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Dr. Swapnesh Taterh

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FOREWORD

I am pleased to put into the hands of readers Volume-5; Issue-8: 2018 (Aug, 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

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Moderation of Information Asymmetry, Self Esteem to the Effect of Participatory Budgeting on Budgetary Slack Government of South Sulawesi Province

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Abstract— Suspected budgetary participation is not always linear effect on budgetary slack. This is because the information asymmetry factor, and self esteem. This study aims to determine whether the asymmetry of information and self-esteem able to moderate Effect of participatory budgeting and budgetary slack. The number of samples in the study were 100 echelons SKPD South Sulawesi Provincial Government selected based on purposive sampling method. The data analysis technique used is moderation regression analysis (MRA). The results obtained are variable participatory budgeting has a positive effect on budgetary slack. Variable self esteem weaken the influence of participatory budgeting in the budgetary slack, while strengthening the influence of information asymmetry variable participatory budgeting in the budgetary slack.

Keywords— *budgetary Slack, Participatory Budgeting, Self Esteem, Asymmetry Information.*

I. INTRODUCTION

Regional autonomy was established, South Sulawesi provincial government is required to realize

good governance. Local governments use performance-based budgeting system which is the process efficient and participatory development, and the use of performance as a benchmark in the achievement of local budgets. However, the assessment of the performance of motivating agents to undertake budgetary slack for the sake of a better career in the future (Suartana, 2010). In addition, the budgetary slack is also common in the planning and preparation phase of the local budget, because it is dominated by the interests of the executive and legislative branches, and less reflective of the needs of society (Kartiwa, 2004). Budgetary slack will result in misallocation of resources and bias in the evaluation of the performance of agents on accountability unit (Suartana, 2010).

For the Government of South Sulawesi province, based on budget data past five years, as a whole has not shown indications of an increase in performance and a significant performance improvement in its implementation as described in the table below:

Table.1: Budget and Realization of Local Revenue and Expenditure strip Povinsi South Sulawesi Fiscal year 2011 -2015 (in millions of rupiah)

Year	Fiscal revenue (Rp)	Realization Revenue (Rp)	Percentage of achievement (%)	Budget Expenditure (Rp)	Actual Expenditure (Rp)	Percentage of achievement (%)
2011	3.106.899,564	3.110.566,841	100,11	2.703.727,485	2.548.690,795	94,19
2012	4.665.214,439	4.433.963,019	95,40	3.569.468,407	3.388.137,989	94,92
2013	4.996.499,327	4.867.592,611	97,42	4.438.230,501	4.081.099,922	91,95
2014	5.650.575,561	5.503.161,406	97,39	4.981.103,824	4.499.032,192	90,32
2015	6.445.779,161	6.105.815,095	94,72	5.350.327,153	4.973.655,476	92,95

Source: Regional Financial Management Board of South Sulawesi Province, 2017

Table 1 shows, the number of budgeted expenditure to finance programs / activities indicate that the budget plan set by the realization there is failure in activity budget. It is seen from the difference between budget and actual spending tends to an excess of the budget, it shows in budgeting is not in accordance with applicable regulations and indicated their programs / activities that have not been fully implemented and there tends to be an indication of budgetary slack.

In addition to the above phenomenon there are few previous studies have examined the effect of participatory budget in budgetary slack declared inconsistent results, among others Merchant (1981), Young (1985), Frederick J. DeMicco, Steven J, and Dempsey (1998), Little, et al., (2002) Vincent K, Chong, Kar Ming Chong (2002), Yuhertiana (2004), Hafisah (2005), Falikhatun (2007), Sudarba (2010), Andriyani and Hidayati (2010), Andry Arifin Rahman (2012), Nila Aprila and Selvi Hardiyani (2012), Widiyastuti (2014) Zahirul Haque and Peter Brosnan (2015), states that a high participatory budgeting led to budgetary slack. Unlike the case with Schiff and Lewin (1970), Onsi (1973), Dunk (1993), Minan (2005), Adam S, Maiga and Fred A. Jacobs (2007), Supanto (2010), Martjin and Wiersma (2011), Lislie Kren and Adam S.Maiga (2015), Laura Francis-Gladney, Robert B. Welker and Nace Magner (2015) that the participatory budgeting can lower the occurrence of budgetary slack. Based on data from South Sulawesi Provincial Budgets and inconsistency of these results, the researchers were motivated to examine the effect of participatory budgeting to budgetary slack with asymmetry information and self esteem as a moderating variable at Work Unit (SKPD) South Sulawesi province.

II. OBJECTIVES

The questions that guide the investigation are: how is the moderation of information asymmetry and self esteem on participatory budgetary relationships and

budgetary slack? Therefore, this study aims to explore a new conceptual model that can fill the research gap between Participatory budgeting in pressing the budgetary slack centered on Moderation of Information Asymmetry and Self Esteem.

III. THEORETICAL-CONCEPTUAL REVIEW

3.1 Participatory Budget and budgetary Slack

Based on agency theory, participatory budget is a process of cooperation between agents and principals in making decisions related to budgeting. The regional budget prepared by the executive as agent and authorized by the legislature as a principal. Meaning of participatory local governance is SKPD involvement in budgeting. Head SKPD have the opportunity to submit proposals related to the implementation of the Work Plan (RKPD) as a reference in preparing the Work Plan Budget (RKA-SKPD). RKA-SKPD a participatory budget documents in local government are internally related to the determination of budget allocation and performance targets in the next proposed budget into the budget (Abdullah, 2012). However, the performance-based budget system could be expected to lead to budgetary slack. Budgetary slack is degrading acts as agent productivity capabilities through participation in budgeting have a chance to determine his standards (Young, 1985). Based on the above, it can be hypothesized:

H1: Participatory Budget affects the budgetary slack.

3.2 Participatory budget, budgetary Slack and Information Asymmetry

Based on the assumption of agency theory, humans will act opportunistic namely a personal interest rather than the interests of the organization. The principal can not monitor agent activity every day. Instead, agents learn of material information related to the capacity to work, work environment and organizational units. This has caused the asymmetry of information between principals and agents who participate in local budgeting.

This is supported by Young (1985), Utomo (2006), Djasuli and Fadilah (2011) that the interaction of participatory budgeting and information asymmetry positive and significant impact on budgetary slack. According to Anthony and Govindarajan (2001) in Falikhhatun (2007), the executive agency tends to perform budgetary slack to secure his position in the government. Meanwhile, as the principal legislative 5 tend to make false contract with the executive. However, Dunk (1993) states that if a positive communication between the agent and the principal case, then the budgetary slack will diminish. Based on these descriptions, it can be hypothesized:

H2: Asymmetry of information moderating influence on budgetary slack participatory budgeting.

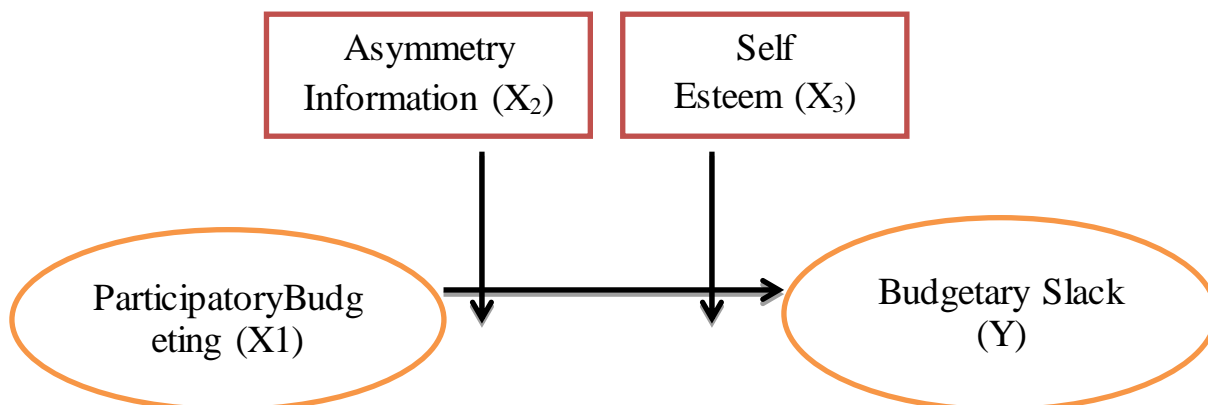
3.3 Participatory budget, budgetary Slack, and Self Esteem

Kreitner & Kinicki (2003) states that a person who has high self esteem tend to think of themselves more than others. Therefore self esteem is able to weaken the influence of participatory budgeting in the budgetary

slack, because if a person feels himself so important, valuable and influential then raised the confidence that what he does will succeed and create optimal results. Conversely, a low Self Esteem means an employee then the resulting incredulity himself that what he did will not be successful and produce results that are not optimal and tend to perform budgetary slack. This is supported by Nouri and Parker (1996). Ikhsan and Ane (2007) states that budgetary slack able to moderate the effect of the participatory budget in budgetary slack. Similarly Desmiyati (2009) that the interaction of participatory budgeting and self esteem and no significant negative effect on the budgetary slack. However, Kreitner & Kinicki (2003) states that self-esteem can not moderate influence on budgetary slack participatory budgeting. Based on the foregoing, it can be hypothesized:

H3: Self Esteem participatory budgeting moderating influence on budgetary slack.

Based on the above it can be presented this study design in Figure 1 below :



The study design in Figure 1 above describe the influence of independent variables, Budgeting participatory (X₁) on the dependent variable is the budgetary slack (Y) with asymmetric information (X₂), Self esteem (X₃) as a moderating variable.

IV. METHODOLOGY

The research will be conducted in the regional work units (SKPD) South Sulawesi province. This research took place in May-July, 2017, because the local government will submit the Public Policy budget year 2017 budget by mid-June 2017. The population in this study is structurally composed of officials of Echelon II, III, and IV are still active duty until the month July 2017, amounting to 476 people. Samples are structural officials who participate in local budgeting. The sampling technique used purposive sampling. Criteria for this sample is Echelon II / III / IV (head of the agency / department head / chief / head office / head subpart /

secretary of the regional committee) who participate directly participate in the budgeting process. These criteria are used to avoid sampling error, because not all echelons participate in budgeting.

