the face of international demand.

Source: Produced by the authors.

The competitive impact can occur in the axis of diversification between the species currently cultivated and those with high potential of commercialization present in the extractive reserves, such as *Angelim Pedra, Roxinho, Angelim Amargo and Favera Ferro*, complementing the offer of products of commercial interest. The incentive policy can direct the form of management to the corporate, individual or community format.

In the installation of native species for the recovery of Permanent Preservation Areas (APPs), according to the need for restoration of degraded areas or by legal requirement, the *Açaí, Copaíba and Seringueiras species*, when tested on the basis of their performance in terms of profitability, to gains from timber production (IBGE, 2016).

The competitive demand provokes the use with other species, such as *Buriti, babaçu, cipó tiririca* and palm trees in general, as there is an excellent demand for artisan and industrial production, both in the domestic and in the external market.

As for agroforestry integration in livestock production, the problem faced is in the axis of high impact and low quality of management, as indicated in EMBRAPA (2016). The primary driver here is the integration of the system of control of planted forests in mountainous areas and line with the agroforestry integration pasture, applying reforestation with the fruit species at strategic pasture points, increasing animal comfort due to the high temperatures present in the area providing greater productivity.

Agriculture practiced in the conventional model on farms that need to be recomposed to conform to the New Forest Code requires the replanting of vegetation through the agroforestry consortium and application of the Planted Forest Management Plan, using varieties as more profitable, such as such as Coffee, *Cupuaçu*, Brazil nut, *Acai*, Lemon, Orange, Cocoa, Banana, *Jambo* and Avocado.

The phytotherapeutic market for several years has generated technological expansion in several locations in Brazil and accelerated the cosmetics industry, favoring the development and commercialization of cosmetics from Amazonian flora. Political measures in the organization and management of the forestry production chain are necessary to create, integrate and articulate the different stages in favor of competitiveness with the sustainability of the forest economy.

VI. CONCLUSION

This work presented drivers to promote sustainability management in favor of the competitiveness of the forest economy in Rondônia and as an alternative the economic approach of high impact on the Amazonian socio-biodiversity. To do so, he surveyed the theme as indicated in theory and according to the practices carried out in the State of Rondônia / Brazil; discussed the main characteristics of forest management with sustainability, promoting its multifaceted characterization in view of planting with tree species and forest consortium and agrosilvopastoral; and finally, it addressed the alternative uses of Forest Management, indicating the most feasible method and its adaptive the spatial conditions of the Amazon region, specifically Rondônia, in the expectation of meeting planetary demands.Given the proposed problematization, drivers for sustainable forest management as alternatives to the predatory use of natural resources were found, since the installation of this activity requires normative standards that include the obligation to preserve illegal sites, as well as the use of conservation mechanisms. Multiple conservative aid inter-linking profitability to sustainable development. Such arrangements can be implemented in favor of the emergence and consolidation of an integrated forest production chain with diversified industrial systems, favoring the competitiveness of the forest economy in Rondônia.

This work is of interest to the entire scientific community and the Amazonian society, managers and rural producers since it contributes to the solution of problems related to the management of forest resources with sustainability.

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Innovating Management Control by Dynamic Analysis of Pareto in a Hotel Business

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Abstract**—** *This paper deals with the Pareto Analysis of problems observed and criticized by clients in a hotel establishment in the municipality of Porto Velho, capital of the State of Rondônia. The general objective of the research is to study the use of Pareto Analysis in these problems that annoy the clients; (1), to group the data in descending order of frequency and to calculate the cumulative values (2), and indicating innovation for managerial control through a tool for Pareto Analysis in a dynamical way (3). The methodology of the qualitative-quantitative approach, of an exploratory nature, is adopted; the bibliographic survey and the field research are applied in support of the case study. Through the database system that the company under study possesses, the data necessary to be used in the Pareto Analysis are obtained, completing the first specific objective; the grouping of these data in descending order of absolute frequency, the calculation of the cumulative values, the preparation of the Pareto Diagram and the analysis carried out successfully completed the second specific objective; and finally the study is finished with the creation of a tool that allows a more dynamic analysis of the scenario in which the company is inserted, as a proposal of innovation for the institution to perform its practical and dynamic analyzes, useful in decision making. This study is a contribution of the academy to managers who work with complex decisions in hotel or related establishments interested in customer satisfaction.*

Keywords**— *Administration. Analyze. Management. Innovation. Pareto.***

I. INTRODUCTION

This study deals with the Pareto Analysis of the frequent problems that are observed and criticized by clients in a hotel located in the municipality of Porto Velho, Capital of the State of Rondônia. A field survey was conducted with data collection from the company's bank, which stores the comments and suggestions of its guests. The collection made possible the Pareto Analysis in relation to the significant points that the management should make efforts for conceptual improvement towards the user clientele. In addition an innovative proposal is created from the elaborated tool.

II. OBJECTIVES

This work has as general objective to study the use of Pareto Analysis in the frequent problems of a three-star hotel. In order to reach this objective, the specific objectives are to gather the necessary data to analyze the problem (1); group the data in descending order of frequency and calculate the cumulative values (2); indicate innovation for managerial control through a tool for Pareto Analysis in dynamic mode (3).

III. THEORETICAL AND CONCEPTUAL REVIEW

The Pareto Law, or Principle 80/20 was created by the Italian economist Vilfredo Pareto. It explains that a large number of consequences (80%) comes from a small range of causes (20%). The studies were deepened by the economist so that it became possible to observe that other phenomena follow this same statistical distribution, many

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of them situated in the business scenario. Contemporary authors such as Ayyub (2014) and Gopalakrishnan (2012) emphasize the importance of this Law as an aid in decision making and a qualitative increase in managerial processes; according to these scholars, the Pareto Analysis that involves the principles of the Law itself is an indispensable tool for the Administration to operate and dedicate efforts in that minority of factors that have a great impact on corporate profits.

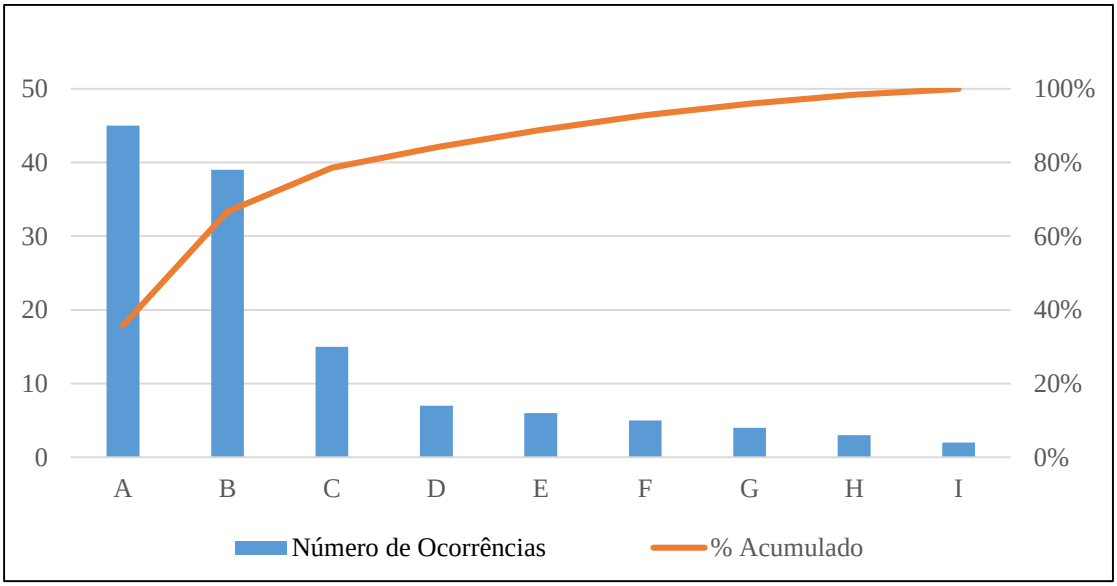
3.1 Data required for Pareto Analysis

According to Dumas, Rosa, Mendling, and Reijers (2013) any phenomenon that has statistical distribution, as in the case of 80% of sales that comes from 20% of customers, can be analyzed in the context of Pareto Law. For this it is necessary to collect all the information and data of that phenomenon so that the analysis is efficient. Moreover, as discussed by Evans and Lindsay (2014), this dominance relation (80-20) is not an invariable constant; on the contrary, it is mathematically elastic according to the reality and quantity of data observed. Therefore, the data needed for an analysis need not necessarily establish this fixed degree of statistical correlation, but rather present a similar nature in which the cause and effect relationship are coexistent.

3.2 How to perform a Pareto Analysis

Ayyub (2014), Cirillo (2012), Russell and Cohn (2012), Spenley (2012) and Kaliszewski (2012) argue that Pareto Analysis is possible through the construction of the Pareto Diagram. The diagram consists of a column chart in which occurrence frequencies are placed in descending order, allowing easy visualization of the most important (higher frequency) and those that are trivial (lower frequency) aspects. In practice, it is possible to construct the graph following four steps: gather all the data that will be used for analysis (1); sort them in descending order of absolute frequency (2); calculate the cumulative frequency of each of the observed items and transform it into percentage numbers (3); construct the vertical bar graph of the absolute frequencies and place the cumulative frequency curve, forming a single diagram (4). Graph 1 below exemplifies the trend of a Pareto Diagram.

Graph.1: Pareto diagram example



Source: by the author*Number of occurrences *Accumulated

3.3 Innovation in Pareto Analysis

Drucker (2014) comments that companies, in order to survive the market, constantly seek ways to innovate their products and processes. In addition, one of the most practical and appreciable ways to innovate is to create something that can be used to improve what is already exposed in the current reality. Pareto analysis, according to Cirillo (2012) and Russell and Cohn (2012), would be more adequate and efficient if it were added to the reality of the enterprise. Thus, it is possible to use this analysis from a tool that is molded according to the needs of the company, making it dynamic and convenient for the decision-making context and the scenario in which companies are located; this would be the way to innovate with focus on malleability, practicality and speed, bringing significant benefits to the business.

III. METHODOLOGICAL PROCEDURES

Prodanov and Freitas (2013) emphasize that a scientific research is the accomplishment of a planned study, possessing its scientific methods of approaching the problem. Also, they cite the main characteristics of a research, in which they are divided in nature, approach, ends, technical procedures, sample and instruments of data collection. In this context, this research has a nature of the applied type; it is a qualitave-quantitative approach; has

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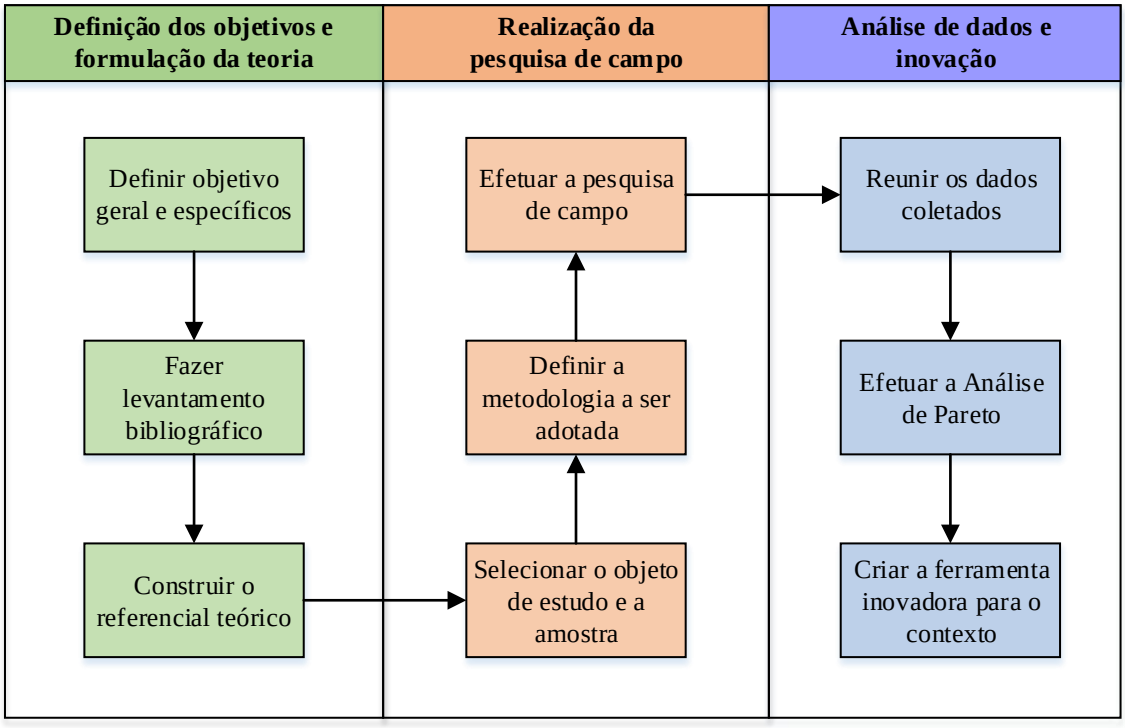
exploratory purposes; gathers technical procedures of bibliographic survey, case study and field research; brings intentional sample; and as instruments of data collection, an interview and documentation survey was used. To facilitate the planning of the research, the methodological procedures were followed in three phases - definition of the objectives and formulation of the theory (1); conducting field research (2); and data analysis and innovation (3). Figure 1 illustrates the flow of the procedures, while in Table 1 it is the descriptive of each phase of this flow.



Source: by the author

Fig.1: Flow of procedures adopted

Table.1: Description of the flow phases of the procedures

Phases	Descriptive
Definition of objectives and formulation of theory	It defines the general purpose of the study and the specific objectives to achieve it. Next, the main recent works (2012-2015) that comment on the subject are selected in the literature, thus constructing the referential.
Conducting field research	The object of study and the applied methodology are chosen. Field research begins, using as main tools of data collection the interview and the documentation in the company's database.
Data analysis and innovation	All collected data are collected for the analysis. After building the diagram, an innovative tool is created to make this whole process more dynamic.

Source: By the author

IV. CASE STUDY ON PARETO ANALYSIS IN A HOTEL ESTABLISHMENT

The hotel under study is located in the municipality of Porto Velho, capital of the State of Rondonia. It has been rated three stars and is therefore considered a tourist hotel. It was built in 2012 in the region and has a good location for tourists, being only 10 minutes away from the airport. All rooms are equipped with air-conditioning, free Wi-Fi, mini bar, cable TV, electric shower, hall for events (accommodation for 200 people) and in some rooms include a balcony, pool and hot tub. It is among the most frequented hotels in the city and has a large clientele. In addition, it has a system of direct contact with customers, in which criticism, praise and recommendations can be made freely. This system is part of the hotel's entrepreneurial strategy, being illustrated by Figure 2 and described in Table 2 below.

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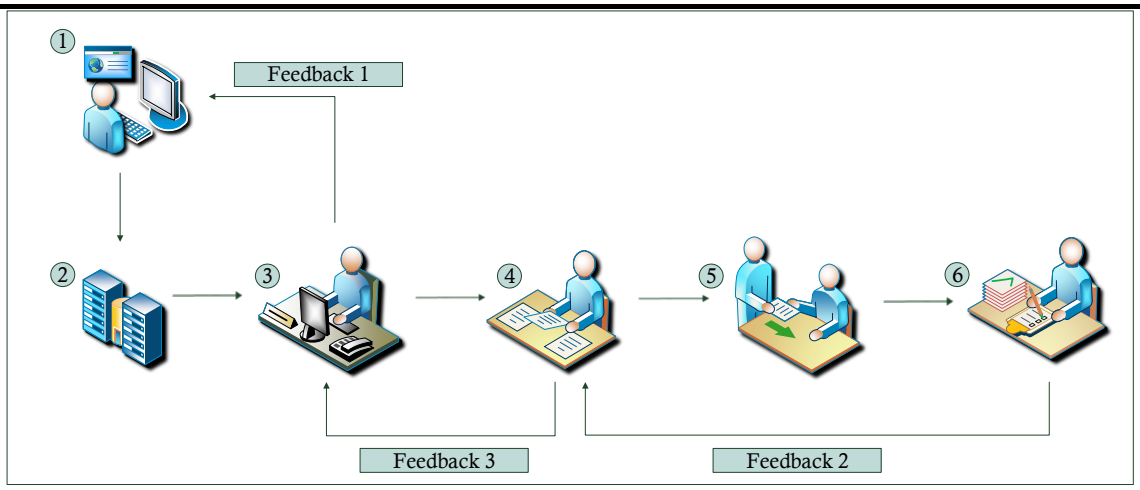

Source: By the author

Fig.2: Customer contact system and operations flow

Table.2: Description of the processes

Processes	Description
1	The customer can comment on the hotel on the company's own website, where he will be free to display any impressions, criticisms, suggestions or compliments he had while staying. The user can identify (with name and email) or still be anonymous. If you identify yourself, the customer will receive an email of thanks for the contribution (feedback 1).
2	The comments posted on the hotel website automatically go to the company database, which is managed by Microsoft Access software. The software organizes the comments in a worksheet on a first-come, first-served basis and can be accessed later by the Information Manager (3) who is responsible for organizing all the files in this database.
3	Information Manager accesses the database through Microsoft Access and performs file verification. For the comments that have identification is made, through the same software, a response of thanks for the contribution (feedback 1) and sent. Finally, it sends the criticisms and suggestions filtered as more pertinent to the General Manager (4) and, those that he judged of less relevance, archives them.
4	The General Manager receives the criticisms and suggestions from the clients and analyzes them. If the comment is of great importance and impacts the business, the manager prepares the service order and directs the Operations Manager (5). If the General Manager judges that the comment does not have some degree of relevance, he forwards the Information Manager to proceed with the feedback.
5	The Operations Manager receives the service order and performs preliminary registration, generating ordinal numbering in the document. The entire collection of what will be necessary to complete the request will be at your charge. Stipulated deadlines must be met in order to avoid unnecessary costs and to undermine the company's profits.
6	Upon completion of the service, the Operations Manager prepares the completion document that will be attached to the service request document for the General Manager (feedback 2). The General Manager, with possession of the completion document, forwards to the Information Manager (feedback 3) to process the process and the control in the database.

Source: By the author

This allows the company to align its strategies for customer satisfaction and, through Pareto Analysis, it is possible to focus on the main problems to be solved.

5.1 Survey of data

Data were collected from the aforementioned system. It was verified that the complaints revolve around 14 typologies: attitude of the attendants; delay in room service; repetitive breakfast; slow and confusing check-in; noisy corridors; difficult to control the shower; excess light switches; lack of closed channels; noise when closing doors; lighting; slow Internet; few takes; problems with air conditioning; and very expensive transfer. These data are shown in Graph 2 below and, afterwards, Table 3 describes each observed problem.

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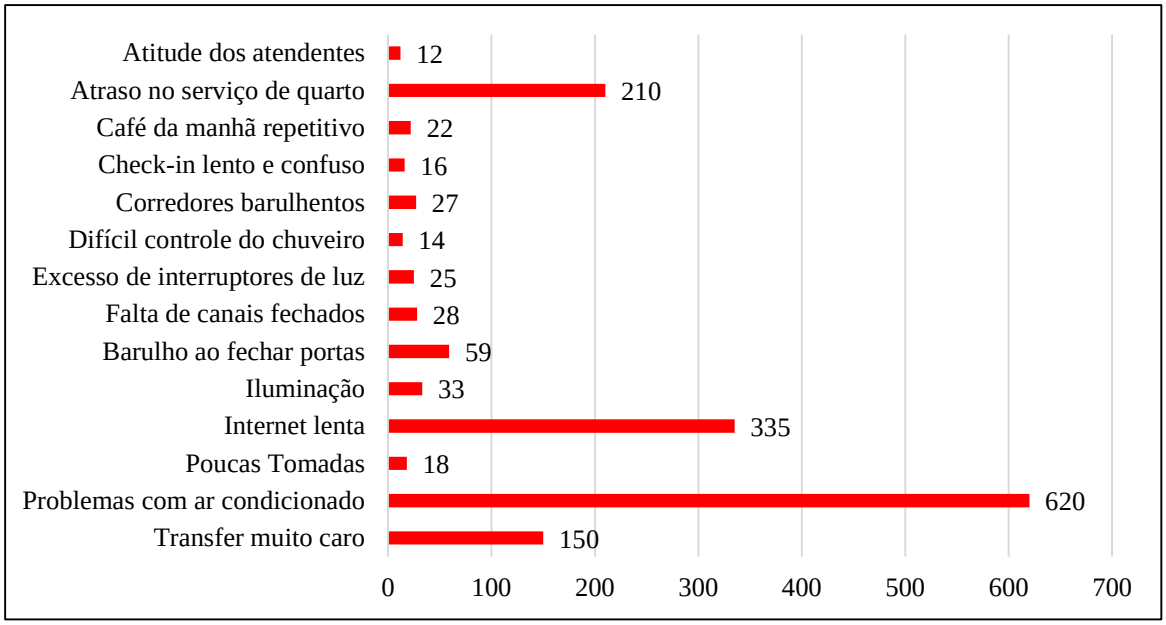
Graph.2: Number of reports of frequent problems



Source: By the author

•Attitude of the attendants • Delay in room service •Repetitive breakfast •Slow and confusing check in •Noisy corridors •Difficult shower control •Excess light switches •Lack of closed channels •Noise when closing doors •lighting •Slow internet •Few takes •Problems with air conditioning •Very expensive transfer

Table.1: Description of problems

Reported Issues	Description
Attitude of the attendants	Attendants sometimes do not act politely and courteously.
Delay in room service	Room service is available on request.
Repetitive breakfast	Breakfast does not change as the days go by.
Slow and confusing check in	The hosting process is slow and loses in practicality.
Noisy corridors	The soundproofing of the rooms is not enough.
Difficult shower control	Electric showers are not practical and have faults.
Excess light switches	There are so many lamps and each has a switch.
Lack of closed channels	The channels available leave something to be desired in entertainment.
Noise when closing doors	Some doors are not aligned and lubricated.
Lighting	The lighting is weak, damaging at the time of reading.
Slow Internet	The internet provided, although free, is very slow.
Poucas tomadas Few takes	A limited number of outlets are available in the room.
Problems with air conditioning	Air conditioning to cool down at night.
Very expensive transfer	High cost on airport-hotel transfer within walking distance.

Source: By the author

Thus, during the current year, 12 reports were made regarding the attitude of the attendants; 210 delays in room service; 22 on repetitive breakfast; 16 addressing the slow check-in; 27 on noisy corridors; 14 reports of difficulty in controlling the shower; 25 of excess light switches; 28 of lack of closed channels; 59 Concerning the noise of closing the doors; 33 reports on poor lighting in rooms; 335 about the slow internet; 18 about the low number of outlets available; 620 alleging problems in the air conditioning; and 150 commissions on the high cost on the transfer. These data will be duly organized in the following section for later to be performed the Pareto Analysis.

5.2 Sorting of collected data and Pareto Analysis

Before performing the analysis, it is necessary that the data is properly organized in descending order of absolute frequency (number of reports). In addition, one must calculate the total accumulated value (1) and that of each observed item (2). For the first, only all the absolute frequencies are summed and the total number of reports is obtained; and finally to the second, the sum of the absolute frequencies of the item and its predecessors is divided by

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this total accumulated value, obtaining the accumulated value of each problem, in percentage quantity. Table 4 shows the result of this ordering process.

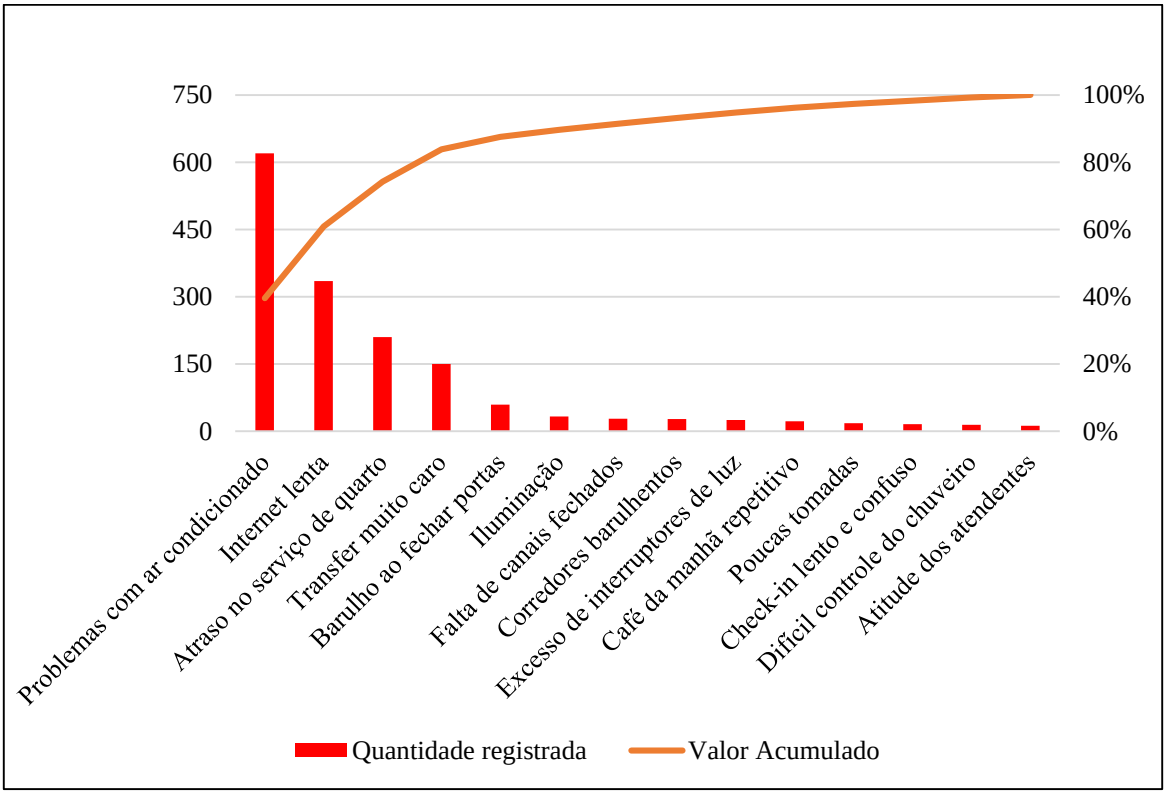
Table.2: Ordered data

Reported Issues	Number of reports	Accumulated value
Problems with air conditioning	620	40%
Slow internet	335	61%
Delay in room service	210	74%
Very expensive transfer	150	84%
Noise when closing doors	59	88%
Lighting	33	90%
Lack of closed channels	28	91%
Noisy corridors	27	93%
Excess light switches	25	95%
Repetitive breakfast	22	96%
Few takes	18	97%
Slow and confusing check-in	16	98%
Difficult shower control	14	99%
Attitude of the attendants	12	100%
TOTAL	**1569**	**100%**

Source: By the author

In the possession of the data properly ordered, there remains the construction of the graph for Pareto Analysis, or Pareto Diagram. For this task, a vertical bar graph is used in this descending order of absolute frequency and a curve is plotted representing the accumulated values of each observation, these being recorded on the secondary axis. Graph 3 represents the Pareto Diagram of this situation.

Graph.3: Pareto diagram of frequent hotel problems



Source: By the author

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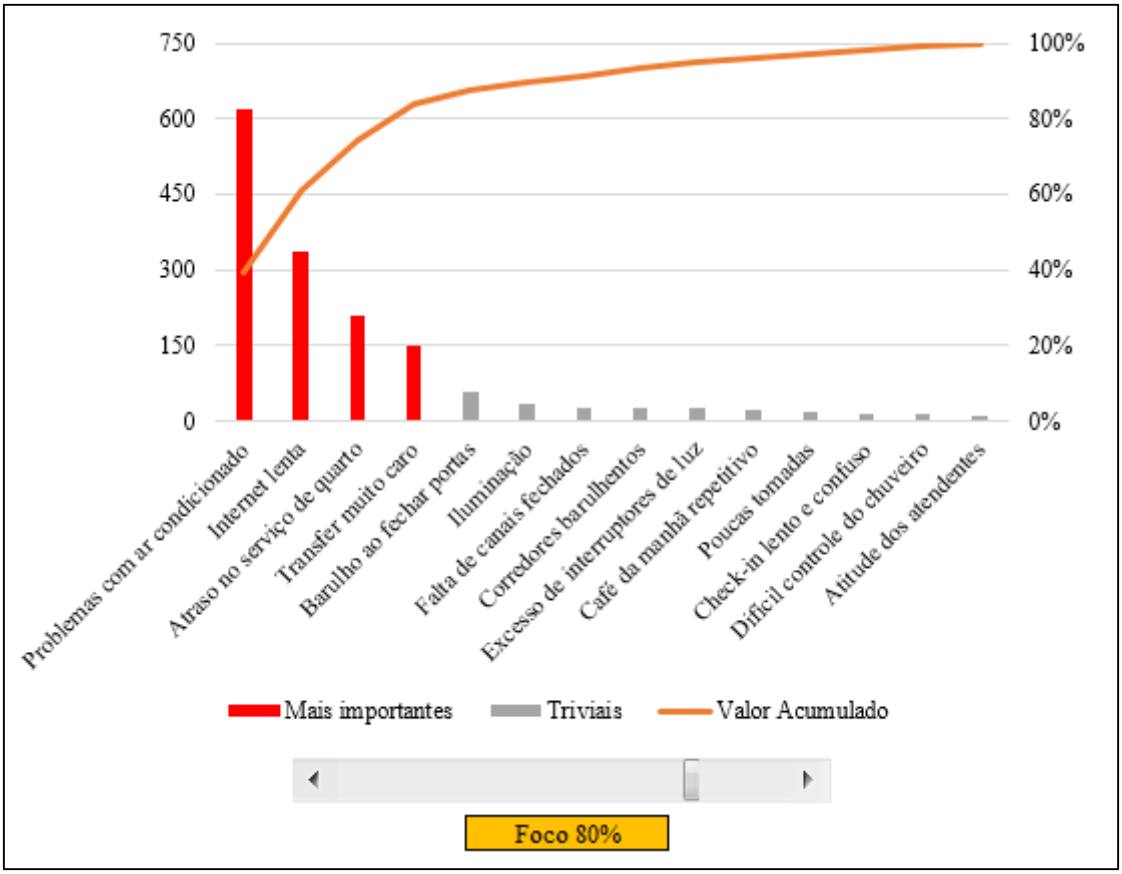
•Problems with air conditioning •Lack of closed channels oning •Slow internet •Delay in room service •Very expensive transfer •Noise when closing doors •Lighting •Lack of closed channels •Noisy corridors •Excess light switches •Repetitive breakfast •Few takes •Slow and confusing check-in •Difficult shower control •Attitude of the attendants

It is possible to notice that, for example, 80% of the frequent problems involve problems with air conditioning, slow internet, delay in room service and very expensive transfer. This information directly supports hotel management where it can work on a small range of issues and still have a big impact on results. However, despite the importance of this diagram in aiding decision-making processes, it in itself can make it difficult to understand and does not provide such "practical" readings to facilitate decision making. Thus, it is necessary to create a tool that makes this process more "practical" and provide the information according to the need and availability of the hotel. This creation characterizes innovation within this context and is exposed in the following section.