Based on these criteria obtained 105 respondents as samples. Methods of data collection using a questionnaire survey, a list of written statements related to the research variables. Therefore, this study used a questionnaire then test instrument (validity and reliability) is performed. Answers from respondents who had accumulated (ordinal data) then tabulated and transformed into interval data. As a condition to meet the regression test, the classic assumption test (test for normality and

heteroscedasticity) done first. Analysis of the data to test the hypothesis using MRA (Moderated Regression Analysis).

V. RESULTS AND DISCUSSION

The questionnaire was distributed in this research were 105 questionnaires and 105 questionnaires were returned (Response Rate = 100%). There are 5 questionnaires were aborted because the contents were not complete, so overall there are 100 eligible questionnaires for analysis (Usable Response Rate = 92.7%).

Correlation coefficient entire instrument above 0.30, which means the entire instrument is declared

Results Moderated Regression Analysis (MRA) can be seen in Table 2

invalid. Overall instruments have also been reliable with cronbach's alpha value for each variable of participatory budgeting, information asymmetry, self esteem, and budgetary slack is equal to 0.744, 0.892, 0.655, 0.871. Normality test results showed that the regression model has a normal distribution of data with Asymp value. Sig. (2-tailed) of 0.423. This model is also free of problems heteroskedastisitas with significant value variable participatory budgeting, budgetary slack, asymmetry of information, and self-esteem respectively 0.595, 0.060, 0.457, 0.077, 0.343 and the significant value of participatory budgeting interaction with information asymmetry and self esteem consecutive succession of 0.089, 0.824.

Table.2: Moderated Regression Analysis

Variabel	Unstandar dized Coeffien B	Sig.
(Constant)	-34,916	0,002
PA	3,428	0,000
AI	1,025	0,001
SE	0,689	0,005
PA*AI	-0,065	0,031
PA*SE	-0,059	
Adjusted (R ²)	0,610	
Sing F	0,00	

Table 2 Adjusted R Square value of 0.610. This value meaning that 61 percent of the variation changes in budgetary slack capable explained by participatory budgeting, information asymmetry and self-esteem. In Table 2, the significant value of 0,000 F is less than 0.05 means that the model where the value of this research have been worth test.

Results of testing the first hypothesis (H1) indicates bahwa a participatory budgeting affect budgetary slack. The regression coefficient is worth 3.428 indicates that participatory budgeting has a positive effect on budgetary slack. This shows that more and more individuals who participate in the budgeting, the higher the chances of budgetary slack.

Asymmetry of information strengthens participatory budgeting influence on budgetary slack formulated in the second hypothesis (H2). This occurs because the beta value having the opposite direction with the hypothesis that a negative value of -0.065. Based on this, the information asymmetry is not able to strengthen the influence of participatory budgeting in the budgetary slack. This is caused by the possibility of asymmetry of information in public sector organizations are very small because there Regulations, duty, and authority (Falikhaturun, 2007).

The third hypothesis (H3), which is able to moderate the influence of self esteem participatory budgeting in the budgetary slack. The regression coefficient indicates that the variable-value -0.059 self esteem weaken the influence of participatory budgeting in the budgetary slack. If self-esteem is owned by individuals who participated in a high budget, then the possibility of budgetary slack will decline. Kreitner & Kinicki (2003) states that a person who has high self esteem tend consider themselves more than others. Therefore self esteem is able to weaken the influence of participatory budgeting in the budgetary slack, because if a person feels himself so important, valuable and influential then raised the confidence that what he does will succeed and create optimal results.

VI. CONCLUSIONS

Based on the analysis and discussion before it can be concluded that Participatory Budgeting has a positive effect on budgetary slack, as well as strengthen the influence of information asymmetry. This means that in order to reduce the asymmetry of information should South Sulawesi Province, local officials can apply the disclosure of information related to the budgeting (budget) in the province of South Sulawesi. The local

governments can use information media with the maximum and can be accounted for, even provide a contact person from the officials concerned. Instead, Self Esteem weaken the influence of participatory budgeting in the budgetary slack.

Suggestions for further research are able to use the bureaucratic ethics, culture of the Organization, individual characteristics, locus of control, motivation in moderating influence on budgetary slack participatory budget.

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Quantitative methods and studies of psychic disorders and job satisfaction of teachers of the prison system in the Amazon, Brazil

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Abstract— Objective: To analyze the level of mental suffering and the level of job satisfaction in 85% of the teachers of the state education network who work in the prison units in the city of Porto Velho, Rondonia, Amazonia, Brazil. Method: This is a cross-sectional study; and for the data collection, three structured instruments were used: the sociodemographic questionnaire; the Self-Report-Questionnaire Questionnaire (SRQ-20), and the OSI-Occupational Stress Indicator Scale, Measured by Likert Scale. Results: The results showed that 12.5% of the teachers presented minor psychic disorders, considered as indicators of evidence of mental distress. Satisfaction in the work had indexes similar to those found in the literature, presenting the highest proportion in the intermediate variables, that is, their highest frequencies are in the range of some

dissatisfaction, with 32.28%; and 32.04% with some satisfaction. The highest index of dissatisfaction is in the variable that refers to salary, with 29.4%. Conclusions: From the results, it is possible to indicate a possible association between job satisfaction and mental suffering. This study will provide great reflections on the teaching practice in prison units and will contribute to the occupational health of teachers working in prison units, allowing a rethinking of public policies in education and health in the context of the prison system.

Keywords— Prison System. Amazon. Psychic disorders. Teachers. Sociodemographic.

I. INTRODUCTION

Education in recent years has been identified as a possibility for the recovery and re-socialization of the

inmates of the various prison units scattered throughout Brazil. According to data collected by the federal government, 96.6% of the young people who committed an infraction did not complete the elementary school. The same data also point out that the incidence of infractions is directly related to the social deprivation of the communities in which the events occur¹.

Indicatives presented by the Ministry of Justice indicate that a quantitative of approximately 18% of prisoners engaged in educational activities. Although the majority of this population is structured by people with low levels of schooling, 70% did not complete elementary education and 10.5% are totally illiterate¹.

To minimize the data presented, an essential figure emerges in this process, the teacher. Meeting the new social and specific requirements is not an easy task, because the teaching practice already requires a lot of this professional, who in addition to the attributions peculiar to their performance, should develop and organize specific activities that contemplate the reality in which learners are inserted, in this particular case, in prison. It will need to rethink a curricular proposal capable of developing in the individual skills and abilities that allow reintegration and resocialization, but at the same time, that respects and sees it as a social agent. This new educational reality adds new responsibilities to the work of the teacher, which could generate an overload of work. According to Esteve², working conditions are considered one of the main factors due to teacher maladjustment, directly affecting the physical and mental health of teachers, leading them to absenteeism and, sometimes, abandonment of the profession.

Education should not eliminate the access to education by the person in jail, even if, in the process of deprivation of liberty in a prison complex. The Brazilian constitutional norm does not restrict to any citizen this widely guaranteed right, but the great agent responsible for bringing education to the prison system must be prepared for the great complexity and diversity that make up this system. According to Sartori³, the education professional in a teaching practice "needs to develop an articulated work in various educational dimensions, oriented to plural multiculturalism and specific school practices" and to attend to the specificities and needs of each reality requires a greater preparation and dedication of the professional involved in this process, however, the new requirements can generate an overload to this professional, who in order to produce and meet expectations needs a peculiar preparation.

Educational reforms, social transformations, and pedagogical models resulting from the working conditions of teachers have generated changes in the teaching profession, stimulating the formulation of policies by the State. Until the 1960s, a large part of

education workers enjoyed relative material security, job stability and social prestige. Since the 1970s, the growth of the population's demands for social protection has led to the growth of public services and public services, including education, which has generated a great deal of social responsibility among the education professionals⁴.

The role of the teacher in this perspective extrapolates the mediation of the student's knowledge process, adding the articulation between the school, community and society, in order to guarantee the prisoner an education capable of attending to and respecting their needs and peculiarities.

The profile of educator to develop an educational work in the prisons ends up adding responsibilities that can have repercussions on physical, mental health and professional performance. Research indicates that the most common problems faced by teachers in teaching are cardiovascular diseases, disorders arising from stress, labyrinthitis, pharyngitis, neuroses, fatigue, insomnia and nervous tension^{5,6}.

Working conditions, as well as the circumstances under which teachers develop their physical, cognitive, and affective capacities to achieve educational goals may lead to over-stress or hypersolicitation of their psychophysiological functions. Souza et al.⁷ present some of the main factors that link the precarious work condition of the teacher: the devaluation of work; the lack of social recognition of professional activity; low wages; the centralization of administrative and pedagogical decisions; authoritarian management; the reduction of spaces for collective discussion; triple journey; poor training; body posture; chalk powder; noise; overcrowded classes; absence of breaks; blame for the negative results. Added to this picture is the precarious infrastructure, bureaucratization and hierarchization of labor relations, the lack of material and human resources that accentuate the workload of these professionals.

Faced with the current attributions to the teacher and to verify a lack of research involving teachers who develop their educational practices in prisons, it was intended with this study to investigate if the mental suffering is related to job satisfaction, and for this, a survey was carried out with teachers from the state education network who work in the prison units in the city of Porto Velho, Rondonia, Amazônia, Brazil, based on the following problems:

- a) What is the level of job satisfaction of these teachers?
- b) What is the level of mental suffering of these teachers?
- c) What is the possible association between the level of job satisfaction and the mental suffering of the teachers of the prisons in the city of Porto Velho?

In view of the problems presented, a study was carried out involving 85% of the teachers working in prisons in teaching practice in the city of Porto Velho.

II. MATERIALS AND METHODS

A quantitative approach was used, with a type of study characterized as epidemiological, whose model is transversal, which consists of a cut in the historical flow of the event, in which the exposure is observed simultaneously⁸.