5.3 Innovation for managerial control through a tool for Pareto Analysis

Using Microsoft Excel (version 2010 or later) you can create an automated worksheet for calculations and a PivotChart that makes it easy to read. The graph created must have a scroll bar where the decision maker can change the amount of problems that he or she wants to focus on, and the graphical layout should highlight the minority of the items that will be the targets of the improvement decisions. So, for example, if the administrator wants to focus on 80% of the problems presented, he needs only to select this amount of focus, and the most important items that should be focused to achieve what is expected will automatically appear on the graph. The scroll bar serves to simulate the amount of problems that the administrator wants to make their efforts. Figure 3 illustrates this tool created.

Fig.3: Tool created for the Pareto dynamic analysis



Source: By the author

•Problems with air conditioning •Lack of closed channels oning •Slow internet •Delay in room service •Very expensive transfer •Noise when closing doors •Lighting •Lack of closed channels •Noisy corridors •Excess light switches •Repetitive breakfast •Few takes •Slow and confusing check-in •Difficult shower control •Attitude of the attendants

*More important *Trivial *Accumulated value

FOCUS 80%

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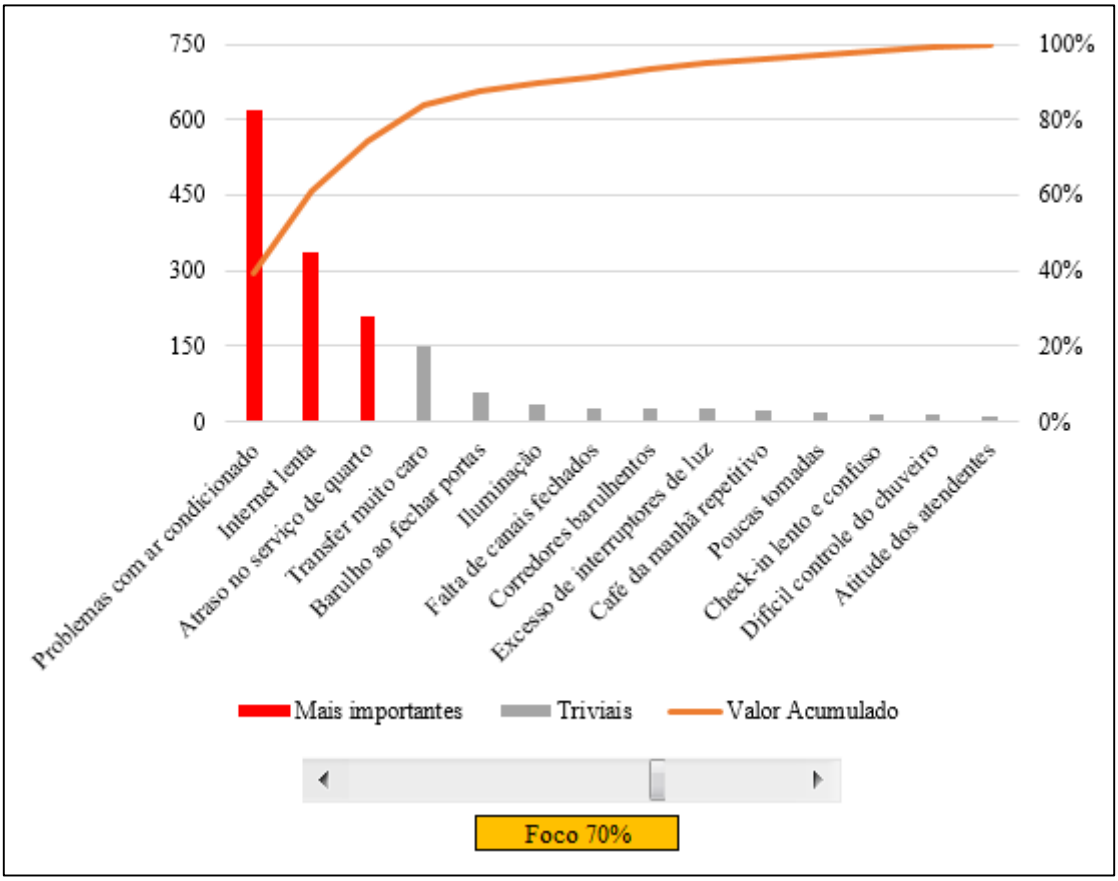
It is observed that the most important items that should be focused on an assumed goal of 80% of the problems are clearly highlighted in the chart. Also, it is noted that the problems that cause less impact (trivial) are highlighted differently from the most important, thus allowing a greater contrast between these two realities. Using the scroll bar you can change this goal according to the reality and strategy of the company, for example, if the administrator finds it convenient to work with a focus of 70% of the problems, it is only necessary to use the scroll bar to select this focus and instantly we obtain the items that should be focused for this new goal, as shown in Figure 4.

Fig.4: Using the tool created



Source: By the author

•Problems with air conditioning •Lack of closed channels •Slow internet •Delay in room service •Very expensive transfer •Noise when closing doors •Lighting •Lack of closed channels •Noisy corridors •Excess light switches •Repetitive breakfast •Few takes •Slow and confusing check-in •Difficult shower control •Attitude of the attendants

*More important *Trivial *Accumulated value

Focus 70%

In this way, it is possible to observe the most important problems that must be focused in order to reach a stipulated goal of improvement and, still, one can perceive those problems that are trivial and do not impact in a significant way in this goal. Pareto analysis then becomes dynamic and fast-viewing, allowing the decision-maker to act with confidence, malleability, and efficiency. In support of this tool is used the Excel worksheet itself as a support to store the data and automate the calculations necessary to obtain the information. Placing the appropriate formulas in cell distributions across the worksheet can minimize efforts with mathematical accounts, allowing anyone to do or simulate an analysis without needing mathematical or statistical knowledge in the area. In fact, there are several combinations of formulas that can be used to achieve the same result, some simpler and some more complex. In this task, the author brings one of the possible ways to configure and automate the Excel spreadsheet and from there create the dynamic tool for Pareto Analysis discussed in Figures 2 and 3. The formatting will be described below and the meaning of the formulas used are shown in Table 5 below and, at the end, the worksheet should be in the molds of Figure 5, being able to differentiate in relation to the number of observations, values or even the layout of preference.

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Table.5: Formulas used

Excel formulas used	Meaning	Mathematical expression
SUM($B$2:B2)/SUM($B$2:$B$15)	$\frac{Accumulated\ Reg.\ Amount}{Total\ Amount} =$ Accumulated value	$\frac{F_{ac}}{F_t} = F_{rac}$
INDEX($C$2:$C$15;SEERRO(CORRESP($B$17;$C$2:$C$15;1);0)+1)	Conditional rounding of the accumulated values (always for the top item)	$Se\ n_a < x \leq n_b$ $x\ assume\ n_b$
SE($B$18>=C2;B2;NA()); SE($B$18<C2;B2;NA())	Condition of numerical existence	$x \in R\ /\ x \geq n$ $x \in R\ /\ x < n$

Source: By the author

	A	B	C	D	E
1	**Problemas observados**	**Quantidade registrada**	**Valor Acumulado**	**Mais importantes**	**Triviais**
2	Problemas com ar condicionado	620	40%	620	#NOME?
3	Internet lenta	335	61%	335	#NOME?
4	Atraso no serviço de quarto	210	74%	210	#NOME?
5	Transfer muito caro	150	84%	#NOME?	150
6	Barulho ao fechar portas	59	88%	#NOME?	59
7	Iluminação	33	90%	#NOME?	33
8	Falta de canais fechados	28	91%	#NOME?	28
9	Corredores barulhentos	27	93%	#NOME?	27
10	Excesso de interruptores de luz	25	95%	#NOME?	25
11	Café da manhã repetitivo	22	96%	#NOME?	22
12	Poucas tomadas	18	97%	#NOME?	18
13	Check-in lento e confuso	16	98%	#NOME?	16
14	Dificil controle do chuveiro	14	99%	#NOME?	14
15	Atitude dos atendentes	12	100,0%	#NOME?	12
16					
17	Foco	74%			
18	Valor Acumulado	74%			
19	Valor do Scroll bar	74			

Source: By the author

Excel Fig.5: Data collected and organized in Excel worksheet

*Problems observed *Quantity recorded *Accumulated value *More important *Trivial
•Problems with air conditioning •Lack of closed channels •Slow internet •Delay in room service •Very expensive transfer •Noise when closing doors •Lighting •Lack of closed channels •Noisy corridors •Excess light switches •Repetitive breakfast •Few takes •Slow and confusing check-in •Difficult shower control •Attitude of the attendants

Focus
Accumulated value
Scroll bar value

Columns A and B refer to the recorded data and must be in descending order of quantities. Column C, which represents the accumulated values of each item of this order, can be easily obtained by the formula "= SUM ($B$2: B2) / SUM ($B$2: $B$15)" arranged in cell C2 and copied to C15. Next, the scroll bar is inserted through the tab path "DEVELOPER - Insert - Scroll Bar", adding the scroll value of the bar with cell B19. The focus, which should be shown as in the example in Figures 3 and 4, being a percentage magnitude, will be the scrollbar value divided by 100, so cell B17 must have the formula "= B19 / 100". In B18 the accumulated value of the item closest to

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the focus for later use as reference in columns D and E must be included, then the formula= $C$2: $C$15; SEERRO ($B$17;$C$2:$C$15; 1); 0) +1) to obtain this value and adapt it to the intervals between observations. Columns D and E must present data that are true for the range proposed in cell B18, with column D for the most important data and column E for the trivial of that interval. In this way, the formula in D must be "= SE ($B$18) = C2; B2; NA ())" disposed in cell D2 to D15, and the formula in E must be = SE$B$18 <C2 ; B2; NA ()) "disposed in cell E2 through E15. Once this is done, the worksheet is ready to finally generate the chart.

The data that the graph requires is contained in columns A, C, D, and E; where in A we have the name of each series, in C if we have the accumulated values that must be shown in a curve in the graph, and in D and E the absolute frequencies that satisfy the interval and that must be arranged in vertical bars in the diagram. By configuring the bars that represent columns D and E with distinct colors, highlighting them from each other, and even organizing the layout of the graph, the tool is created and ready to be used in the molds of Figures 3 and 4.

V. FINAL CONSIDERATIONS

This research sought to study the use of Pareto Analysis in the problems that are observed by the clients of a three star hotel, located in the municipality of Porto Velho, capital of the State of Rondonia. Three specific objectives were established that involved the collection of data, the organization of these for the analysis and the creation of a tool as innovation in this context. From a database system that the company owns, the stored information was collected to be used in the analysis, completing the first specific objective. By grouping these data in the relative order of decreasing frequency and calculating the cumulative values with subsequent creation of the Pareto Diagram, the analysis was performed and thus the second specific objective was successfully completed. As a third and last specific objective, the study concluded that a tool was created that allows a more dynamic analysis of the scenario in which the company is inserted, the latter being disclosed as a proposal of innovation for the institution to carry out its analyzes in a more practical and dynamics, thus forging more efficient decision-making.

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Inverse Kinematics and Trajectory Planning Analysis of a Robotic Manipulator

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Abstract*—In this work, we pretended to show and compare three methodologies used to solve the inverse kinematics of a 3 DOF robotic manipulator. The approaches are the algebraic method through Matlab® solve function, Genetic Algorithms (GAs), Artificial Neural Networks (ANNs). Another aspect considered is the trajectory planning of the manipulator, which allows the user to control the desired movement in the joint space. We compare polynomials of third, fourth and fifth orders for the solution of the chosen coordinates. The results show that the ANN method presented best results due to its configuration to show only feasible joint values, as also do the GA. In the trajectory planning the analysis lead to the fifth-order polynomial, which showed the smoothest solution.*

***Keywords*—Robotic Manipulator, Genetic Algorithms, Artificial Neural Networks, Trajectory Planning, Comparative Analysis.**

I. INTRODUCTION

In the past years, we can found several approaches to the robotics' research field due to its wide-range applications, such as in industrial production, space exploration and medical surgery (Zou, Hou, Fu, & Tan, 2006).Thus, the study and development of mobile robots, e.g. robotic manipulators, became a recurrent theme in engineering.

A key concept in the research of robotic manipulators is the trajectory planning. To reach a determined coordinate with the smoothest sequence of movements in a plausible solution, and the ability to avoid obstacles in the manipulator's workspace are essential tasks in this application (Zou et al., 2006).

Trajectory planning refers to how a robot goes from one location to another in a controlled manner. Composed of straight-line motions or sequential motions, the use of kinematics and dynamics of a robot is required. In comparison to a simple path, its advantage is the possibility of configuring the trajectory for each portion of the motion segments between the points through desired speed and acceleration(Niku, 2010).

A commonly used methodology of movement analysis of a robotic manipulator is the kinematic study. When this analysis is done, the geometric complexity increases if the manipulator present several DOF, mainly if we use the inverse kinematics method.

Thekinematic study is an important aspect of a manipulator calibration.In this way, two models are used, the direct and inverse kinematics. The inverse kinematics, used in this work, exhibit challenge due to its equations are non-linear, the manipulators present elevate DOF, with the possibility of presenting multiple solutions(Nunes, 2016).

Some traditional methods as geometric, algebraic and numerical-interactive are used for inverse kinematics solution and are from inappropriate usage whenever in a complex manipulator structure (Alavandar & Nigam, 2008). In this way, some alternative approaches in solution and ANNs application can be found in the literature. Hence, its effectiveness to understand the manipulator is due to the flexibility and capability of learning through training.

In order to accomplish a desired purpose, a recurrent methodology is the use of redundant manipulators, which present more degrees of freedom (DOF) than required to a specific task. Otherwise, the manipulator's end-effector will not have the necessary accuracy (Xiao & Zhang, 2014).

In this work, for a two-dimensional (2D) space, a 3 DOF robotic manipulator is used to reach desired points within its workspace. Three different methodologies are

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used to solve the inverse kinematics of the manipulator: Geometric Equations System through Matlab® *solve* function, Genetic Algorithms (GAs) and Artificial Neural Networks (ANNs). Thus, the second step is the trajectory planning for a specified point in the manipulator's workspace. In this work, all the manipulator's joints have simultaneous movement in the same crossing time.

Some similar papers can be cited. In work (Tian & Collins, 2004), Tian and Collins propose a GA method for trajectory planning with obstacles in workspace. Polynomials represent the trajectory and are formulated for internal points interpolated with GA parameters. The objective is to search for an optimal solution in the manipulator's workspace.

An intelligent posture calibration method is proposed in (Kuo, Liu, Ho, & Li, 2016) for a robot arm calibration which integrates Particle Swarm Optimization (PSO) and ANN methods. The problem describes an error due to a not ideal mechanism design. The results demonstrated the feasibility and practicability of the proposed method.

In(Savsani, Jhala, & Savsani, 2013), a robotic manipulator trajectory is optimized through Teaching Learning Based Optimization (TLBO) and Artificial Bee Colony (ABC) optimization techniques. The objective was a trajectory planning with less travelling time and distance between joints. The results show better performance of TLBO and ABC in comparison with a GA.

This work is developed as follows: Section II presents the fundamentals of robotic manipulators and the *solve*, GA and ANN techniques. Section III shows the methodology used and the constructive aspects of the studied manipulator. In Section IV, we show and discuss the obtained results for the three approaches, as the trajectory planning for a desired coordinate. Finally, Section V concludes the paper and addresses future works.

II. BACKGROUND

In this section, we present the concepts of robotic manipulators and three polynomial methods used for trajectory planning. In addition, we briefly discuss the GA and ANN techniques used for the manipulator calibration.

1. Robotic Manipulators

Robotic manipulators are devices used in engineering that interact and execute tasks within a workspace, with similar characteristics to the human arms. Several manipulators are installed in industries to handle objects through stations, to welding, assembling *etc*. (Hexmoor, 2013). Fig. 1 shows an example of robotic manipulator with 2 DOF; l_1 and l_2 are the joints' lengths, θ_1 and θ_2 the angles of the first and second joints, and P the desired point.

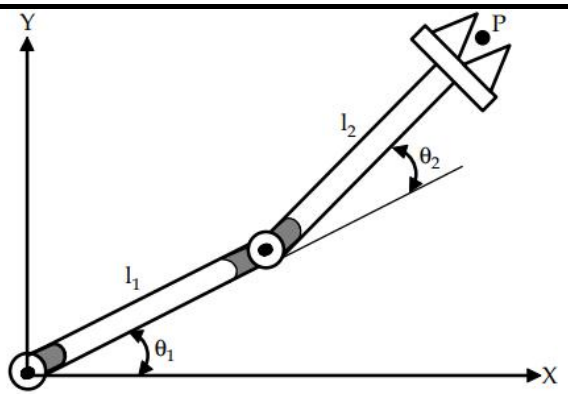

Fig. 1: 2 DOF Robotic manipulator

Robots are unable to respond in emergency situations unless through situation prediction and the response is already included in the system. This scenario divides robotics into the fields of programmed and autonomous robotics. The PUMA, Stanford and others known robots are arms mechanical systems exhibit complex kinematics, static and dynamics, which makes difficult its analysis, control (Niku, 2010)and the interaction between the manipulator and environment (Hu & Xiong, 2018).

With the increase in the use of manipulators, their environments present in several forms. Their interaction with non-static environments led to adaptive manipulator's controllers in order to maintain acceptable performance levels. The applications involve changing loads, varying geometry *etc*.(Zhang & Wei, 2017).

In this way, intelligent systems such as Adaptive Neuro-Fuzzy Inference System (ANFIS), ANNs and GAs have been used in robotics mainly due to the design of autonomous robots and their controllers for unstructured, flexible, and/or partially unknown environments is a very difficult task for a human designer.

Inherent to inverse kinematics is the problem of multiple solutions. In this case, the angles set that lead to the same initial and final points, but with impossible solutions due to the constructive aspect of the manipulator or also through undesirable paths, as also redundant solutions. In addition, the number of possible solutions increases exponentially with increasing DOF.

From the position of origin of a manipulator, i.e. the reference of its base represented by O and the desired position at the other end of the manipulator represented by P, multiple solutions could satisfy the joints' angle configuration. Thus, there are redundancies in the inverse kinematics solution, as shown in Fig. 2, for 2 and 3 DOF manipulators, respectively(Nunes, 2016).

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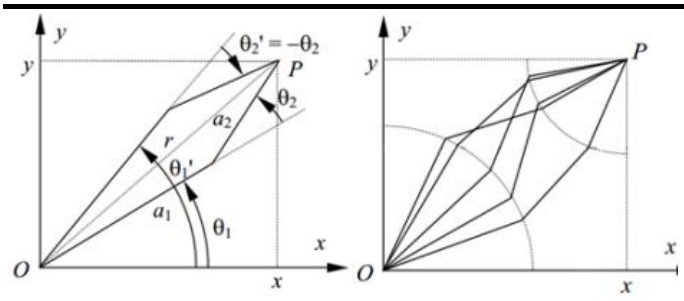

Fig. 2: The problem of multiple solutions

In Fig. 2, θ_1 and θ_2 are the angles of the first and second joints, a_1 and a_2 are the joints lengths and *P* the desired point.

2. Trajectory Planning

The trajectories are composed by a sequence of displacements of a robotic manipulator. It can be seen as a sequence of points in which the end-point must course. Due to the manipulator's discretized movement, we obtain a continuous trajectory. Thus, the trajectory optimization of robotic manipulators is the identification, the optimal combination and the number of intermediary positions (Pires, 1998).

The trajectory planning is presented generally in two forms, the operating space and joint space. In the first one, the trajectory of end-effectors (the manipulator itself) is trivially described. However, it lead to kinematic singularities and manipulator redundancy. In this way, the joint space approach guarantee the smoothness of the joints movement, but reducesthe position accuracy in the operating space. The joint space is the method used in most cases, and the trajectories have been formed by several interpolation functions such as the polynomials used in this work (Huang, Hu, Wu, & Zeng, 2018).

The general form of the polynomials used in the joint space is given as follows. For joints' speed and acceleration, we trivially derive (1) one time for joint speed and again for joint acceleration.

$$\theta(t) = c_0 + c_1.t + c_2.t^2 + \cdots + c_{n-1}.t^{n-1} + c_n.t^n \quad (1)$$

In (1), *t* is the time vector, *θ(t)* represent the angles in time and c_n are the constants associated with the *n*-order polynomial. The *n*-order polynomial enables the user to choose *n+1*specifications, such as initial and final speed and positions, a desired acceleration *etc*.

3. Genetic Algorithms

The development of computational simulations of genetic systems began in the 50s and 60s through many biologists, with John Holland developing the first researches in the area, in 1975 (Holland, 1992). Since then, they have been applied successfully in several real-world search and optimization problems, like regression, feature selection(Kramer, 2017), classification or machine learning (Goldberg, 1989; Pedrycz, Stach, Kurgan, & Reformat, 2005).

GAs are known as a powerful tool for optimization. It is a model designed to emulate natural selection and genetics (Holland, 1992). It has several benefits over conventional optimization methods. The GA use do not require an entire system model, therefore employed trivially to solve optimization problems. According to (Kramer, 2017), GAs are heuristic research approaches applicable to a wide range of optimization problems, which makes them attractive for various problems in practice.

These algorithms are composed of a population of individuals and a set of operators over the population. *A priori*, an initial population consisting of random individuals is selected. Each individual into population represents a solution of the optimization problem, which is coded to the parameter set (chromosome). If the population of individuals is large, the algorithm lacks in efficiency and if it is small GA lacks in diversity.

Posteriori the fitness function is defined. In this work, the Euclidean distance is the fitness function. The individuals are crossed and mutated until the most adequate solution is found. According to the evolutionary theories, through which the GA was developed, the better-adapted individuals to its environment are more likely to survive and reproduce, transmitting their genetic material to the new generations.

In this work, it is used to search for the optimal solution for the inverse kinematics of the manipulator (Tian & Collins, 2004). Fig. 3 show a flowchart used for the GA development (Lopes, Rodrigues, & Steiner, 2013).

In Fig. 3, at first, we generate an initial population of possible solutions. Thus, the individuals are evaluated according to the fitness function. Then, we check if the GA stop criterion was reached: if not, the most adequate individuals are selected through a selection or reproduction method. The selected ones are exposed to the genetic operators (crossing, reproduction, mutation) and a new generation is formed from the previous one. This cycle repeats until the stop criterion is reached. At this moment, the algorithm converges presenting the solution found for the problem (Lopes et al., 2013).

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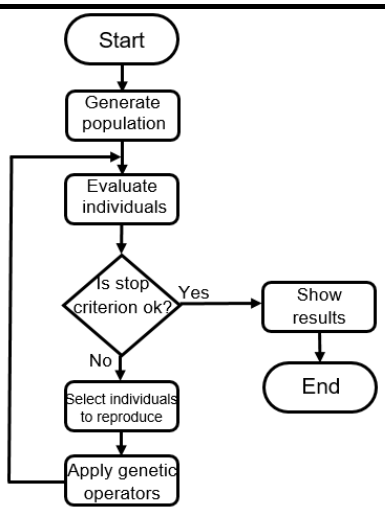

Fig. 3: GA flowchart used

4. Artificial Neural Networks

By a neurobiological analogy, ANNs are based in a fast and powerful brain. In engineering, it as an opportunity to solve complex problems and, to neurobiologists, is a research tool to understand the neurobiology behavior(Haykin, 1998).

The ANNs have a computational power from massively distributed structure and its ability to learn. These two capabilities make it possible for solving complex problems(Haykin, 1998). Thus, ANNs have some capabilities such as nonlinearity, input-output mapping, adaptiveness, evidential response, contextual information, fault tolerance, very-large-scale-integrated (VLSI) implement ability and uniformity of analysis and design (da Silva, Spatti, Flauzino, Liboni, & Alvez, 2017). These concepts are exploited in the next paragraphs.

For nonlinearity, ANNs are a nonlinear structure of artificial neurons distributed throughout the network and are an important figure due to the nonlinearity of input signals(Haykin, 1998).The ANNs also present input-output mapping. The synaptic weighs are modified by training the network with a task-determined number of samples randomly picked in order to minimize de difference between output and desired response. The network learns from the examples as mapping the input-output problem(da Silva et al., 2017).

To become adaptive, an ANN may react at minimum changes in the environment of study causing changing by the synaptic weights. A more robust performance for a non-stationary environment depends on a greater adaptability of the system. However, adaptiveness and robustness are not always proportional. Another aspect of the ANNs is the evidential response. It can provide information about pattern selection and its confidence. The objective is for a better performance and pattern classification(Haykin, 1998).

By meanings of a contextual information,the activation and structure of an ANN define the knowledge which affects all neurons in the network by information dealing. In terms of fault tolerance, anANN is a capable of robust computation by adverse conditions. However, it is uncontrollable and the algorithm must be carefully optimized(Haykin, 1998).

The very-large-scale-integrated (VLSI) technologyimplementability means that some complex behavior tasks are well solved due to a parallel computation by the network. In the feature of uniformity of analysis and design,a notation is used in all domains in a network and manifests through neurons, share of theories and algorithms by many applications, and seamless integration of modules building modular networks(Haykin, 1998).

III. MATERIALS AND METHODS

The first step was to determine the joints' physical limitations. In this case, for all the joints we use a maximum angle of 60º.Then, we generate the point cloud considering the first and second quadrants in the *xy* plane using forward kinematics.

The next step was to choose five test points in order to verify the accuracy of the three methods used to compare them and choose the best method to use in the second phase: the trajectory planning. The point cloud and the test points are shown in Fig. 4. The desired points were (-10,20); (-5,22); (3,25); (10,22); (23,18).

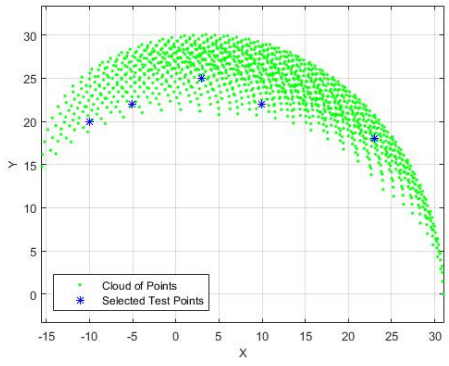

Fig. 4: Point cloud and test points

For the *solve* method, we used (2) to (4) to describe the*(x, y)* positions for each manipulator's joints. Each equation describes one of the DOF of the manipulator, with l_1, l_2 and l_3 being the joint lengths, respectively 7, 10 and 14 cm. $\theta_1, \theta_2$and θ_3 are the angles of joints 1, 2 and 3.

$$X = l_1\, cos(\theta_1) + l_2\, cos(\theta_1 + \theta_2) + l_3\, cos(\theta_1 + \theta_2 + \theta_3) \quad (2)$$

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$$Y = l_1\,sin(\theta_1) + l_2\,sin(\theta_1 + \theta_2) + l_3\,sin(\theta_1 + \theta_2 + \theta_3)(3)$$

$$cos^2(\theta_1) + sin^2(\theta_1) = 1(4)$$

For the GA method, several heuristic configurations were tested for initial number of individuals, mutation rate and tournament size. The worst and best configurations tested are shown in Table 1.

Table.1: GA tested configurations

Configuration	Initial population	Tournament size	Stop error [cm]
1	20	5	0.10
2	50	5	0.05

For both GA configurations used in Table 1, we defined a maximum of 500 generations for convergence, simple cross and a 1% mutation. In this work, the second configuration obtained better results, using an initial population of 50 individuals.

For the ANN method, we used a Multilayer Perceptron (MLP) with an offline calibration (training) process. The input layer is composed of two neurons as*x* and *y* coordinates of the manipulator end-effector. There are 100 neurons in the hidden layer and two in the output layer representing the calibration anglesθ_1, θ_2 and θ_3.

The training algorithm used was back-propagation with Levenberg-Marquardt (L-M) method and the sigmoid was used as activation function for the hidden layer and a ramp for the output layer.A limit of 1000 epochs or a network error in order of 10^{-6} for the convergence of the ANN was defined. After the training step, the MLP is able to generalize the output within the point cloud of the manipulator's workspace.

To compare the three methods used, we use the Euclidean error. However, since the geometric *solve* method is exact in this work, it was inconsiderate in the comparisons made. Its use is justified in Section 4.

For the trajectory planning, we chose the method with the lowest relative Euclidean error at the point that presented the smaller error. In this work, due to the offline calibration, the comparison of algorithms' execution times are not discussed. Thus, we show the performance only for the best method in this case.

Once the method has been chosen, the last step is to execute a trajectory planning using the third, fourth and fifth-order polynomials using (1) as reference. In (5) to (13), θ is the angular position of the joint, $\dot{\theta}$ is the angular speed and $\ddot{\theta}$ the angular acceleration.

The third-order polynomial equations are shown in (5), (6) and (7).

$$\theta(t) = c_0 + c_1.t + c_2.t^2 + c_3.t^3(5)$$

$$\dot{\theta}(t) = c_1 + 2.c_2.t + 3.c_3.t^2(6)$$

$$\ddot{\theta}(t) = 2.c_2 + 6.c_3.t(7)$$

The fourth-order polynomial equations are given by (8), (9) and (10).

$$\theta(t) = c_0 + c_1.t + c_2.t^2 + c_3.t^3 + c_4.t^4(8)$$

$$\dot{\theta}(t) = c_1 + 2.c_2.t + 3.c_3.t^2 + 4.c_4.t^3(9)$$

$$\ddot{\theta}(t) = 2.c_2 + 6.c_3.t + 12.c_4.t^2(10)$$

Finally, (11), (12) and (13) describe the fifth-order polynomial system.

$$\theta(t) = c_0 + c_1.t + c_2.t^2 + c_3.t^3 + c_4.t^4 + c_5.t^5(11)$$

$$\dot{\theta}(t) = c_1 + 2.c_2.t + 3.c_3.t^2 + 4.c_4.t^3 + 5.c_5.t^4(12)$$

$$\ddot{\theta}(t) = 2.c_2 + 6.c_3.t + 12.c_4.t^2 + 20.c_5.t^3(13)$$

In this work, in order to obtain a smooth trajectory for the manipulator we design the polynomials to move all the joints simultaneously. For the three cases, we determined initial and final joint speed and position. In the fourth-order polynomial, only the initial acceleration was controlled, while in the fifth-order one both initial and final accelerations were determined.