Field research was structured in three stages:

- a) In the first stage, a questionnaire was applied to survey the sociodemographic profile of teachers.
- b) In the second stage, the OSI Occupational Stress Indicator Scale was applied to identify the level of satisfaction.
- c) In the third stage, the evaluation of the mental health of workers was carried out through a tool for detecting minor psychic disorders: the "Self-Report-Questionnaire (SRQ-20)".

2.1 Instruments and Procedures

For this study, the following guiding instruments were used:

1. Questionnaire with closed questions with the purpose of identifying the sociodemographic profile of the teachers who work in the prison units by identifying their training, qualification and specialization for acting and conception about the education in the prison, being constituted of three blocks of questions.
2. Application of the OSI-occupational Stress Indicator, for teachers working in prison units, Cooper's instrument, translated and validated into Portuguese by Swan, Moraes and Cooper - Portuguese version of the satisfaction scale work, available in Couto⁹, on job satisfaction.
3. An instrument for detecting minor non-psychotic psychic disorders, the Self-Report-Questionnaire (SRQ-20). This instrument was validated by Mari & Willianas apud Borges & Argolo¹⁰, for use in studies of psychiatric morbidity in primary health care institutions in developing countries, coordinated by the World Health Organization.

The instrument titled SRQ is derived from four existing psychiatric research tools. The original version consists of 24 items, the first 20 items for screening for non-psychotic disorders and the last 4 items for detection of psychotic disorders. As it is an instrument that is intended for the detection of symptoms is quite suitable for the study of populations. It is a self-administered instrument containing a range of YES / NO responses. The Portuguese version adopted the first 20 items for nonpsychotic morbidity.

2.2 Study Location and Sampling Number

The research was carried out at the State School Ênio dos Santos Pinheiro, which includes a total of 20 (twenty) teachers, of which 85% participated in the study. The school is located inside the Ênio dos Santos Pinheiro prison, but provides educational services to the three

prisons in the city of Porto Velho: 1. Ênio dos Santos Pinheiro Unit; 2. Panda Unit and 3. Women's Unit.

2.3 Inclusion and Exclusion Criteria

Inclusion criteria: the research counted on the participation of 17 (seventeen) teachers who work in the prisons units in the City of Porto Velho, that is, 85% of the searchable universe.

Professionals who do not act in the classroom (director, supervisor, educational supervisor, psychologist, pedagogical technicians and others) were excluded from the research, as were professionals who refused to participate in the research.

2.4 Ethical Aspects

The project was forwarded and approved by the Research Ethics Committee of a Higher Education Institution (IES), in compliance with the provisions of Resolution 196 of 96/CNS/MS for the necessary procedures to carry out the research.

2.5 Data Analysis

In order to gather important data for this study, the sociodemographic questionnaire was divided into three blocks: (a) BLOCK I - Survey of the profile of the teachers acting in the prison units of the state educational system; (b) BLOCK II - Teacher qualification or specialization and (c) BLOCK III - Teachers' conceptions about the school in prison units.

2.6 Satisfaction at Work

The instrument of satisfaction with aspects of work has 22 variables. Each analysis is categorized into satisfaction with the options:

- I - a) huge satisfaction and b) with great satisfaction,
- II - Intermediate: a) some satisfaction;
- III - Dissatisfaction: a) huge dissatisfaction and b) a lot of dissatisfaction.

Satisfaction in the work was evaluated by the sum of the results of the presented variables, being the degree of satisfaction or dissatisfaction measured by the scale, being attributed 6 for great satisfaction, 5 for many satisfactions, 4 for some satisfactions, 3 for some dissatisfactions, 2 for many dissatisfaction, 1 to huge dissatisfaction.

For the tabulation of the data the Microsoft Excel 2003 program was used, the same process was carried out to associate the variables of teacher conception on the education in prison units with the satisfaction in the work and mental suffering.

2.7. From Mental Suffering

Mental distress was assessed by means of 20 variables, the response scale being composed of yes or no.

The categorization was carried out by 5 factors, being approached in the factorial analysis 1 - energy reduction consisting of 6 variables: (you feel tired all the time, you get tired easily, you find difficulties to make decisions, you find it difficult to perform with satisfaction of his

activities of daily living, he has difficulties to think clearly, he has difficulties in the service - his work is painful, causes him suffering.

Next are the variables of factorial analysis 2 - somatic symptoms, composed of 4 variables, being: (have a headache often, have unpleasant stomach sensation, have poor digestion, lack appetites).

As for the variables of factorial analysis 3 - of depressive mood, 3 variables appear, being: (feeling nervous, tense or worried, has been feeling sad lately, has cried more than usual).

And in factor analysis 4 on depressive thoughts - it consists of 4 variables, being: (he has lost interest in things, is unable to play a useful role in his life, feels a useless person, has no idea, has no idea of to end life).

Finally the organized factor (5) of other symptoms of SRQ-20, having 3 variables: (sleeps poorly, scares easily, has tremors in hands).

Mental distress was assessed by the sum of the variables presented in SQR 20, considering as a cut-off point 7 or more affirmative answers of the 20 questions presented, to classify teachers as suspects of minor psychic disorder, consequently with possible mental suffering. Teachers who answered fewer than 7 affirmative questions were categorized as not suspected of mental suffering or 'no mental suffering'.

III. RESULTS AND DISCUSSIONS

3.1 Results of the sociodemographic questionnaire: From sociodemographic variables

Block I questionnaires show the predominance of the female gender, totalizing 64.70% of the respondents. The predominance of age was greater in the age group of 40 to 49 years, with 64.70% of the teachers; followed by 17.64% in the range of 50 to 59 years; 11.76% with age from 30 to 39 and 5.8% with age over 59 years. There was no teacher under the age of 29.

Regarding the teaching time, it was found that 41.17% are working for more than 20 years in the profession, and with the same percentage those aged 16 to 20; 11.76%,

are working between 11 to 15 years and 5.8% from 7 to 10 years. Regarding the level of education, 88.23% of the teachers have a complete upper level, 76.47% are already postgraduates at the level of specialization and 11.76% have an incomplete upper level. Of the professors who have a higher education degree, 40% have a degree in Portuguese Literature, 20% are graduates of other teaching courses and the same percentage, graduates in Mathematics and Pedagogy with 13.33%, in addition to those graduated in Geography and History with the same 6.6%.

Regarding the time spent in prison units, 35.29% of the teachers who took part in the study work between 16 and 20 years; 23.52% work for more than 20 years; and with the percentage of 17.64%, those of 07 to 10 years and those of 11 to 15 of performance; with a lower percentage of those who work from 1 to 3 years with 5.8%. Of the hours of teaching activity, 82.35% have a weekly workload of 40 hours, with only 17.64% working with 26 hours a week. Of the extra teaching activities, 52.94% stated that they dedicate up to 05 hours a week; 17.64% dedicate up to 10 hours per week; 5.8% up to 15 hours per week; 5.8% up to 20 hours; 5.8% more than 30 hours per week and 11.76% did not respond to this questioning.

3.1.2 Teacher Training.

Block II questionnaires refer to training or specialization. The data indicated that, 76.47% of the teachers working in prison units, did not receive training for this performance and 23.52% received training; of those who received training 50% had a workload with more than 80 hours; and 50% had a workload of 21 to 40 hours. Regarding the training received 75% of the teachers did not consider enough time to base their practice; and 25% consider sufficient time to support their practice.

3.1.3 Teachers' Conceptions on Education in Prison Units

Block III, refers to the conceptions of the teachers researched, about the education in prison units. And it was sought to verify, what teachers think about education in prison units.

Table.I: Frequency (%) of teachers' conceptions regarding their performance in prison units - Porto Velho / RO.

QUESTION	YES	%	NO	%	Sometimes	%
1. Do you feel prepared to teach for students in deprivation of liberty?	13	76,47	-	-	4	23,52
2. Do you believe that the educational process is important in prisons?	17	100	-	-	-	-
3. Do you feel that the management team is prepared to work with this reality?	10	58,82	4	23,52	3	17,64
4. Do you believe that school meets students' expectations?	5	29,41	4	23,52	8	47,05

5. Do you believe that schooleducation helps in the process of re-education and re-socialization of students?	17	100	-	-	-	-
6. Do you work with the curricular adaptation to meet the students in jail?	10	58,82	7	41,17	-	-

According to the data presented in Table I, 76.47% of the teachers answered that they felt prepared to work with students with deprivation of liberty, and only 23.52% responded at times. When questioned if they believe that the educational process is important in prison units, 100% of the respondents answered yes.

As for the management team, 58.82% believe that they are prepared to work in prison units; 23.52% believe that the management team is not prepared and 17.64% answered the times. With regard to student expectations, 47.05% answered that they sometimes attend; 23.52%

believe that they do not meet the expectations of the students, and 29.41% believe that they meet the students' expectations.

When questioned if they believe that education helps in the process of re-education and resocialization of students, 100% of the teachers interviewed said yes. Regarding the curricular adaptation 58,82% stated that they work with curricular adaptation, and 41,17% of the teachers do not work with curricular adaptation.

3.1.4 Satisfaction at Work

Table.II: Frequency of affirmative answers about job satisfaction and dissatisfaction.