It is noteworthy that simulation environment is ideal in this work, in other words, it is noise-free, there are no obstacles in the manipulator's workspace and its weight is not considered for the calculations.

IV. RESULTS AND DISCUSSION

In this section, we present and discuss the obtained results for the three methods used for the solution of the robotic manipulator's inverse kinematics and the methods used for its trajectory planning.

1. Robotic manipulator inverse kinematics

In this comparison step, Tables2, 3 and 4 show the results for *solve*, GA and ANN methods used. In Table 2, we zeroed the error due to its Matlab® value was in the order of 10^{-29}, considered as a memory trash. It is also necessary to point out that in Table 4 the ANN method chosen omits the angles values.

Table 2: Matlab® solver results

P	Desired [cm]		Obtained Angles[°]			Obtained [cm]		Error [cm]
	X	Y	θ_1	θ_2	θ_3	X	Y	
1	-10.00	20.00	1.25	-9.39	65.00	-10.00	20.00	0
2	-5.00	22.00	28.00	64.00	50.00	-5.00	22.00	0
3	3.00	25.00	25.00	47.00	44.00	3.00	25.00	0
4	10.00	22.00	-12.97	5.50	3.58	10.00	22.00	0
5	23.00	18.00	27.38	-10.44	-2.84	23.00	18.00	0

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Table 3: GA results

P	Desired [cm]		Obtained Angles[°]			Obtained [cm]		Error [cm]
	X	Y	θ_1	θ_2	θ_3	X	Y	
1	-10.00	20.00	52.69	45.18	61.29	-10.21	20.45	0.49
2	-5.00	22.00	38.46	47.47	58.00	-5.13	22.56	0.58
3	3.00	25.00	30.20	35.55	54.25	3.15	24.76	0.28
4	10.00	22.00	17.27	26.46	61.47	10.23	22.50	0.55
5	23.00	18.00	5.24	27.53	24.44	22.66	18.19	0.38

Table 4: ANNresults

P	Desired [cm]		Obtained [cm]		Error [cm]
	X	Y	X	Y	
1	-10.00	20.00	-10.04	19.96	0.05
2	-5.00	22.00	-4.97	22.04	0.05
3	3.00	25.00	3.06	25.09	0.11
4	10.00	22.00	9.97	22.02	0.04
5	23.00	18.00	23.15	18.03	0.16

To graphical represent the obtained points, Fig. 5 present the point cloud, desired and *solve*, GA and ANN reached points.

By the analysis of Tables 2, 3 and 4 we conclude that the *solve* method obtained better results in comparison to GA and ANN. However, its present solution is one among several ones, constituting the multiple solution described in first sections. Hence, this method was discarded since the other methods obtained only one solution.

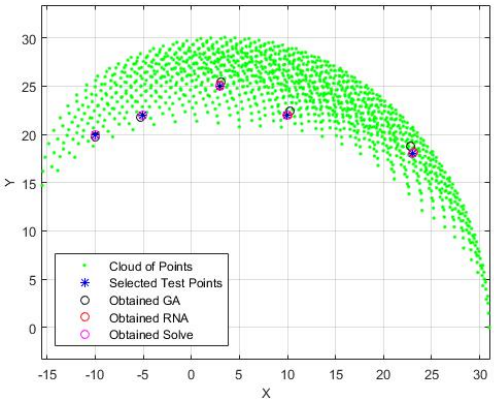

Fig. 5: Point cloud and reached points

Thus, in this case, the ANN presented errors up to ten times lower than the GA approach. Due to that it was chosen for the trajectory planning comparison between the third, fourth and fifth-order polynomials.

2. Trajectory planning

In this step of the work, the trajectory chosen was from the initial point (manipulator in the *x* axis) to Point 2 of Tables2, 3 and 4. The desired trajectory time chosen was 5 s.For all polynomials, we chose initial and final speeds as zero. In the fourth-order one, the final acceleration was designed zero, and in the fifth-order polynomial, both initial and final accelerations are zero.

The angles in discrete time are shown in Tables 5, 6 and 7, respectively for third, fourth and fifth orders. The trajectory planning is shown in Fig. 6. Each joint's angular speed, position and acceleration are seen in Figs. 7(third-order), 8 (fourth-order) and 9 (fifth-order).

Table 5: Third-order polynomial results

Time [s]	θ_1[°]	θ_2[°]	θ_3[°]
0	0.00	0.00	0.00
1	2.88	6.65	5.14
2	9.75	22.50	17.40
3	17.95	41.43	32.04
4	24.82	57.28	44.30
5	27.70	63.93	49.44

Table 6: Fourth-order polynomial results

Time [s]	θ_1[°]	θ_2[°]	θ_3[°]
0	0.00	0.00	0.00
1	5.01	11.56	8.94
2	14.53	33.55	25.95
3	22.73	52.47	40.58
4	26.94	62.19	48.10
5	27.70	63.93	49.44

Table 7: Fifth-order polynomial results

Time [s]	θ_1[°]	θ_2[°]	θ_3[°]
0	0.00	0.00	0.00
1	1.60	3.70	2.86
2	8.79	20.29	15.69
3	18.90	43.63	33.75
4	26.09	60.23	46.58
5	27.70	63.93	49.44

In Tables 5, 6 and 7, we can note that the fourth-order polynomial has the highest acceleration and deceleration. In a real scenario, this fact can cause malfunction and/or damage the motors used to control the joints.

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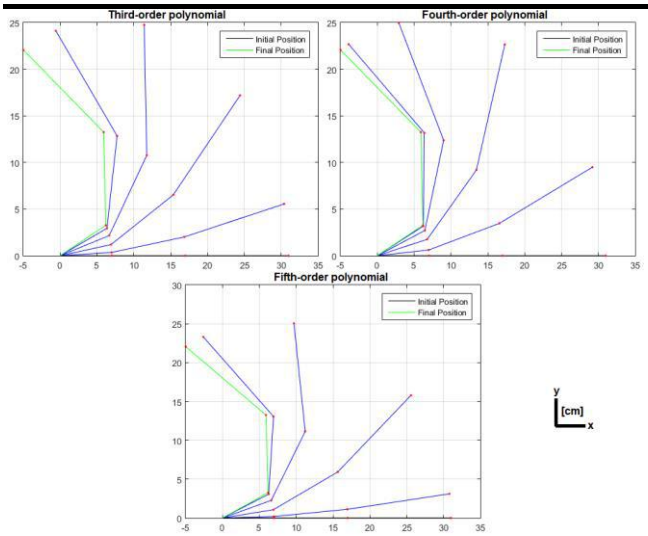

Fig. 6: ANN trajectory planning

In Fig. 6, in its initial position, the manipulator are black and, in the final point, it is green. In its analysis, we can note that third and fifth-order polynomials present higher speeds at the intermediate points of the trajectory, but decelerate in a smaller rate compared to the fourth-order one. Figs. 7, 8 and 9 complement the solution visualization. The *y*-axis represent position (º), speed (º/s) and acceleration (º/s^2) of each joint.

In Fig. 7, the first approach presented a linear response in the acceleration, initiating with high values, which can harm the motors in a possible real application.

As seen in Fig. 8, the fourth-order polynomial present values that, in a real prototype, may harm motors' functioning due to the drastic changes in acceleration and higher speeds in comparison to the other two methods used.

Finally, for Fig. 9, the fifth-order polynomial provides a smooth curve due to its full controllability of position, speed and acceleration, generating a continuous trajectory without discontinuities.

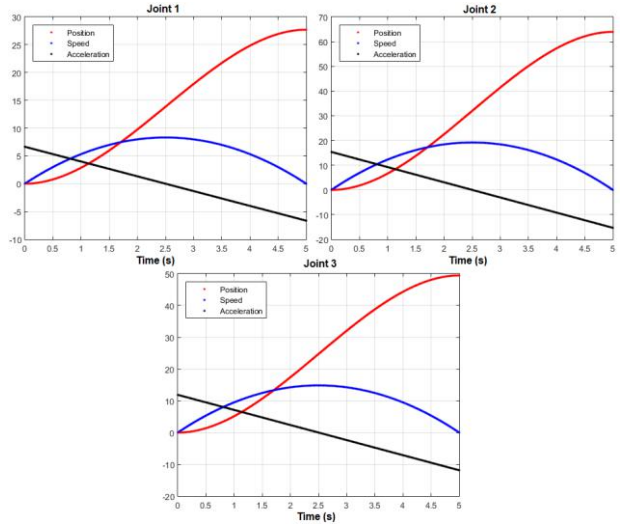

Fig. 7: Third-order ANN trajectory planning

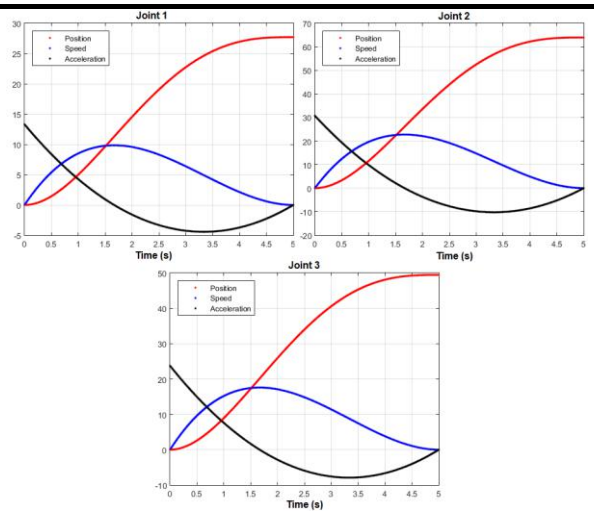

Fig. 8: Fourth-order ANN trajectory planning

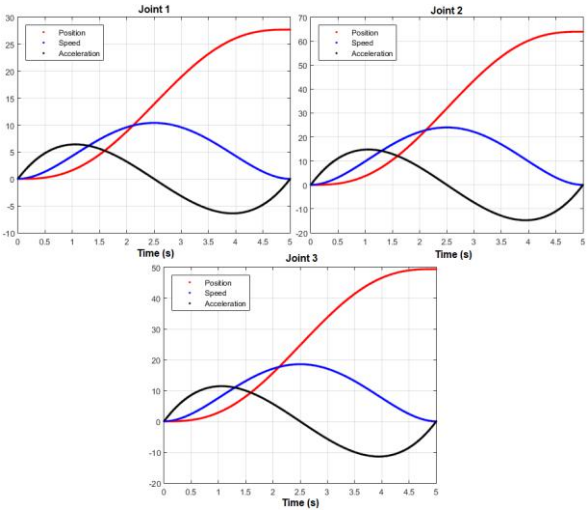

Fig. 9: Fifth-order ANN trajectory planning

V. CONCLUSION

The results provided key-information to future works. Its analysis of the inverse kinematics solution prove that different topologies of MLP can be tested and get feasible results to a three dimensional space and to a more DOF manipulators. It is also noteworthy that this study can be extended to serial and parallel educational and industrial robots.

The fifth-order polynomial trajectory planning results presented the desired smooth curves principally for speed and acceleration, which can be totally user-controlled, that is, assuming values to preserve the components used, e.g. servo or step motors.

This work next step is to use computer vision, through a calibration of a two-camerastereo system in order to use the images to coordinate the robotic manipulator to identify and pick up targets, such as screws, or even execute more complex tasks like welding and cutting operations in three dimensions. The trajectory planning will be done in order to enable the manipulator to avoid

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possible static or dynamic obstacles autonomously, using intelligent systems like Fuzzy and Fuzzy Cognitive Maps (FCM) to the decision-making.

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The Influence of Organizational Culture on Employees Performance at Cv. Putra Saleh Anugrah in District Samosir

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Abstract— *This study aims to determine and analyze the influence of organizational culture on employee performance at Cv. Putra Saleh Anugrah of Samosir Regency. Data analysis method is used simple correlation analysis method, simple linear regression analysis and t-test. The population and sample of this research are all employees at Cv. Putra Saleh Anugrah in Samosir regency with the total number of sample were 25 employees. Based on research analysis, it was found that* r_{caunt} *= (0,936)>* $r_{table=}$ *(0,413), it concluded that there is a significant relationship between Organization Culture (X) with Employees' Performance (Y) at Cv. Putra of Saleh Anugrah of Samosir Regency. The regression equation is Y = 0.299 + 1.184X. The significance of variable correlation is equal to 12,724. Then the value is compared with* t_{table} *with the error rate 5% df = n-2 = 23. The value of* t_{table}*= 2.069. In accordance with the requirements of hypothesis testing that* t_{caunt} *= (12.724)>* t_{table} *(2.069) it is concluded that Organizational Culture (X) has a positive and significant effect on Employee Performance (Y) at Cv. Putra Saleh Anugrah Samosir District, hence the research hypothesis accepted.*

Keywords— Organizational culture, Employee Performance*.*

I. INTRODUCTION

Organizational culture is a system of spreading trust, and values that develop within an organization and direct the behavior of its members. Organizational culture can be an instrument of a major competitive advantage, in which an organizational culture supports an organizational strategy, and an organizational culture can answer or address environmental challenges quickly and appropriately. Organizational culture affects all aspects of organizational life such as affecting employees' task satisfaction. Organizational culture not only affects the members of the organization in acting, but also how they communicate, and behave in working. Organizational culture is one factor that can affect employee performance. The linkage to performance can be seen that culture creates high motivation and job satisfaction within the employees that will ultimately make the employees work earnestly, responsibly, and they will work in accordance with the existing organizational culture values system. The organizational culture is very important to be socialized for every member of the organization to make them be a good member of the organization, so that they do not feel strange to the situation and culture owned by the organization. In this case, the member of the organization is the person who carries out a series of activities in the organization. The way an employee carries out a task affects its performance, and ultimately influences the performance of the organization in which he or she performs. Performance itself has various characteristics, such as productivity, cost efficiency, work-time efficiency, and quality of work. Mondy, et al states (1995), employee performance can be seen from time standards, productivity standards, and cost standards. This research, cost standard is not applied, because the field under study does not use the cost in the work systems. Referring to the introduction, the author is interested in conducting a research entitled "The Influence of Organizational Culture on Employee Performance at Cv. Putra of Saleh Anugrah in Samosir Regency.

The Problem of the Research

Based on the background, the research problem is formulates as follow; Does organizational culture influence on employee performance at Cv. Putra Saleh Anugrah in Samosir Regency?

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The Objective of the Research

The objective of this study is to find out the influence of organizational culture on the employee performance at Cv. Putra Saleh Anugrah in Samosir Regency.

II. LITERATURE REVIEW

Some definitions of organizational culture by experts, according to: Moeljono (2003) states that *"budaya korporat atau budaya manajemen atau juga dikenal dengan istilah budaya kerja merupakan nilai-nilai dominan yang disebar luaskan didalam organisasi dan diacu sebagai filosofi kerja karyawan"* "corporate culture or management culture or also known as work culture, it is the dominant values that are disseminated within the organization and referred to as employee work philosophy. Susanto (1997) argued that *"budaya organisasi sebagai nilai-nilai yang menjadi pedoman sumber daya manusia untuk menghadapi permasalahan eksternal dan usaha penyesuaian integrasi ke dalam perusahaan sehingga masing-masing anggota organisasi harus memahami nilai-nilai yang ada dan bagaimana mereka harus bertindak atau berperilaku"* "organizational culture as the values that guide human resources to face the external problems and business adjustment integration into the company so that each member of the organization must understand the values that exist and how they should act or behave " Robbins (2002) defines *"bahwa sebuah sistem pemaknaan bersama dibentuk oleh warganya yang sekaligus menjadi pembeda dengan organisasi lain"* "organizational culture as a system of shared meanings embraced by the members which differentiate the organization from other organizations " in addition, Robbins (2002) says *"bahwa tiap karakteristik ini berlangsung pada suatu satu kesatuan dari rendah ketinggi"* "that each of these characteristics takes place on a single entity from a low to high". By assessing the organization based on its seven characteristics obtain a compelling picture of organizational culture. This picture forms the basis for shared feelings shared by members about the organization, how the affairs are resolved within, and the way members are expected to behave.

The Function of Organizational Culture

In adapting to the external environment and sustaining its survival, as well as in carrying out internal integration, the culture performs a number of functions to address organizational member issues to adapt to the external environment by strengthening the understanding of members of the organization, the ability to realize against the mission and strategy, goals, ways, size and evaluation. Culture also serves to overcome internal integration issues by increasing the understanding and ability of the organization's members to speak, communicate, deal or internal consequent, its power and rules, the relationships of organizational members (employees), as well as rewards and sanctions (Schein, 1992). Culture can be used as a source of inspiration, pride and resources that are then directed to become a driving force so as to produce an ability to form value added. Culture as a pattern of behavior is a picture of behavior, the behavior of members of the organization into a pattern. Then the patterned behavior is inherited to their children and grandchildren. Culture can also be used as a substitute for formalization, in which, the rules of association among fellow members of the organization are formed because of the habits that are mutually agreed as the rules that are not written. By the culture, it can be used as a mechanism of adaptation to the changes taking place. Robbins (2002) explains *"fungsi budaya organisasi berperan menetapkan batasan, menetapkan perbedaan yang jelas antara satu organisasi dengan lainnya, dimana ini bisa membawa suatu rasa identitas bagi para anggota, sehingga budaya mempermudah timbulnya komitmen pada sesuatu yang lebih luas daripada kepentingan individu"* "the function of organizational culture has a role to set limits, establish clear distinctions between one organization and another, which can bring a sense of identity for members, so that culture facilitates commitment to something wider than individual interests. By culture, the social system in the member society of the organization becomes steady and becomes social glue that helps unify the organization by providing the right standards for what employees should say and do. Culture also serves as a mechanism of meaning and control that guides and shapes attitudes and behaviors of employees. The varieties of cultures and its distinctive features are formed due to the influences of beliefs, attitudes, social relationships and solidarity of its members, it creates a distinct and unique type of culture among organizations with each other, in research Goffe & Jones in Robbins (2002) identifies four unique of cultural types:

a. Culture Network (high on social relations, low on solidarity)

This organization sees its members as friends and family. Members of the organization know and love to provide assistance to others and provide open information. The dominant negative aspect of this model of culture is the focus on friendship but gives the effect of tolerating low performance and the occurrence of political play.

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b. Wage culture (low on social relations, high on solidarity)

This organization is really focused on the goal. Members of the organization are required to be goal-oriented. They have to do everything quickly. Focus on objectives, in which objectives can reduce the political factor. The impact of this cultural treatment is the lack of humane treatment on members of low performing organizations.

c. Culture Fragment (low on social relations, low on solidarity)

This organization is created individually. Commitment is an important factor placed on the first element in all members of the organization and on the job task. The member of organizations are required to be productive and oriented to the quality of work. The dominant impacts that occur in organizational culture like this are mutual criticism among members and less closely the relationships between members of the organization.

d. Communal culture (high on social relations, high on solidarity)

Assessments on friendship and performance, the members of the organization have a feeling of belonging but remain focused on achievement. The leaders of this organizational culture are very inspiring and charismatic with a clear vision for the future of the organization, but in organizational culture like this, a charismatic leader produces more pupils than followers, so the working climate is the occurrence of worship of its leader.

So, there are two dimensions that underline the organizational culture, first called social relations (sociability) is a measurement of friendship. Social relationships relate to a high orientation on human relationships, team orientation, and focus on process rather than outcomes. While the second is called solidarity, it is a measurement on task orientation associated with high attention to detail and high aggressiveness.

Formation of Organizational Culture

According to Robbins (2002), the culture of the organization does not form by itself, but the organizational culture is derived from the philosophy of its founder, then the unique culture influences the criteria used to employ employees, all actions of top management determine the general climate of acceptable and unacceptable behavior, then, it is socialized, in which success rates are achieved in matching the values of new employees with the organization in the selection and preference of top management.

Understanding Performance

Performance *"kinerja"* is a word in Indonesian from derived from the base word "*kerja*" that is translated to a foreign language of achievement or results. Performance in the organization is the answer to the success or failure of the organizational goals that have been established.

Performance can be interpreted as the importance of a job, the level of skill required, progress and degree of completion of a job (Panggabean, 2002: 74). Meanwhile, according to Mangkunegara (2000: 67) *"Kinerja adalah hasil kerja secara kualitas dan kuantitas yang dicapai oleh seseorang karyawan dalam melaksanakan tugasnya sesuai dengan tanggung jawab yang diberikan kepadanya"* "Performance is the result of a work in quality and quantity achieved by an employee in performing his duties in accordance with the responsibilities given to him".

According to Miner (1990), performance is how someone is expected to function and behave in accordance with the tasks assigned to him. Any expectation of how one should behave in carrying out a task implies a role in the organization. An organization, both governmental organizations and private organizations in achieving the objectives set out, must be through means in the form of an organization that is driven by a group of people who play an active role as actors in an effort to achieve the goals of the institution or organization concerned (Prawirosentono, 1999). Performance according to Irianto (Sutrisno, 2010) is the achievement that someone gained in doing the task. Hasibuan (2001: 34) argues that *"Kinerja adalah suatu hasil kerja yang dicapai seseorang dalam melaksanakan tugas tugas yang dibebankan kepadanya yang didasarkan atas kecakapan, pengalaman dan kesungguhan serta waktu"* "Performance is a result of work achieved by someone in carrying out tasks assigned to him based on skills, experience and seriousness and time". According to Rivai (2004: 309) *"Kinerja merupakan perilaku yang nyata yang ditampilkan setiap orang sebagai Kinerja karyawan yang dihasilkan oleh karyawan sesuai dengan perannya dalam perusahaan"* "Performance is a real behavior displayed by every people, as employee performance is generated by employees in accordance with its role in the company ". From the statements given, it can be concluded that the performance is the level of achievement of results associated with the vision carried by the organization or company.

Factors Affecting Performance

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The quality of work of employees directly affects the performance of the organization. Achieving optimal employee contribution, management must understand in depth the strategy to manage measure and improve performance.

According Mangkunegara (2000: 27) there are several factors that affect performance:

a. Capability factor

Psychologically, the ability of employees consists of the potential ability (IQ) and the ability of reality (education). Therefore, employees need to place on work in accordance with his or her skill

b. Factors of motivation

Motivation is formed from the attitude of an employee in facing the work condition. Motivation is a condition that moves employees directed to achieve the purpose of work. Mental attitude is a mental condition that encourages someone to try to achieve maximum job potential. Based on the above definition, the author draws the conclusion that performance is the quality and quantity of an individual or team-work out put in a particular activity caused by the natural ability or ability derived from the learning process and the desire to perform.

Performance assessment

Performance appraisal is the process of measuring employee performance. Performance appraisal is an oversight of one's qualities, in which, it is an organization's process of evaluating or assessing employee performance. Performance appraisal generally covers both qualitative and quantitative aspects of job performance.

According to Mathis (2002:81) *"Penilaian kinerja adalah proses evaluasi seberapa baik karyawan mengerjakan pekerjaan mereka ketika dibandingkan dengan satu set standar dan kemudian mengkomunikasikan informasi tersebut"* "Performance assessment is the process of evaluating how well employees do their work compared to a set of standards and then communicating that information".

Performance assessment can occur in two ways:

a. Informally
b. Systematically

Informal assessments are conducted at any time in which the employer feels the daily working relationships between managers and employees that provide an opportunity for employee performance to be assessed. This assessment is communicated through conversations during work, at leisure, or during examination of specific administrative work at the workplace. An informal assessment is well worth using especially if time becomes the point. The longer a feedback is delayed, the less likely it is to motivate a behavioral change. Frequent informal feedback to employees can also prevent surprises when formal appraisals are communicated.

According to Heidrahman and Suad Husnan (2000: 126) performance factors that need to be assessed are as follows:

a. The Quantity of Work

The number of work results in accordance with the existing working times, which need to be considered, not the routine results but how fast the work can be completed.

b. The Work quality

Quality of work based on established standards. Usually measured through accuracy, skills, and cleanliness of the work.

c. Reliability

Whether or not a dependable employee is able to meet or follow instructions, initiatives, caution, diligent, and cooperation.

d. Initiative

The ability to recognize problems and take corrective action, provide suggestions for upgrading and accepting solving responsibilities.

e. Diligent

Willingness to perform tasks without coercion and also as a routine.

f. Attitude

Employee behavior towards company, employer or co-worker.

g. Presence

The existence of employees in the workplace to work in accordance with the time / hours of work that has been determined.

The Benefits of Performance Assessment

From the employee's point of view, performance appraisals are useful for giving employees the information of how he/she has done the job and knowing his weaknesses, it also informs what to do next to change work behavior in order to estimate the likelihood of getting compensation, determining a salary increase, determining the sequence of employee dismissals, determining the virtues of rank and promotion, helping to plan the training program as well other more rising rewards in the future.

According to Tulus (2005:127) the point of view of the performance appraisal institution has four benefits:

a. "To obtain a basis for promotional decision making, transfer, demotion or demotion and termination of employment.

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b. As a criterion for the validity of selection tools and training programs.
c. To allocate rewards to employees.
d. To ensure feedback for individuals who can support their development and careers and thereby ensure the effectiveness of institutions "

Performance Elements

According to Siswanto (2005: 194) the assessor should establish an assessment whereby the assessment criteria include in the elements of the performance:

a. Cooperation
b. Responsible
c. Discipline
d. Leadership
e. Work quality

Hypothesis

Based on the problems formulated, the hypothesis is "Organizational culture has a positive and significant effect on employee performance at Cv. Putra of Saleh Anugrah in Samosir Regency.

III. RESEARCH METHODOLOGY

Sugiyono (2005: 72) Population adalah "wilayah generalisasi yang terdiri dari objek/subjek yang mempunyai kualitas dan karakteristik tertentu yang ditetapkan oleh peneliti untuk dipelajari dan kemudian ditarik kesimpulannya (generalization region consisting of objects / subjects that have certain qualities and characteristics set by researchers to be studied and then drawn conclusions) The population in this research is all employees at Cv. Putra Saleh Anugrah in Samosir regency with total number of sample was 25 employees. Sugiyono (2005: 83) *"Sampel adalah bagian dari jumlah dan karakteristik yang dimiliki oleh populasi tersebut (*The sample is part of the number and characteristics possessed by the population) Sample determination technique used in this research is saturated sampling technique. All members of the population are used as samples. So, the samples in this study were 25 employees. Data collection technique used was the observation and questionnaire. The method of analysis used was Simple Regression Analysis, Significance Analysis of product moment coefficient correlation (t-test).

IV. RESULT AND DISCUSSION

Correlation Coefficient Analysis

Calculation of correlation analysis was done by considering the questionnaire of each variable.

Table.1: Correlation Coefficient

		X	Y
Pearson Correlation	Y	1.000	.936
	X	.936	1.000
Sig. (1-tailed)	Y	.	.000
	X	.000	.
N	Y	25	25
	X	25	25

Based on table, comparing r_{caunt} for decision which r_{table} obtained equal = 0,413. Based on the above data then r_{caunt} = (0.936)> r_{table} = (0,413) concluded that there is significant relationship between Organization Culture (X) on Employee Performance (Y) at Cv. Putra of Saleh Anugrah in Samosir Regency.

Simple Linear Regression Analysis

To analyze the influence of Organization Culture (X) on Employee Performance (Y) at Cv. Putra Saleh Anugrah Samosir regency, it is necessary to calculate the regression analysis. By using SPSS program version 16.0.

Table.2: Coefficients

Model		UC		SC		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	.299	2.466		.121	.905
	Organizational culture	1.184	.093	.936	12.724	.000

a. Dependent Variable: Employee performance

Based on the table obtained a simple linear regression equation as follows:

Y = a + bX
= 0.299 + 1.184X

The above regression equation was explained that if Organizational Culture or X = 0, then the value of Employee Performance or Y= 0.299.

Hypothesis testing (t-test)

To test the hypothesis, t-test was used to know the extent of significance influence of variables. The result of hypothesis testing partially using SPSS version 16.0 as follows:

Based on the table. 2 above obtained variable correlation significance are equal = 12.724. Then the value was compared to r_{table} with the error rate 5% df = n-2 = 23. The

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value of t_{table} = 2.069. In accordance with the terms of testing hypothesis that t_{caunt} = (12,724)> t_{table} = (2.069) concluded that Organizational Culture (X) has a positive and significant influence on Employee Performance (Y) at Cv. Putra Saleh Anugrah in Samosir Regency. Research hypothesis is accepted.

V. CONCLUSION

After Analyzing data the following conclusions are derivided.

a. The data obtained from the questionnaires distributed to the sample of 25 people, it was obtained that the results r_{caunt} = (0.936)> t_{table} = (0.413) concluded that there is a significant relationship between Organizational Culture (X) with Employee Performance (Y) at Cv. Putra of Saleh Anugrah of Samosir Regency.
b. The regression equation is Y = 0.299 + 1.184X. The above regression equation explained that if Organizational Culture or X = 0 then the value of Employee Performance or Y = 0.299.
c. The significance of variable correlation is equal to 12,724. Then the value is compared t_{table} with the error rate 5% df = n-2 = 23. The value of t_{table} = 2.069. In accordance with the requirements of hypothesis testing that t_{caunt} = (12.724)> t_{table} = (2.069) can be concluded that Organizational Culture (X) has a positive and significant effect on Employee Performance (Y) at Cv. Putra Saleh Anugrah Samosir District, hence the research hypothesis is accepted.

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Remote Sensing analysis of the meanders migration in the Mamorecillo River between 1985 and 2012, Bolivia

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Abstract *— The morphology of a channel, in a space-time resolution, suffers with sedimentological processes of erosion, transport and deposition. Processes that are more accentuated in meandering channels. In the present work the objective is to analyze, identify and discuss the changes occurred in spatial and temporal sequence in the form of the meanders and river bed of a section of the Mamorecillo River between the provinces of Cochabamba and Santa Cruz - Bolivia. Characterized by being an extensively meandering river - characteristic of the river basin in which it is inserted, the Amazon Basin, the present study, through remote sensing resources, seeks to discuss and correlate the changes occurred in the channel in a period of twenty-seven years (1985-2012). As well as understanding the processes of migration of the meanders that this section of the Mamorecillo River suffered through the sedimentological processes of erosion and deposition and consequently understand the processes in the Amazon basin. For the accomplishment of the work, the studied area was delimited and allied with geoprocessing tools such as software and aerial images, the main geomorphological features were identified and their changes discussed during the studied period. In this work, we intend to correlate and verify the inter-dependence (referring to the sedimentological and / or hydrological contribution) that exists between the Mamorecillo River and the Chimoré and Ichilo rivers.*

Keywords— Amazon Basin, Fluvial Dynamics, Meanders Migration, Hydromorphology.