Aspects of Work	6	%	5	%	4	%	3	%	2	%	1	%	TOTAL
1- Communication	0	0	4	23,53	4	23,53	7	41,18	2	11,8	0	0	17
2- Relationship	2	11,76	8	47,06	4	23,53	3	17,65	0	0	0	0	17
3- Evaluation	0	0	3	17,65	10	58,82	4	23,53	0	0	0	0	17
4- Contents	2	11,76	3	17,65	7	41,18	4	23,53	0	0	1	5,88	17
5- Motivation	4	23,53	4	23,53	5	29,41	3	17,65	1	5,88	0	0	17
6- Career	1	6,25	5	31,25	4	25,00	2	12,50	3	18,75	1	6,25	16
7- Security	2	11,76	3	17,65	2	11,76	8	47,06	1	5,88	1	5,88	17
8- Image	1	6,667	2	13	8	53	4	27	0	0	0	0	15
9- Supervision	1	6,25	3	18,75	4	25,00	7	43,75	1	6,25	0	0	16
10- Changes	1	6,25	2	13	4	25	7	44	2	12,5	0	0	16
11- Task	1	6,25	2	13	5	31	6	38	2	12,5	0	0	16
12- Growth	3	17,65	4	23,53	5	29,41	5	29,41	0	0	0	0	17
13- Conflict	0	0	0	0,00	6	38	7	44	3	18,8	0	0	16
14- Aspirations	1	5,88	4	23,53	4	23,53	7	41,18	1	5,88	0	0	17
15- Decisions	2	11,76	1	5,88	8	47,06	5	29,41	1	5,88	0	0	17
16- Potentials	0	0	5	29	6	35	6	35	0	0	0	0	17
17- Flexibility	2	11,76	4	23,53	5	29,41	5	29,41	0	0	1	5,88	17
18- Climate	0	0	1	6,25	3	18,75	9	56,25	2	12,50	1	6,25	16
19- Salary	0	0	2	12	4	24	5	29	5	29,4	1	5,88	17
20- Structure	0	0	2	13	3	19	7	44	4	25	0	0	16
21- Volume	1	6,25	3	18,75	8	50,00	3	18,75	1	6,25	0	0	16
22- Development	0	0	5	31	7	44	3	19	1	6,25	0	0	16
TOTAL		6,54		19,17		32,04		32,28		8,34		1,64	

Table II shows the frequencies found in the Work Satisfaction Scale. The job satisfaction scale consists of

variables that measure individual feelings in relation to different aspects of their work11,12, which makes it

possible to measure job satisfaction from 22 different psychosocial aspects of work through the Liker scale of 6 points, classifying the level of satisfaction as: enormous satisfaction (6), great satisfaction (5); some satisfaction (4); some dissatisfaction (3); much dissatisfaction (2) and enormous dissatisfaction (1).

The data presented in Table II show that, the percentage of teachers who are with some dissatisfaction is 0.24% more than those who are with some satisfactions. While 32.28% of the teachers interviewed are with some

dissatisfaction, 32.04% are with some satisfactions; 19.17% are very satisfied; 8.34% are very dissatisfied; 6.54% are extremely satisfied, and only 1.64% are extremely dissatisfied.

3.1.5 Of Mental Suffering

The data on mental suffering will be presented according to the classification of Iacoponi & Mari¹³, sequentially, Factor 1, energy decrease; Factor 2, somatic symptoms; Factor 3, depressive mood; Factor 4, depressive thoughts and Factor 5, other symptoms of SQR-20.

Table.III: Frequency relative to factor 1 - energy decrease

QUESTIONS AND ANSWERS	YES	%	NO	%
Do you feel tired all the time?	2	12,5	14	87,5
Do you get tired easily?	3	18,75	13	81,25
Do you find it difficult to make decisions?	3	18,75	13	81,25
Do you find it difficult to perform your daily activities with satisfaction?	3	18,75	13	81,25
Do you have trouble thinking clearly?	5	31,25	11	68,75
Do you have difficulties in the service (your work is painful, causes you suffering?)	1	6,25	15	93,75

Table III, composed of factor 1 - energy decrease, presents a higher frequency in the variable "Has difficulties to think clearly" with 31.25%; then, with the same percentage, the variables "You tire easily", "Difficulties to make decisions" and "Difficulties to carry

out with satisfaction your daily activities" with a rate of 18.75% appear. The variables with the lowest percentage were "Feeling tired all the time" with 12.5% followed by "He has difficulties in the service (his work is painful, causes him suffering" with 6.25% of frequency.

Table.IV: Relative frequency to factor 2 and 3 - somatic symptom and depressive mood

QUESTIONS AND ANSWERS	YES	%	NO	%
Do you have frequent headaches?	3	18,75%	13	81,25%
Do you have unpleasant sensations in your stomach?	4	25%	12	75%
Does it have poor digestion?	4	25%	12	75%
Do you have a lack of appetite?	3	18,75%	13	81,25%
Do you feel nervous or upset or worried?	5	31,25%	11	68,75%
Have you felt sad lately?	7	43,75%	9	56,25%
Have you cried more than usual?	1	6,25%	15	93,75%

Table IV presents factors 2 and 3. In factor 2, the frequency of somatic symptom had the highest index of "Has unpleasant sensations in the stomach" and "Has poor digestion" with 25%; followed by the variables "You have a lack of appetite" and "You have frequent headaches" with a percentage of 18.75%.

In factor 3, it presents the frequency of Depressive mood, the highest frequency was the variable "Has been feeling sad lately", with 43.75%, then with 31.25% "Feeling nervous tense or worried", and with the lowest frequency was the variable "has cried more than usual, with 6.25%.

Table.V: Factor 4 frequency - depressive thoughts

QUESTIONS AND ANSWERS	YES	%	NO	%
Have you lost interest in things?	-	-	11	100%
Are you unable to play a useful role in your life?	-	-	11	100%
Do you feel like a useless, helpless person?	-	-	11	100%
Do you have any idea to end life?	-	-	11	100%

In Table V Factor 4, with regard to depressive thinking, there was no positive occurrence in any of the teachers

interviewed. Pointing according to the table that 100% of respondents do not have depressive thoughts.

Table.VI: Factor 5 other symptoms of SRQ-20.

QUESTIONS AND ANSWERS	YES	%	NO	%
Sleep bad?	5	31,25%	11	68,75%
Are you scared easily?	4	25%	12	75%
Do you have tremors in your hands?	-	-	16	100%

In other SQR-20 symptoms, the variables "sleep badly" with 31.25%, followed by the variable "easily frightened" with 25%, and the variable "have tremors in the hands" were not indicated by any teacher interviewed.

3.1.5 Frequency of teachers with mental suffering and without mental suffering.

Of the seventeen teachers interviewed, one (01) chose not to answer the questionnaire regarding mental suffering. In order to detect mental distress in the teachers who participated in the study, the following criteria were used: teachers who answered (YES) on seven or more questions were considered in this study, with mental suffering, with a percentage of 12.5% of (psychic disorders) and 87.5% without mental suffering, that is, without psychic disturbances

3.2 DISCUSSIONS

3.2.1 Sociodemographic Questionnaire

According to the data collected, the sociodemographic characteristic of the teachers studied has a predominance of the female gender, constituting 64.70%. Regarding the predominance of the female gender, research carried out in Brazil emphasizes this characteristic. Jacarandá¹⁴ when developing a work on Mental Suffering and Job Satisfaction involving teachers from inclusive schools, of the 132 participants, 70.5% were female, while 29.5% were male. Chaves & Fonsêca¹⁵ in a survey involving teachers, 91.4% were female. Delcor¹⁶, in a study on working conditions and health of private school teachers, 82.8% of the respondents were female teachers. In an approach on this issue, Codo¹⁷ emphasizes that the category of education workers is predominantly female, and the male presence has appeared in greater numbers only in recent years.

The highest average age of the educators involved in the study is between 40 and 49 years old and corresponds to 64.70% of the teachers interviewed. Regarding teaching time, 41.17% are working for more than 20 years in the profession and 32.29% work in prison units for more than 16 years, followed by those who work for more than 20 years with a percentage of 23, 52%.

As far as training is concerned, 88.23% have a complete upper level, and 76.47% have a postgraduate level of specialization. Of the teachers, 40% are trained in Portuguese Literature, and the others in other areas of teaching. In recent years, it has been observed that the index of teachers with higher education and postgraduate level is increasing, this from the Law of Guidelines and Base n° 9.394 (LDB) that in its art.62 requires of the teachers formation in superior level. Pereira¹⁸, addressing this issue, emphasizes that when they are obliged to attend the higher level, the teacher may have an overload of activities, but, on the other hand, may arouse a situation of contentment of these professionals because they are in search of a higher educational level, aspect that can raise your self-esteem. In Decor¹⁶'s study on the condition of work and health of the teacher, 72.1% of the interviewees had completed higher education; of Peixoto¹⁹ 92.9% of the teachers surveyed had a university degree; Jacarandá¹⁴ presented in his data the quantitative of 49.2% of teachers with higher education, evidencing the search of the educators by academic formation.

Regarding the hours of teaching activity, 82.35% have a weekly workload of 40 hours and only 17.47% work 26 hours a week. How much more hours dedicated to teaching activities such as planning, correction and other 52.94% of respondents said they dedicate to another 05 hours a week; 17.64% dedicate up to 10 hours per week; 5.8% up to 15 hours per week; 5.8% up to 20 hours; 5.8% more than 30 hours per week and 11.76% did not respond to this questioning.

The weekly workload had the largest variable in 40 hours per week with 82.35%, the result being similar to other surveys. Jacarandá¹⁴, when checking the weekly teaching hours, obtained 69.7% of the educators working 40 hours a week in their study; in studies presented by Lemos²⁰ pointed out that 40% of the teachers who participated in the study have a workload of 40 hours per week. Oliveira²¹ in a study carried out in Campinas, involving primary school teachers of the private network, evidences the contamination of extra-work time, being frequent the difficulties in performing daily tasks with satisfaction, explaining the picture of nervousness, tension and worry.

Delcor¹⁶ finds in its study, a weekly average hourly teacher load of 34.3% hours, and Porto²² in a study also with teachers, finds an average of 30 hours a week.

Regarding the hours dedicated to extra-class activities, what was observed was a double working day, because the teaching activity does not end with the end of the class, which ends up generating an overload of work, as emphasized by Lemos²⁰; Delcor¹⁶ and Mendes²³. Codo¹⁷ on this issue brings, that the work overload of the teacher happens when he has no way to channel this energy to other pleasurable actions, can lead him to illness.

Regarding training, the data indicated that, 76.47% of the teachers working in prison units did not receive training for this activity. Of the 23.52% who received training, 50% had a workload of more than 80 hours and 50% had a workload of 21 to 40 hours. Of the teachers who received training, 75% did not consider enough time to base their practice, and 25% considered it sufficient time to base their practice. The formation and qualification of teachers can not be considered an eternal resumption, but an incessant process of reconstruction of knowledge and practices and the widening of consciousness to act as individual and collective subject. Silva²⁴, brings as a right relative to labor law, as one of the principles of professional valorization and as one of the necessary conditions for the improvement of the quality of education three objectives, which besides being rights, should be an obligation of an educator and among them, improve the professional competence of teachers in the various fields of their activity; encouraging teachers to participate actively in educational innovation and in improving the quality of education and teaching; acquire new skills related to the specialization required by the differentiation and modernization of the educational system.