I. INTRODUCTION

To understand and comprehend how rivers operate and, also how changes on their river bed form are fundamental for the use and occupation of their surroundings, especially in the development of activities such as agriculture, livestock, industrialization and urbanization. In this way, the present study achieved an analysis on the change of meanders in a certain area of the Mamorecillo River.

Christofoletti (1977) emphasizes the river dynamics as the removal, transport and deposition of sediments that are in particular network drainage and that directly reflects on the stability of the river system. Therefore, when disturbances occur in the system, the channel will adjust or readjust until it finds a new balance point. Fluvial dynamics with channel mobility and registration on the flatland, paleochannel and flood basin include temporal and spatial variation. In this case, covering the influence of the hydrological and sedimentary regime (Gilvear et. al. 2000; Zancopé et al. 2009; Micheli & Larsen, 2011; Kiss & Blanca, 2012).

Suguio & Bigarella (1990) characterize in a geological-morphological sense a river as the main "trunk" of a drainage system, represented by a water body confined in a channel (whether this water body is feed by precipitation, groundwater and / or other means)

Currently, several authors classify water courses as intermittent, perennial or ephemeral. The intermittents are those bodies of water that usually flow during the rainy season (i.e. the flood period) and dry up during the dry season. While courses classified as perennial has water throughout all the year, the groundwater usually feeds the channel continuously while the ephemeral channels only run during or slightly after the rains (Suguio & Bigarella, 1990, Carvalho & Silva, 2006)

The usage of classifications such as: rectilinear, meandering, anastomosed and interlaced to distinguish between channels is current. Thus, straight channels are less frequent and are only restricted to a few drainage segments, while anastomosed channels are marked by constant ramifications and subsequent re-encounters with their courses. A channel excessively marked by sinuosity is called a meandering channel. In these channels, the curves become so sharp over time that they meet each other - forming abandoned meanders. The

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interlacing is characterized by the presence of small islands between two or more channels with bars (Suguio & Bigarella, 1990, Riccomini et al., 2000).

Goerl et al. (2012), assumes that water acts as the principal modeling agent of the landscape. While Scheidegger (1973) apud Goerl et al. (2012) studies about forms that are caused by the water action according to a hydrogeomorphology definition.

In relation to the morphology of the river channels, it's controlled by several factors, which are classified in a very complex relationship as autocyclic (i.e. drainage network) and allocyclic (those that affect not only the basin but the region where it is inserted as a whole). The autocyclic factors considered are: the discharge (type and quantity), the transported sediment load, channel width and depth and the flow rate consecutively conditioned to allocyclic factors, for example, climatic and geological variables (Temperature, evaporation, precipitation, type of rock/substrate and faults) (Riccomini et al., 2000).

Alterations in meandering fluvial channels will rarely produce immediate responses. Modifications are perceived over time (Brookes, 1996). The meanders evolution and their form variation in a time scale, are characterized by the channel's migration in the plain, increasing the sinuosity index of the meander, which causes the adjacent meanders union provoking the bottleneck of the peduncles. The meanders compose a pattern where suspended and bottom loads are bordering on equivalent quantities of continuous and regular flow. They acquire this feature by crossing plain landform, where the low slope and the small velocity of flowing water creates more accentuated deviations (Christofolleti, 1981, Zancopé et al., 2009).

The changes on the river forms, mainly the migration of meandering channels, occur due to the continuous processes of excavation and deposition in its concave and convex margins, respectively. This process leads to an adjustment of the river in search of a new equilibrium (Hack, 1973, Ouchi, 1985, Gregory & Schumm, 1987).

In view of rivers as responsible for process such as erosion, transport and deposition of sediments, these processes will determine along with other factors, the geomorphologic features of the river itself (Candido, 1971, Zancopé et al., 2009). Factors such as: basin area, basin slope, the river's flow rate and drain volume are few among many factors that accentuate and / or intensify the geomorphological changes and river dynamics. Therefore, rivers behave as natural agents of transformation and modification in the space where they are inserted. In this sense, studies in the Andes-Amazon Basin has been intensified in the last decades (Do Nascimento et al., 2015, Dunne et al., 1998, Salo et al., 1986, Peixoto et al., 2009, Constantine et al. Atya et al., 2003).

The fraction under study of the Mamorecillo River, is characterized by an extensively meandering channel. Meandering rivers are characterized by presenting themselves with an extremely numerous amount of successive curves in their channel/course. Erosion and deposition processes act in order to accentuate this sinuousness present in the channel, even reaching the point of bottleneck adjacent meanders, forming the so-called abandoned meanders (Christofoletti, 1980, Zancopé et al., 2009).

Channels with meandering patterns are relatively common throughout the entire Amazon basin. They are typically characterized by being in alluvial plain, that is, where the landform is topographically mature. Although, due to geological factors such as faults, this drainage pattern can occur in topographically distinct regions.

Geotechnologies have become great allies for professionals and researchers in the area of Earth Sciences, allowing data acquisition to occur very quickly and safely. Studies of digital cartography, remote sensing, satellite positioning and aerial photogrammetry are the result of technological advent applied on Geosciences. As a consequence, it helped the development of this work by monitoring and evaluating the mobility of the channel with meandering pattern as well in the river dynamics of the Mamorecillo River in a period of twenty-seven years, between 1985 and 2012.

In this context, this study aimed to analyze in a temporal sequence the river dynamics, that is, the change that occurred during approximately two and a half decades in a section of the Mamorecillo River located between the departments of Cochabamba and Santa Cruz, Bolivia. In this study besides the main purpose of understanding and studying the hydrodynamic processes of the channel, the study also highlights the importance of geotechnologies in the aid of Geosciences research.

II. THE MAMORECILLO RIVER

The studied area is located in the Amazon's river watershed and it is held nearby the confluence of Chimoré and Ichilo rivers (Fig. 1). The Mamorecillo River shows a meander pattern, sinuosity of the channel (<1.5), and a predominance of suspension sediments transportation that currently form the alluvial plains (Lombardo et al., 2012, Lombardo, 2014, Hanagarth, 1993). The analyzed area has a total of approximately 39 km of extension (in a straight line), between the geographical coordinates 16°44'27" - 16°26'12" south latitude and 64°50'37" - 64°40'44" west longitude.

Climate changes can affect the river patterns since they have a directly affect in the magnitude and frequency of flows. The Mamorecillo River suffers direct influence of

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the El Niño cycle (Aalto et al., 2003) causing small floods and low sedimentation rate. The La Niña cycle, on the contrary, causes great floods and higher sedimentation rates (Aalto et al., 2003, Schöngart & Junk, 2007). Therefore, the river consequently adjusts itself to the process of erosion, transport, and deposition.

The Mamorecillo River meets with Ypacani River and at the end of this course of approximately 260 kilometers, its meets with Chaparé River still on the border between the departments of Cochabamba and Santa Cruz, Bolivia. From this confluence between Chaparé and Mamorecillo rivers, the Mamoré River is born, comprehending the second and most important precipitation of the southern Andes (Espinoza et al., 2015).

The Madeira River has its origins related to the Mamorecillo River, exhibiting an extension of approximately 1100 km running through an expressive part of the Bolivian territory in North direction until its confluence with Beni River in order to form the Madeira River. During the lower and middle Holocene (Plotzki et al., 2013) the Mamoré river advanced and occupied one of the paleochannels of Beni's River. However, since the Middle Holocene, one of its alluvial distributary systems deposited thick sedimentary layers at the south and central part of Llanos de Moxos (Lombardo, 2014, Plotzki et al., 2015).

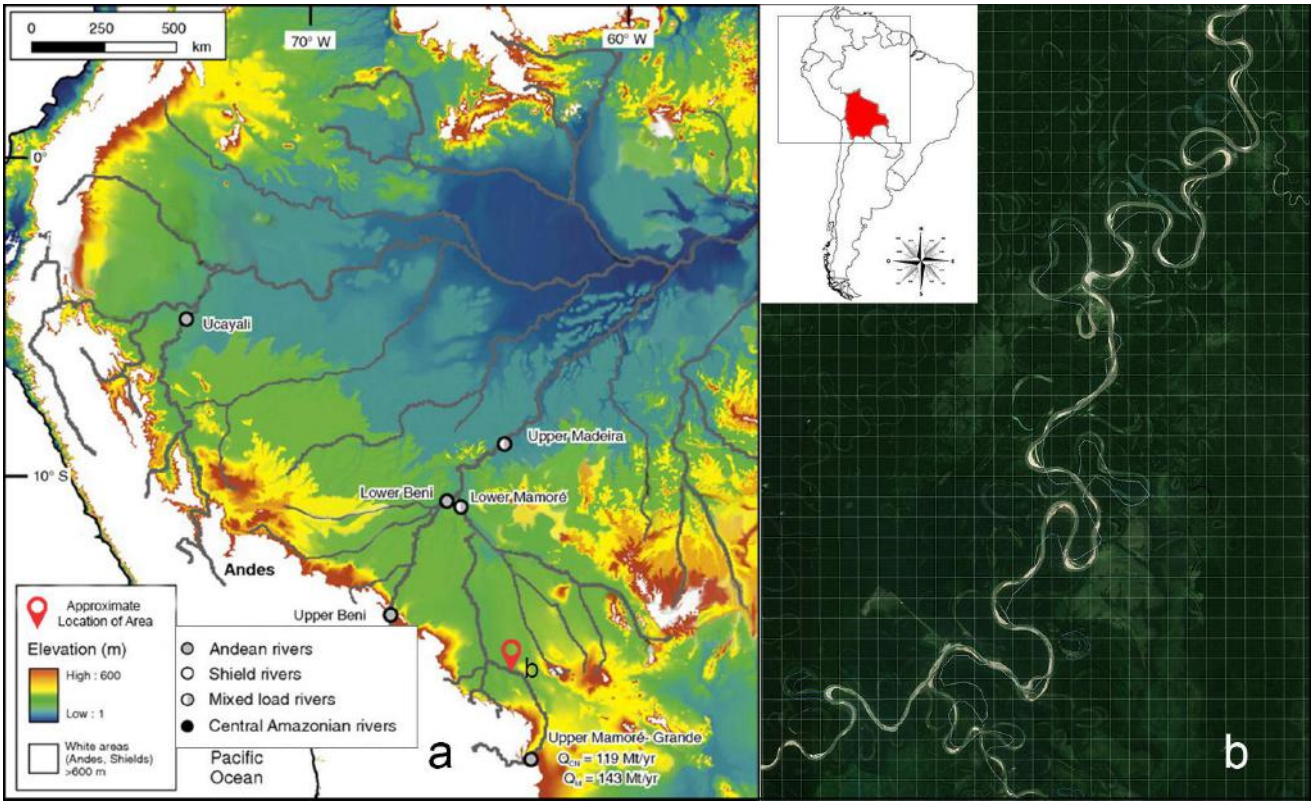

Fig. 2: a) Localization map of the studied area (Adapted from Wittmann et al., 2011) and, b) Studied area detailed.

Because of its own characteristics is important to promote the comprehension of Mamorecillo's river behavior and the alluvial mechanisms that control the accumulation of sediments.

III. METHODOLOGY

The spatial and temporal analysis of the fraction in study of the Mamorecillo River was performed through analysis of images with 30 meters spatial resolution satellite of the Landsat catalog, a platform from the National Institute of Space Research (INPE) between the years of 1985 and 2012, the Earth Engine tool was used as well - which has greatly aided to the understanding about the fluvial dynamics of the channel.

The analysis was performed in an area of approximately 39 km in a straight line, distance that approaches the 90 km when traveled in the channel - accurately because of its meandering form. From the treatment of images in a software developed specifically for this purpose, channel maps were constructed for the years of 1985, 1995, 2005 and 2012. The data obtained was fundamental for the channel hydrodynamics studies, as well to help with the understanding about the changes in the channel geomorphology - and all aspects that are correlated such as, the creation and extinction of meanders, the formation of sedimentary deposits in the bed and river bank, the widening and narrowing of the channel and its river bank.

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The meanders were grouped, separated on the upstream in direction to downstream and named as Flames A, B and C (Fig. 2). This procedure was performed in order to facilitate the understanding and visualization of the obtained results, thus simplifying the discussion of the results. In order to better represent the changes occurred in detail, whether in the meanders, the abandoned meanders, or even to verify the performance of sediment accumulation and removal processes in the canal, separate figures were created for each of the Frames (Figures 3, 4 and 5). These figures are discussed the processes suffered in each period of time for each flame.

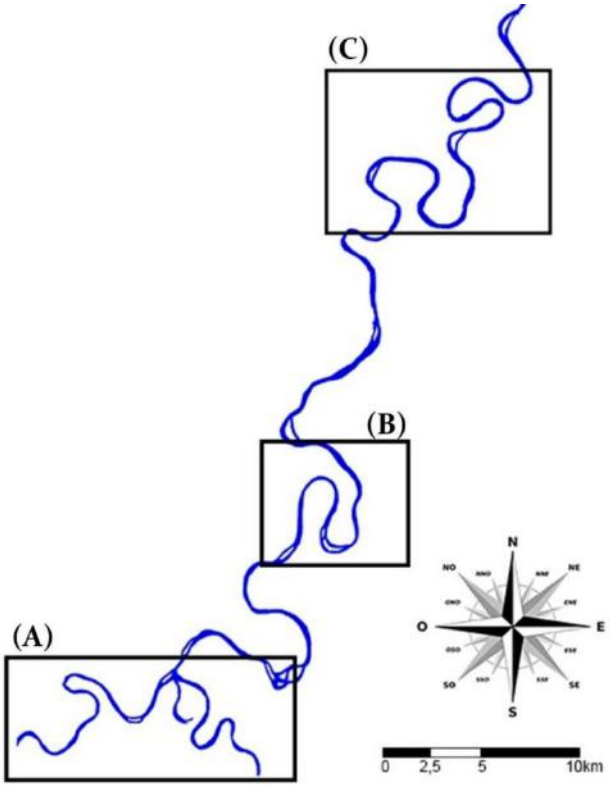

Fig. 2: Patch of Mamorecillo River with Flames A, B and C highlighted.

IV. DISCUSSION AND RESULTS

During the twenty seven year period on which the images were evaluated, significant changes occurred in the bed form of the studied area. It is possible to observe the accentuation of the erosive processes acting on the margins, in conjunction with sediment deposition processes on the banks of the Mamorecillo River (Fig. 3, 4 and 5). In some analyzed portions a gradual increase in the meandering amplitude is observed to the point of causing the bottleneck of the channel, creating in a natural way a redefinition of the channel and consequently of the flow of the river. In figure 3, we observe the performance of these processes that caused a total spatial change in the confluence of the channel. In the same way, depositional processes foment the formation, thickness, and also the geomorphological modification of the channel margins.