The data of the sociodemographic questionnaire point out that although the great majority of the teachers interviewed did not undergo any training or preparation to work in prison units, in addition to the exhaustive workload, most have a wide experience in educational actions in prison units. This statement does not rule out the need, much less the importance of offering training to teachers. This fact would greatly enrich their practices.

3.2.2 Of the Teaching Profession in Prison Units

Of the teachers who participated in the study, 76.47% answered that they felt prepared to work with students with deprivation of liberty, and 23.52% answered at times. The National Plan of Education (PNE) (Law n.10.172 / 2001), in setting the objectives and goals for the initial and continuing training of teachers, emphasizes that it is necessary to establish programs articulated between public institutions of higher education and the

secretariats of education, in order to raise the "minimum standard of quality of education through adequate preparation of teachers 1.

When questioned whether the educational process is important in prison units, teachers were unanimous in answering that yes 100%, demonstrating that they know the importance of education in building a new identity for the imprisoned students. Barreta²⁵ stresses that education is essential for the cultural, social and political development of a society and, moreover, is capable of transforming individuals into citizens who are practicing citizenship and aware of their rights and obligations.

When questioned if they meet the expectations of the students, 47.05% of the teachers interviewed believe that they sometimes meet the expectations of the students; 29.41% believe that they meet the expectations of the students, and 23.52% believe that they do not meet the expectations of the students.

Regarding work with curricular adaptation, 58.82% stated that they work with curricular adaptation, and 41.17% of teachers said that they do not work with curricular adaptation. In order for an educational proposal to meet its objective, it is necessary to take into account the reality in which the student is inserted and to have a curriculum that can meet the student's real expectations. According to Silva²⁶ a curricular proposal and a school concerned with student participation in society, it must be accompanied by clear and objective intentions of the educators, and this means a curriculum focused on human needs, that allows learning alternatives and knowledge that can intervene in the world and rebuild it.

Asked if education helps in the process of re-education and resocialization of students, 100% of the teachers interviewed said yes. However, there is a need for a social conscience that respect for the prisoner's dignity and preparation for a return to society is in everyone's interest, it is not only the practice of a humanitarian gesture, society is acting against itself when it shoots the prisoner in the and leaves him. Foucault²⁷ in a work entitled Watch and Punish, shows that prison work is the most adequate way for the transformation of the individual, because, at the time when the being that is arrested, has an occupation, and in time loses its violent personality, and becoming a quieter, more docile being.

3.2.3 Of Mental Suffering

Of the questioned teachers, 31.25% said they "have difficulties to think clearly", while 68.75% said they do not feel this difficulty. Then, with the same percentage, the variables "You tire easily", "Difficulties to make decisions" and "Difficulties to perform your daily activities with satisfaction" with a rate of 18.75% corresponds to the opposite opinion pointed out 81.25%

in each variable. The variables that had the lowest index were: "You feel tired all the time" with a percentage of 12.5% and "You have difficulties in the service, it is painful, it causes you suffering" 6.25% of the teachers interviewed.

The data presented from the study carried out with the teachers who work in prison units do not agree with the data found in national surveys on Work satisfaction and Mental Health. According to Dejours²⁸ contrary to what one imagines, the exploitation of suffering by the organization of work does not create specific mental illnesses, so there are no work psychoses. The greatest critics of psychiatric nosology to date have not been able to prove the existence of a mental pathology derived from work. Studies presented by Jacarandá¹⁴, presented a prevalence of 45.5% of suspected psychiatric disorders in special education teachers. In research on work and psychic disorders in teachers of the municipal network in Bahia, found DPM of 55.9% in teachers. Oliveira²¹ points out that there is a higher prevalence of psychic disorders in the category of teachers compared to other categories, which contradicts the results of this study.

When asked if they "had unpleasant sensations in the stomach," 25% said yes, while 75% said no. When verifying if the respondents "Has poor digestion" 25% answered yes, while 75% said no. The variables "lack of appetite" and "You have headaches often" had the same percentage, 18.75% said yes, while 81.25% said no. Gomes²⁹, when performing an ergonomic study with teachers in Rio de Janeiro, found that the most identified health problems were: a feeling of intense general malaise; anxiety, tension, nervousness, irritability, depression, distress and exhaustion; sleep disturbances; digestive problems; breathing problems and voice. In a study by Cunha³⁰ he found that the most frequent health problems among teachers are, the unpleasant sensation in the stomach, poor digestion, gastritis (30.0%) and headache (17.4%).

When asked if "Has been feeling sad lately", 43.75% answered affirmatively, while 56.25% answered that they do not feel sad. He then wondered whether "Feeling nervous or upset" and 31.25% said yes, but 68.75% said no. With the lowest frequency was the variable "has cried more than usual, with 6.25% affirmative, while 93.75% responded negatively.

In studies conducted in Hong Kong in recent years, it is reported that approximately one-third of educators surveyed showed signs of stress as one of the major health problems. Some teachers presented more severe signs than others, ranging from mild symptoms of frustration, anxiety and irritability to emotional exhaustion, with severe psychosomatic and depressive symptoms³¹.

As for depressive thinking, in none of the interviewed teachers was there any positive occurrence. Pointing according to the table that 100% of respondents do not have depressive thoughts.

In other SQR-20 symptoms, the variables "sleep bad" with 31.25%, followed by the variable "easily frightened" with 25%, and the variable "have tremors in the hands" were not indicated by the teachers interviewed.

Codo³² in a study on the mental health of 1st and 2nd grade teachers nationwide, involving the number of 1440 schools and 30,000 teachers, found that 26% of teachers surveyed had emotional exhaustion (about 1 teacher in every four studied) . This percentage varied in some states, 17% in Minas Gerais and Ceará; 39% in Rio Grande do Sul. According to the study, the professional devaluation, low self-esteem and lack of results perceived in the work developed were determining factors for the found frame.

In a study by Carvalho³³, with teachers from the initial years in Belém, she found higher levels of suspicion of psychic symptoms (according to the instrument used: MMPI) in educational institutions where the relationship was less democratic with the direction, more democratic relations prevailed.

The highest index found in this study, refers to the variable "sleeps badly", with the quantitative of with 36%. The working conditions of the teachers mobilize their physical, cognitive and affective capacities to reach educational requirements, generating over-stress or hypersolicitation of their psychophysiological functions, triggering clinical symptoms, which would explain the indexes of work withdrawal caused by mental disorders.

3.2.3 Satisfaction at Work

The data presented indicate that 32.28% are with some dissatisfaction, followed by some satisfactions with 32.04%. 19.17% of respondents are very satisfied; 8.34% are very dissatisfied; 6.54% are with great satisfaction and only 1.64% are with great dissatisfaction. Martinez¹² states that this is normal. According to him, the distribution of data in a central value is natural, the majority of employees have intermediate levels of satisfaction, the smaller percentages are distributed in levels of greater satisfaction and less dissatisfaction; this assertion of the author can be confirmed in this research by the variables "enormous satisfaction" obtained 6.54% and "huge dissatisfaction" with 1.64%. According to Robbins³⁴, on average 30% of a person's satisfaction is explained by heredity ... an individual's willingness to live, if he thinks and acts positively or negatively, all this is part of his genetic makeup, and takes its disposition in relation to work.

In the study carried out, it is verified that the aspect in which the teachers show more satisfactions refers to the relationship with other people with the percentage of 47.06%, and the highest index of dissatisfaction refers to the salary with 29.4 %.

Studies of several researchers have sought to determine the real causes of job satisfaction, and although there is still no consensus among researchers, studies are based on different variables. The studies of Arvey, Bouchard, Segal, and Abraham³⁵ on determinants of job satisfaction have analyzed variables related to organizational culture as generic factors. The bibliographic variables have been raised by Cohen³⁶; Scott, Moore & Miceli³⁷, related to personality traits verified by (Duffy, Schiflett & Downey³⁸; Sims & Szilagy³⁹ Other researchers, however, have studied factors intrinsic to work itself, such as Griffin's task characteristics⁴⁰ and mode which is performed.⁴¹ Satisfaction at work, in the face of the discussions raised, may characterize it as a multifactorial variable, and the most studied according to the surveys carried out are the nature of work, the working conditions, and the climate in which is performed.

Chaves & Fonseca, 15 in a study of 313 public school teachers from Paraíba about work satisfaction, found that 38% of the professionals surveyed said they were very satisfied, and 35.8% stated that they were recognized for their work by directors, supervisors and parents of students.

Esteve² brings an interesting discussion to emphasize that the educational changes that occurred in these last decades can cause problems to the health of the professionals, however, the result of this study pointed the opposite, and although the work performed is in an atypical environment, the satisfaction index of the teachers is high.

Questions of satisfaction and dissatisfaction at work generate contradictory opinions at times. In 1992, a line of studies postulated that the satisfaction was originated by characteristics and situational occurrences, and these characteristics were constituted by aspects that the individuals evaluate before accepting the work, like payment and conditions of work. For researchers Vroom, Loffquist and Davis, Orpen, Landy, the affective manifestations of individuals are related to the interaction between them and their environment. Other researchers, however, say that the individual needs to satisfy needs or meet values to feel satisfied at work. Therefore, even after decades of studies, there is no consensus in the literature about the components of job satisfaction. On the one hand a trend studies the dispositional aspect of the individual and the other, within a contemporary perspective, a tendency defines the construct as being affective,

attitudinal nature, and determined by multilevel variables, individual, group or organizational.

3.2.4 The Association between Mental Health and Job Satisfaction

According to data collected in the research, 12.5% of the teachers surveyed are suffering mentally. If we add teachers who are very dissatisfied, with those who are very dissatisfied, we reach 9.98% of the teachers surveyed.

From the data collected in this study, it is possible to indicate a possible association between job satisfaction and mental suffering. Henne & Locke, 42 discuss how difficult it is to establish the association between mental health and job satisfaction, since there is no way to determine whether satisfaction produces health, whether health produces satisfaction or whether the two are the result of some other factor.

Therefore, while interest in studies on the possible association between mental health and job satisfaction is growing, there is still no consensus that satisfaction engenders health. Martinez's research¹² makes it clear that, in studying the relationship between job satisfaction and worker health, despite the high statistical percentage, job satisfaction could not explain the variability of mental health aspects, because other factors not addressed in the study, could also interfere with the mental health of these workers.

IV. FINAL CONSIDERATIONS

The study of teachers' mental distress and their possible association with job satisfaction showed a predominantly female category, with a mean age of 40 to 49 years, with 41.17% being in the profession for more than 20 years.

Of the teachers who participated in the study, 88.23% had a university degree and 76.47% had a postgraduate degree in education, of which 35.29% were between 16 and 20 years in prisons and 82.35% weekly load of 40 hours in the classroom. And of those surveyed, 76.47% did not receive training to work with students in deprivation of liberty.

How many teachers' conceptions about education in prison units were unanimous in affirming that education helps in the process of resocialization of students, besides the great majority feel prepared to work with students in deprivation of freedom, affirming that education is of paramount importance in prisons.

Thus, satisfaction at work presented a percentage similar to those found in the literature, and in specific studies Martinez¹² and Martins et al⁴³ and their highest frequencies are in the range of some dissatisfaction, with 32.28% and 32.04% with some satisfaction. The highest indices of dissatisfaction are in the variable referring to

the salary with the percentage of 29.4%. And the highest satisfaction indexes refer to the relationship with other people in the company, with the percentage of 47.06% on the scale of many satisfactions. Concerning mental suffering, it was verified that 12.5% of the teachers studied have minor psychic disorders, considered as indicators of evidence of mental suffering, and may be directly associated to work dissatisfaction.

Therefore, in the face of the paucity of national research involving teachers working in prison units, this study will provide great reflections on teaching practice in prison units, often overlooked by researchers. An awakening to the educational practices on Mental Suffering and Job Satisfaction in Prison Teachers in Porto Velho, will bring contributions to the occupational health of teachers working in prison units. It will also serve as a research source to reflect the health of the teacher, as well as to allow a rethinking of public policies in education and health in the local context.

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Effect of Air Pollution on Rain Water: A Case Study of Ado-Ekiti, Nigeria

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Abstract— This study investigates the effect of air pollution on rain water in Ado-Ekiti. Air pollution is becoming a global phenomenon and a source of concern to the entire world. Plants, animals, environment and public health are subjected to risks due largely to the earth that is getting warmer, ozone layer getting depleted, acid rain being recorded, all as a results of air pollution. This study was carried out in order to determine the pH level (i.e acidity and alkalinity), Total Dissolve Solids (TDS), Electrical Conductivity (E.C), Nitrate, E-Coli and Total Coliform count of the rainwater in Ado-Ekiti. The study area was classified into three environmental zones (high income, medium income and low income) based on standard of living of the residents. Fifty six samples of rainwater was collected in the three environmental zones between April and September, 2017 using small buckets that were washed and rinsed with distilled water. The collected samples were taken to the laboratory for chemical and bacteriological analysis. The results showed that the observation zone having pH in between 5.3 and 7.5 while EC fell in between 0 and 0.2 mS/cm indicating that the zones were polluted. Results of bacteriological analysis showed rainwater is free from bacteriological pollutants. It is concluded that gone are the days in the study area when rainwater can be collected for drinking purposes without treatment. Measures have to be taken in the area of efficient energy consumption and vehicular emissions control.

Keywords— Air pollution, rainwater, Ado-Ekiti, pH, TDS, EC.

I. INTRODUCTION

Rapid industrialization, unplanned urbanization, population and vehicular growth are the major causes for the increased air pollution level in the city. Exposure assessment studies carried out in the developing world on several air pollutants have been reviewed and it is known that pollutants in the outdoor and indoor environments are associated with acute adverse effects on health of human and plants, [1]. Normal air contains about 78% nitrogen, 21% oxygen, 0.93%, argon, 0.038% carbon dioxide, and several other trace gases. Changes in the

gaseous composition of earth's atmosphere have become a prime concern for today's world due to human activities [1].

Nigeria and other developing countries have experienced a progressive degradation in air quality due to industrialization, urbanization, lack of awareness, number of motor vehicles, more use of fuels with poor environmental performance, badly maintained roads and ineffective environmental regulations. Rainwater has become increasingly dirty in the passage of time because of pollution. While it is initially a product of natural distillation, the formation of rainwater involves initially nucleation on aerosol particles. When the water is condensed, it interacts with various substances in the air dissolving some of them. As the rainwater falls, it collects more impurities. In effect, the first amounts of rainwater can be much polluted but the condition improves as the raining continues, i.e., the rainwater becomes cleaner [2].

The entire process also cleans the air. Aerosols (ammonium, nitrate, and sulfate) get reduced by 30% to 73% after rainfall while the gases (ammonia, nitrogen dioxide, sulfur dioxide, and chlorine) can go down by 24% to 63%. The ability of rainwater to capture air pollutants makes it a good medium for studying the extent of pollution in a locality. Such a study was done in Singapore in 1997-1998 which showed, among others, that both formic acid and acetic acid are the major organic acids that contributed to the acidity of rainwater [3]. A longer-term research based on rainwater was done in a semi-arid region of India wherein the chemistry of the rainwater was largely affected by the wind-carried dust and soil as indicated by the good correlation between calcium and nitrate ions, calcium and sulfate ions, and sulfate and nitrate ions. This study aimed at study rainwater in five locations within Ado Ekiti metropolitan area to determine whether it is polluted or not.

II. THE STUDY AREA

Ado Ekiti is a city in southwest Nigeria (Figure 1 & 2), the state capital and headquarters of the Ekiti State. It is also known as Ado. It has a population of above 424,

340. The people of Ado Ekiti are mainly of the Ekiti sub-ethnic group of the Yorubas. Ado Ekiti (Figure 3) has four tertiary educational institutions namely: Ekiti State University, Afe Babalola University and The Federal Polytechnic Ado Ekiti and Ekiti State School of Nursing and Midwifery. It also play host to two local television and three radio stations; NTA Ado Ekiti, Ekiti State Television (ESBS), Ekiti FM, Voice FM and Progress FM Ado Ekiti. Various commercial banks and enterprises operate in Ado Ekiti. Ado Ekiti also have ninety four (94) hotels and more that fifty (50) petrol stations all running on generating sets as source of electricity between two to twenty four hours per day

The town lies between the latitude $7^{\circ} 33'$ and $7^{\circ} 42'$ North of the equator and the longitude $5^{\circ} 11'$ and $5^{\circ} 20'$ East on a low-land surrounded by several isolated hills and inselbergs, [4]. Geologically, the region lies entirely within the pre-Cambrian basement complex rock group, which underlies much of Ekiti State [5]. The temperature of this area is almost uniform throughout the year; with little deviation from the mean annual temperature of 27° C. February and March are the hottest 28° C and 29° C respectively, while June with temperature of 25° C is the coolest [6]. The mean annual rainfall is 1,367mm with a low co-efficient variation of about 10% and 117 raining days in year 2017. Rainfall is highly seasonal with well marked wet and dry season. The wet season lasts from April to October, with a break in August.



Fig.2: Map of South West Nigeria showing Ekiti State
Source: [7]

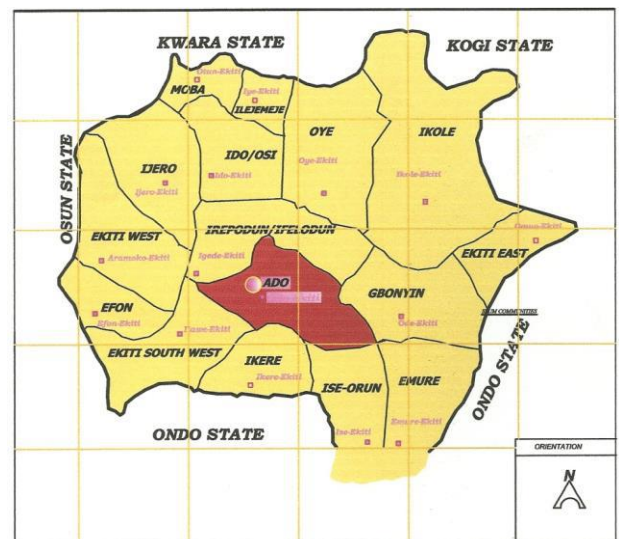


Fig.3: Map of Ekiti State showing Ado-Ekiti. Source: [7]



Fig.1: Map of Nigeria showing Ekiti State. Source: [7]

III. RESEARCH METHODOLOGY

A. Sample Collection Procedure

The procedures for collection of rainwater samples in the selected locations were:

- i. The plastic basin used for collection was washed with a soap.
- ii. The basin was rinsed with distilled water before it was used for collecting samples each time.
- iii. The basin was raised at least one meter above the ground level and covered with the cover lid after the collection of rainwater, so as to avoid contamination.
- iv. The samples collected were then taken to the laboratory.

B. Rainwater Sample Analysis

Water samples were collected from different locations within the study area. Records were taken for every

sample collected. Every container was identified by attaching appropriate inscription of the location where the samples were collected. Records made include; Source of sample, Date sample was collected and Sample number. The rainwater samples were taken to the laboratory within four hours for the following analysis; pH, Electrical - Conductivity, Total Dissolved Solids, Nitrate, E-Coli, and Total Coliform Count.

C. Chemical Test Procedures

By simple analysis of rainwater using pH-Meter, TDS-Meter and Conductivity meter for the measurement of pH, TDS of rainwater, and electro conductivity. We can predict whether studied locations are polluted or not

D. Determination of pH (Hydrogen potential) value

Aim: To determine the hydrogen potential (pH) of the samples

Apparatus and materials: Glass beaker, pH meter, distilled water, Standard buffer solution (pH4 and pH7)

Method: The reagents (buffer solution of pH4.0 and pH7.0) were prepared and were used to calibrate the pH meter. This was done by placing the electrode in the beaker containing the buffer solution. When the pH meter did not show the pH value of the buffer solution, the calibration knob is used to adjust it to the exact value. The electrode was then taken from the buffer solution, washed with distilled water and wiped with soft tissue. The sample was then poured into a beaker washed with distilled water, and the electrode of the pH meter placed in the beaker containing the sample to measure the pH value. A stable value on the meter was then recorded.