From 1985 to 2012, the SW portion of the river (Fig. 3) presented an exceptional temporal evolution. In 1985 was perceived the confluence forming the main trunk of the river and also, near by the confluence, a meander already in process of strangulation. It is also possible to identify places where erosion processes work in an evident way - to cause a future bottleneck of the canal, consequently forming abandoned peduncles. Therefore, when the canal is strangled, a new meander will form - due to erosion processes, sediment transport and deposition, and the sedimentological contribution of the canal (Zancopé et al., 2009).

When compared the 1985 year with 1995 it is possible to observe that there is a change on the geomorphologic aspects of the channel. The meander - active, which existed nearby the river's confluence, suffered a shutdown of the channel, being abandoned. It is also observed the abandonment of a secondary peduncle which previously formed the main channel of the river. The erosion suffered by the meanders caused floods and progression of the river towards its bank. Between the years of 2005 and 2012, it is noticed a complete modification of the river's confluence, this change was already in progress in the year of 1995. The bottleneck of the meander located at NW of the confluence in 1995 happened as a result of erosive processes in the river bank. In the images from 2005 and 2012 years, it is noticed the channel reviewed and running at the exact point where the channel bottleneck happened. In this way, it is noticed a geomorphologic change in the bed of the river at the confluence of Chimoré and Ichilo rivers, noticing the old channel - in progress in the year 1995 as an abandoned peduncle located between the confluence of these rivers.

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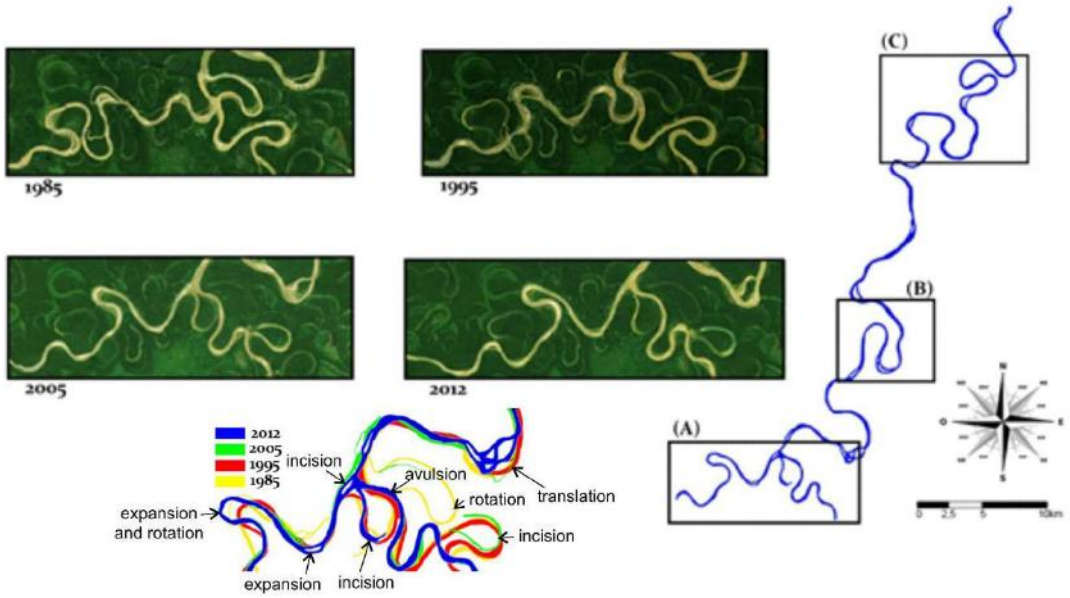

Fig. 3: Space-time evolution of the patch relative to Flame A and the processes that happened in the analyzed period.

The river's central region analyzed (Fig. 4) shows significant geomorphological changes over the period of study. According with the geological photo interpretation from images taken of the channel in the year of 1985 it is noticed a meander feature extremely sinuous which it is highlighted the erosional movements on the concave margin - by symmetry the action of deposition processes on the convex margin. In function of these processes the narrowing of its margin is accentuated.

The meander abandonment process turns more visible in the year of 1995 when the bottleneck of channel happened, that is, this channel patch got a new course. However, the meander in the study is still active and it receives a lower flux of water becoming a secondary meander on the channel. In the year of 2005, it is observed that the meander was practically aborted from the channel, in this way the processes of sediments deposition strongly influenced the bottleneck of the channel while biological processes of vegetation growth in the aborted meander became evident. In the year of 2012, the channel is highlighted being geomorphically distinct from the year of 1985 when the growth of vegetation covered almost all the peduncle abandoned.

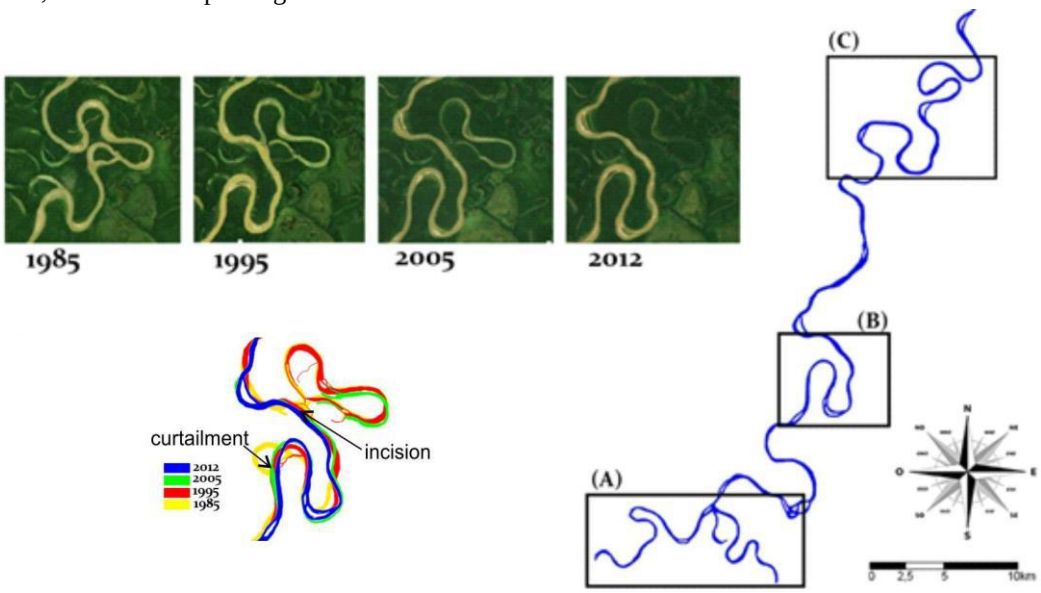

Fig. 4: Time-Space evolution of the patch relative to Flame B and, the processes that happened during the analyzed period.

In Figure 5 from the sequence of highlighted images (1985, 1995, 2005 and 2012) it is possible to observe the dynamic evolution in this patch at N-NE of the channel. In the analyzed images from 1985, it is noticeable an accentuation in the number of abandoned meanders. These meanders were formed in function of processes that

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acted in the channel before 1985. Probably the remotion of sediments inputted in the meander's margin. Therefore, in this period was only one very narrow and thick margin, indicating a spot of rupture of the meander in a near future.

The peduncle cut in an advanced process is visible on the images from 2005. Also, already in process, it is the redefinition of the channel. Notwithstanding was still the feeding of meanders by the river flux it is noticeable that the processes of sediments deposition in the local became strongly active in a way that the place stopped suffering from the sediments accumulation. As well, it is evident the action of erosion processes in the meander located in the upper right part of the image in the year in question, which by similitude will suffer similar process. In the year of 2012, it can be identified the meander's rupture (S-SO portion of the square), being verified vegetation growth processes in smaller proportion than the central part analyzed while the smaller meander, located in the upper right part (Fig.5), starts the process of rupture by the bottleneck of the meander in function of erosion and transport of sediments happening in the margin part of it.

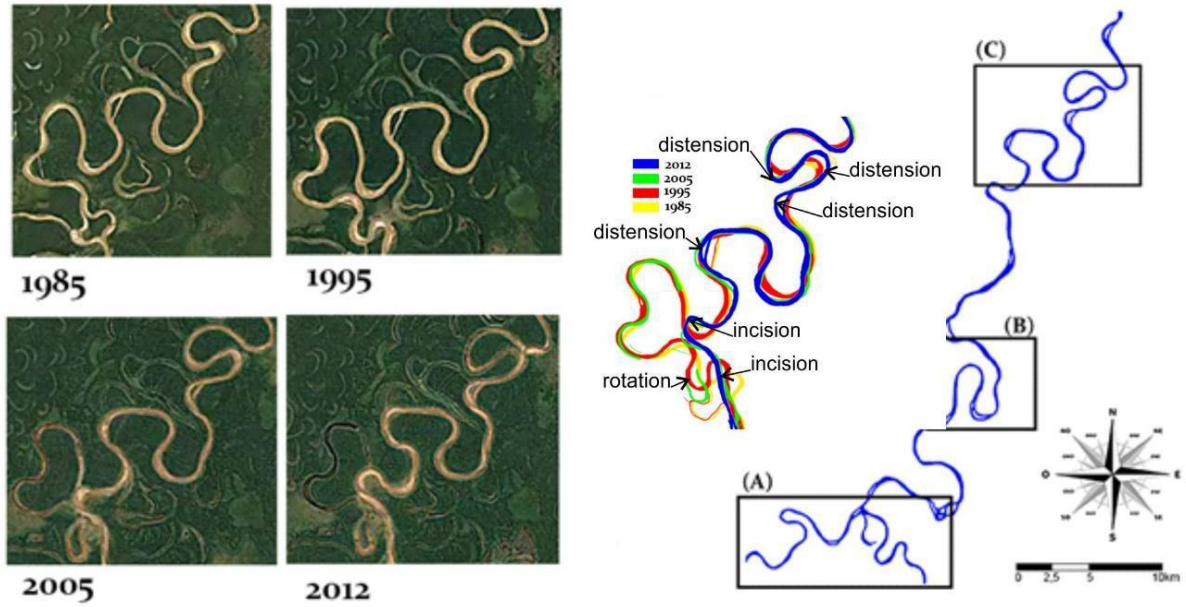

Fig.5: Time-Space evolution of the patch relative to Flame C and, the processes in the analyzed period.

The comparative analyses through the decades lead us to realize that between the years of 1985 and 2005 the Mamorecillo River has an increased sinuosity index higher than the subsequent period (2005 to nowadays). For Hickin & Nanson (1975) it is caused by the increase in the radius of curvature of a curve is indirectly proportional to the radius of curvature of the adjacent curve. In this way, the adjacent meanders unite through the peduncle bottleneck due to the high expansion of the meanders. Thereby, in the first 20 years of study occurred a fast lateral migration of the channel on the Mamorecillo River plain, being observed that in the convex marginal cords, paleochannels, abandoned channels and avulsion by a resumption of the flow in these last forms of relief of the river.

Another fact related to this is the change in the meanders' axis direction. The increase in the rate of curvature and meander length allies in expansion and rotation are consequences of the adjustment of detrital load constituent flow (Hickin & Nanson, 1975). In order to find its balance between the processes and forms, the Mamorecillo River also developed forms to shortening curves. This being the inverse process of meander's expansion and directly related to the expansion rate.

On the Mamorecillo River, the processes of curve expansion and abandonment of channel by peduncle cut are more frequent. The meander expands and then it is abandoned, causing a sideway migration throughout the channel's course. Therefore, the relation between the sideway migration, sedimentation, and erosion happens within the meanders band.

In Figure 6, formed by the schematic superposition of channel maps from the years 1985 (yellow), 1995 (red), 2005 (green) and the most recent channel, 2012 (blue), exemplifies the processes that happened on the analyzed meanders from Mamorecillo River. The differences observed in the river's channel show the different behavior during the study period. Highlighting that all these processes are common to the meandering dynamics and discuss the sedimentation process by lateral addition. These consist basically in the successive lateral accumulation of sediments - especially within the curve

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of the meandering canal. This accumulation is justified by the continuous removal of sediments from the concave margin (erosion) and the deposition of these sediments in the convex margin, causing constant lateral migration of the channel (Christofoletti, 1981; Bigarella, 2003).

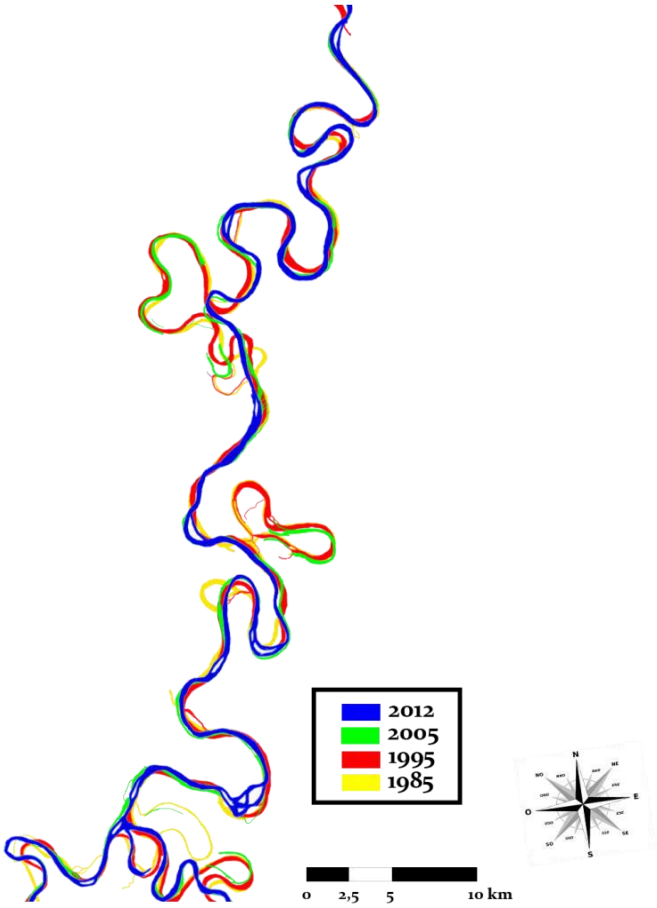

Fig.6: Schematic overlap of Mamorecillo river patch studied in the years of 1985, 1995, 2005 and 2012.

V. CONCLUSION

For this study, the use of tools applied to geoprocessing, Geographic Information System (GIS), proved to be extremely efficient in analyzing, understanding and describing the meander migration processes in the fraction of the studied Mamorecillo River.

The shape of the form from which the meanders appear, is directly related to the sedimentological processes that act on them, like the sediments contribution provided by the Chimoré and Ichilo rivers in the channel.

The endogenous processes or even exogenous factors that act on the section under study of the Mamorecillo River acted in order to make this part of the channel evolve to assume a more rectilinear form. These factors developed in such a way that the meandering form of the river was slightly minimized when compared to its initial state in 1985.

As part of a larger dynamic system, the Mamorecillo River is influenced not only by autocyclical factors, but also by the Ichilo, Sacta and Chimoré rivers that comprise it. Characterized as a meandering stretch of the river, the hydrodynamics and hydrogeomorphology of its flow results in morphological processes characterized by a permanent erosion of its concave margin and greater deposition in margins where the point bars (the convex margins) are located.

The variation in the form and migration of the meanders in the studied section of the Mamorecillo River is related to natural processes of erosion, transport and deposition of sediments. Emphasis is given to some of these natural processes: the [inter] dependence of the sedimentological contribution and also, the energy flow of its forming rivers, namely: Chimoré and Ichilo. Climatic factors such as the rainy season, where the consequence is the period of the floods which is related to erosive processes causing new meanders to appear.

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