E. Determination of EC (Electro conductivity)

Aim: To determine the electro conductivity of the samples

Apparatus and materials: Glass beaker, portable EC meter, distilled water, tissue paper and Potassium chloride.

Method: The EC sensors was first washed with distilled water and wiped dry with tissue paper then inserted into a beaker containing KCl reagent for calibration. The meter was then rinsed in distilled water before using it to measure the conductivity. Readings are performed by an amperometric sensor. An alternating voltage is applied to the sensor and the amount of current that passes between the two stainless steel pins is dependent upon the amount of pollutants present

F. Determination of TDS (Total dissolved solids)

Aim: To determine the total dissolved solids in the samples

Apparatus and materials: Glass beaker, portable TDS meter, distilled water, tissue paper.

Method: In the determination of TDS of rainwater, TDS meter is used. Wash the electrode of TDS Meter with the help of distilled water, thereafter, electrode of the TDS

meter was dipped into the rainwater sample and the readings were taken.

G. Determination of Nitrate

Aim: To determine Nitrate in the sample.

Apparatus and materials: Glass beaker, Test tube, Acid reagent, Nitrate Nitrogen comparator, Tissue paper.

Method: The test tube was rinsed and filled with the sample to the 2.5 ml line which was then diluted to the 5 ml line with the Mixed Acid Reagent. The mixture was then mixed. After 2 minutes. A 0.1 g spoon was used to add one level measure and after waiting for 10 minutes, the test tube was inserted into the Nitrate Nitrogen Comparator. The sample color was matched to a color standard and result was record in mg/l (ppm)

H. Determination of Total Coliform

Aim: To determine Total Coliform in the sample.

Apparatus and materials: 1.0 ml each of the samples, incubator, auto colony counter electronic machine and nutrient agar

Method: 100 ml of the sample was filtered through thin acetals membrane sheet with openings less than 0.5 mm so that the bacteria present in the sample were trapped. The filter was later raised with the nutrient agar and incubated at a temperature of 37°C for a period between one and five days, in which the bacteria start to grow in the nutrient agar (which acts as the nutrient medium). Visible colonies are produced.

IV. RESULTS AND DISCUSSION

A. Results

The Tables 1 – 5 show results of rainwater analysis from the five sampling locations. Each table show results of pH, TDS, EC, Nitrate, Total coliform count, and E-coli. In this study, the analyzed rainwater samples met the requirements for safe drinking water in terms of physicochemical composition and the microbiological parameter except of some samples which had a pH lesser than 5.6 and considered to be acidic according to [8].

Table.1: Physicochemical and Bacteriological Analysis of Rainwater Samples at Dalimore

Date	pH	TDS (ppm)	EC (mS/cm)	Nitrate (mg/L)	Coliform Count (cfu/ml)	E-coli Count
18-06-17	5.3	6.4	0.1	0.2	0	0
30-06-17	6.5	0	0	0.48	0	0
05-07-17	6.5	0	0	0.29	0	0
14-07-17	6.5	0	0	0.32	0	0
16-07-17	7.2	0	0	0.21	0	0
17-07-17	7.8	6.4	0.1	0.53	0	0
Average	6.63	2.2	0.03	0.34	0	0

WHO Standard	6.50-8.50	600	1000	50	1	0
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Table.2: Physicochemical and Bacteriological Analysis of Rainwater Samples at Fajuyi

Date	pH	TDS (ppm)	EC (mS/cm)	Nitrate (mg/L)	Coliform Count (cfu/ml)	E-coli Count
18-06-17	6.6	6.4	0.1	0.15	0	0
30-06-17	6.8	0	0	0.27	0	0
01-07-17	6.5	0	0	0.42	0	0
05-07-17	6.7	0	0	0.13	0	0
14-07-17	6.6	0	0	0.81	2	0
17-07-17	5.9	0	0	0.24	0	0
Average	6.52	1.07	0.02	0.34	0.33	0
WHO Standard	6.50-8.50	600	1000	50	1	0

Table.3: Physicochemical and Bacteriological Analysis of Rainwater Samples at Ilokun

Date	pH	TDS (ppm)	EC (mS/cm)	Nitrate (mg/L)	Coliform Count (cfu/ml)	E-coli Count
02-06-17	6.3	0	0	NC	NC	NC
04-06-17	6.2	0	0	NC	NC	NC
06-06-17	6.3	0	0	NC	NC	NC
07-06-17	6.2	0	0	NC	NC	NC
09-06-17	6.8	0	0	NC	NC	NC
11-06-17	6.7	0	0	NC	NC	NC
13-06-17	6.4	0	0	NC	NC	NC
14-06-17	7	0	0	NC	NC	NC
18-06-17	6.8	0	0	NC	NC	NC
19-06-17	6.6	0	0	NC	NC	NC
20-06-17	6.7	0	0	NC	NC	NC
Average	6.55	0	0	NC	NC	NC
WHO Standard	6.50-8.50	600	1000	50	1	0

*NC = Not conducted

Table.4: Physicochemical and Bacteriological Analysis of Rainwater Samples at Bawa Estate

Date	pH	TDS (ppm)	EC (mS/cm)	Nitrate (mg/L)	Coliform Count (cfu/ml)	E-coli Count
11-06-17	6	0	0	0.31	0	0
14-06-17	6.3	0	0	0.19	0	0
16-06-17	6.4	0	0	0.24	0	0
18-06-17	6.6	0	0	0.13	0	0
19-06-17	6.9	0	0	0.17	0	0
24-06-17	6.5	0	0	0.32	0	0
24-06-17	6.7	0	0	0.21	0	0
30-06-17	5.1	0	0	0.17	0	0
01-07-17	5.7	0	0	0.22	0	0
Average	6.24	0	0	0.22	0	0
WHO Standard	6.50-8.50	600	1000	50	1	0

Table.5: Physicochemical and Bacteriological Analysis of Rainwater Samples at GRA

Date	pH	TDS (ppm)	EC (mS/cm)	Nitrate (mg/L)	Coliform Count (cfu/ml)	E-coli Count
29-05-17	6.14	6.4	0.1	NC	NC	NC
31-05-17	6.42	0	0	NC	NC	NC
06-06-17	6.1	0	0	NC	NC	NC
07-06-17	6.5	0	0	NC	NC	NC
12-06-17	6.87	0	0	NC	NC	NC
14-06-17	6.9	0	0	NC	NC	NC
19-06-17	6.6	0	0	NC	NC	NC
Average	6.5	1.07	0.02	NC	NC	NC
WHO Standard	6.50-8.50	600	1000	50	1	0

*NC = Not conducted

B. Discussion

The above tables show the result of the water samples tested for all five locations and the average values for each parameter.

C. Physical parameters

The pH of water samples from all locations ranged from 5.10 – 7.80, with Dalimore, Fajuyi, Ilokun, Bawa and G.R.A having an average pH of 6.63, 6.52, 6.55, 6.24 and 6.50 respectively. The rainwater in the area is normal, except for the one that in Bawa on 30/06/2017 that was 5.10 and Dalimore on 18/06/2017 which was 5.30 below 5.60 which is considered to be an acidic rain according to [9], who reported that the reference level commonly used to compare acid precipitation to natural precipitation is pH 5.6 (the pH that results from the equilibrium of atmospheric carbon dioxide with precipitation). The rain of 01/07/2017 was 5.70 while the rest were above 6.00.

And when an enquiry was made in the Bawa location, it was made known that they had not had electricity supply for some days before the day it rained and most houses, hostels and shops had to use their Generating sets with must have increased the CO₂ content in the air causing a rise in the pH. With the construction work going on in Fajuyi as at when this study was carried out, it is believed that the pollution created as a result of the construction must have caused the pH of the sample collected that day to drop to 5.9.

Dalimore is a commercial location with high level of pollution generated as a result of vehicular activities and generating sets. But because pollutants are easily dispersed, it is believed that pollutants generated from the construction site in Fajuyi had dispersed to Dalimore on 18/06/2017

But this also showed that the rain within Ado-Ekiti is not acidic in comparison to research work by [10], which showed that the pH of four industrial areas of Lagos state namely: Ilupeju, Costain, Ikeja and Ikorodu were 4.94, 4.20, 4.22 and 4.30 respectively.

The range for the total dissolved solids for all the location ranged between 0.0 – 6.4 mg/l and which reflected in the conductivity of the samples. The values gotten is within range of the value of 5.25 ± 1.2 mg/l reported by [11] in physicochemical and trace metal levels of rain water for Ile-Ife, South-western Nigeria. This value makes the rainwater in ado someway safe for drinking assuming other parameters are in the green. As water with a total dissolved solids (TDS) level of less than about 600 mg/l is generally considered to be good and drinking water becomes significantly and increasingly unsafe at TDS levels greater than about 250 mg/l [12].

D. Chemical parameter

The levels of Nitrate in all locations were considerably low compared to the WHO limits for Nitrate in rainwater.

No health based guideline value has been derived for Nitrate [12].

E. Bacteriological parameter

There was no presence of E-coli in all samples and a Total coliform count of 2cfu/ml in samples from Fajuyi which was within limits.

V. CONCLUSION

Rainwater appears to be one of the most promising alternatives for supplying freshwater even in a polluted area hence it is collected from an open space. The chemical quality of open space harvested rainwater in Ado-Ekiti is quite satisfactory with no parameter being detected above the corresponding maximum allowable concentration for drinking purposes according to WHO standard. Since this research focused on “Effect of Air Pollution on Rainwater in Ado-Ekiti”, not all the physico-chemical analysis and microbiological composition needs be checked to know what effect air pollution would have on rainwater. In general, examination of the physicochemical composition of the rainwater is a prerequisite before its utilization for drinking purposes.

The physicochemical quality of the rainwater samples examined in this study indicates that at Ado-Ekiti is unpolluted in terms of rainwater according to WHO standards. Even though there are increasing vehicular activities, deforestation, increase in use of Generating set for power supply, bush burning, e.t.c going on daily in the study area, the findings indicated that the rainwater was still not affected which shows that pollution or gas emissions might travel far away from its source or can settle on roof, leaves etc and do not always remain on the air. Which makes the authors conclude that except for rare occasions, Ado-Ekiti does not experience what is termed “Acidic rain” and with the low level of Nitrogen ion present in the rainwater, “Eutrophication” would be nothing to worry about.

VI. RECOMMENDATION

Because rainwater harvesting as an alternative source of water for domestic use is an age long popular practice as public water supply are not always available and consistent [9] and rainwater harvesting is a simple and low cost technique that involves the capturing and storing of rainwater from roof catchments or directly for domestic, agricultural and environmental purposes [9].

In order to curb the effect of air pollution on rainwater within the state capital, the following measures could be considered so as to reduce the amount of air pollution generated within the state capital:

- i. Awareness should be made on air pollutions. Residents within the study area need to be educated on air pollution, the sources and its effects. If people are self-aware and knowledgeable

about air pollution, some activities causing air pollution such as bush burning, burning of tire by vigilantes, burning of refuse instead of disposing it properly though Ekiti State Waste Management Authority (EKSWMA) would be reduced. This would also make people switch from using artificial indoor product that causes pollution to a natural product. For example, swapping insecticides for lemon peels soaked in water to kill mosquitoes, or using baking soda and onions to kill cockroaches.

- ii. Sensitization on the need for residents and shops or office owners to plant trees and flowers around their premises and have smaller trees in pots or flowers in pots placed in their premises.
- iii. Source reduction happens to be the most effective way of reducing air pollution; a shift to clean energy (e.g. Solar, Inverter, etc.). Instead of using a generating set which its long term cost is almost equal to that of a solar power unit, a solar or an inverter should be used because they are eco-friendly when compared to a generating set which produces pollutants e.g. CO₂, Unburned hydrocarbon.

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Weed flora in rice areas under distinct cropping systems, herbicide and irrigation managements

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Abstract— We aimed to evaluate the incidence of weeds in the pre-planting of the summer crop as a function of planting system, herbicide use and irrigation management. The experiment was installed in field conditions, in RBD and 3 x 2 factorial scheme with eight replications. Treatments consisted in submitting rice to three management factors: water management – continuously flooded or intermited irrigation (Factor A), coupled to the application (traditional control) or not (semi-ecological system) of herbicides (Factor B), and planting system – conventional soil tillage, minimum tillage and no-till systems (Factor C). One year after rice cultivation, preceding the planting of the next cropping season, phytosociological evaluations of the weed communities were carried out. We assessed the overall infestation and weed species composition, which were classified by their respective density, frequency and dominance. We also estimated the diversity coefficients of Simpson and Shannon-Weiner, and the sustainability coefficient of Shannon; treatments were also grouped by similarity in weed composition. In flood-irrigated rice, no-till provides the lowest levels of weed infestation and, together with the conventional cropping system, results in values closer to the ecological sustainability; The application of herbicides in flooded rice crops reduces weed infestation, increases diversity and equalizes the ecological sustainability, compared to areas without the application of weed management methods. However, chemical control leads to the selection of resistant or tolerant species to herbicides, such as *Polypogon sp.*; Both continuous and intermittent water management systems did not cause changes in the level of infestation, composition or diversity coefficients.

Keywords— crop management, phytosociology, *Oryza sativa*.

I. INTRODUCTION

Management systems as well as agricultural practices interfere on the agroecological dynamics of weed growth and dispersal (Salomão et al., 2012); the weed community may vary according to the cultural practices applied to the area, and their identification become indispensable to avoid crop grain yield losses by subsidizing the choice for the most adequate control method (Nordi and Landgraf, 2009).

Lack of knowledge on existing weed species in a given crop, coupled to the inadequate use of control methods, often result in the excessive use of herbicides, increasing both the environmental risk and the economical cost of the field. In this sense, the identification and quantification of these species becomes necessary to the proper selection of control methods (Silva et al., 2015).

In rice, the conventional planting system is usually adopted, but recently the minimum soil tillage is being vastly adopted; in this system, soil tillage occurs right after the harvest of the field, and a simple burndown operation is applied prior to planting, on the next cropping season. Weeds on the soil seed bank may be stimulated to germinate due to this late season soil tillage.

Irrigation management is another issue of concern for weed occurrence in rice, since the rice cropping system in Southern Brazil comprehends a definitive flooding of the area to be imposed from rice tillering start onwards. Alternative management systems aiming to save water are being tested; among them, the intermittent irrigation is gaining importance. This irrigation system comprehends alternate period of flooding and drainage of the rice fields, aiming to save water. Preliminary data show that the periods in which the field is drained, may allow the establishment of a new weed flora in the area.

The floristic survey has been shown to be tool for the recognition of infestation patterns in agricultural areas, allowing to characterize the weed community

structure in quantitative and qualitative terms (Silva et al., 2015). For Pitelli (2000), phytosociological indexes support the analysis impacts caused by differential management systems and agricultural practices on the dynamics of weed communities in cropped fields, subsidizing the decision on the herbicides to be applied.

II. OBJECTIVE

The aim of the present study was to evaluate the incidence of weeds in the pre-planting of the summer crop as a function of the planting system, herbicide use and irrigation management.

III. MATERIAL AND METHODS

The experiment was installed in field conditions, at Embrapa Clima Temperado, Pelotas-RS, Brazil, in randomized complete blocks design, and 3 x 2 factorial scheme with plots measuring 4 m x 4 m, with eight replications. Treatments consisted in submitting rice to three management factors, as follows: water management – continuously flooded or intermittent irrigation (Factor A), coupled to the application (traditional control) or not (semi-ecological system) of herbicides (Factor B), and planting system – conventional soil tillage, minimum tillage and no-till systems (Factor C). Seeding was carried out with nine rows spaced in 0.175 m, on 09 Nov. 2016 with 100 kg ha⁻¹ of the variety Guri Inta CL. The basic fertilization applied at the planting furrow consisted of 300 kg ha⁻¹ of N-P-K 5-25-25.

For the planting system, in the conventional system, the area underwent plowing and disking prior to planting. In the minimum cultivation, the area underwent two light diskings, 20 days before planting rice. For no-till, the vegetation mulching was burndown 20 days prior to planting rice.

As for the chemical treatments, those without herbicide did not receive any application, not even for burndown prior to planting; the natural area mulching was only accommodated closer to soil by the planting operations. In plots where herbicides were to be applied, the area was burndown 20 days before planting, with 1440 g ha⁻¹ of glyphosate. Subsequently, 73.5 g ha⁻¹ of imazapyr + 24.5 g ha⁻¹ of imazapic (140 g_{c.p.} ha⁻¹ of Kifix) + 400 g ha⁻¹ de clomazone were applied right after rice planting. Thirty-five days after emergence, the application of 375 g ha⁻¹ of quinclorac was necessary for control of jointvetch (*Aeschynomene* spp.).

Flood irrigation was established on 08 Dec. 2016, 20 days after crop emergence, at the beginning of tillering (~ V3), by establishing a water layer of 7 cm, which was maintained throughout the cropping cycle in treatments continuously flooded. In treatments with intermittent irrigation, water was replenished only when about 20% of

the soil was under no water layer. After harvesting, in April 2017, ryegrass (*Lolium multiflorum*) was established as winter cover at rate of 25 kg ha⁻¹ of seeds. No cuts were made to ryegrass throughout the cycle, nor any fertilizer was applied to the winter crop.

On 27 Oct. 2017, phytosociological evaluations of the weed communities present in the treatments were carried out. The sampling method adopted for surveying the weed occurrence was that of the Random Quadrats, as proposed by Barbour et al. (1998), being randomly sampled one quadrat per plot (n = 8), with 0.25 m of side. In the quadrat area, fleabane (*Conyza* spp.), fringerush (*Fimbristylis* sp.), Ryegrass (*Lolium multiflorum*) and beardgrass (*Polypogon* sp.), which predominated in the area, were quantified; the other weed species reported, were grouped as "others". Plants were cut to the soil level, packed in paper bags by species, and dried into forced air circulation oven at ± 75 °C for three days, for later dry mass measurement. The number of plants (number m⁻²) and its total dry mass (g m⁻²) for each weed species (absolute infestation) were presented in histograms as a function of treatment, with the respective sampling standard errors.

The absolute infestation data set was tested for normality by the Shapiro-Wilk test, prior to estimating the density (based on number of individuals), the frequency (based on the spatial distribution of the species) and the dominance (based on capacity to accumulate mass) in relative terms, which were used to obtain the importance value for each species in each factor/treatment, according to Pandeya et al. (1968) and Barbour et al. (1998), as follows:

$$rDe = \frac{I}{RI} * 100 \quad (1)$$

$$rFr = \frac{Q}{tQ} * 100 \quad (2)$$

$$rDo = \frac{DM}{TDM} * 100 \quad (3)$$

$$IV = \frac{rDe + rFr + rDo}{3} \quad (4)$$

where rDe = relative density (%); rFr = relative frequency (%); rDo = relative dominance (%); IV = importance value (%); I = number of individuals of species "x" in area "r"; RI = total number of individuals in area "r"; Q = number of samples evaluated in area "r" where species "x" is present; tQ = total number of samples in area "r"; DM = dry mass of individuals of species "x" in area "r"; TDM = total dry mass of weeds in area "r". The importance value (IV) locates each weed within the community, depending on its ability to cause damage (severity of occurrence), based on the three parameters mentioned above.

The areas were also intra analyzed by the diversity coefficients of Simpson (D) and Shannon-Weiner (H') (Barbour et al., 1998). The sustainability coefficient (SEP) was also estimated according to McManus and Pauly (1990), as follows:

$$D = 1 - \frac{\sum ni * (ni - 1)}{N * (N - 1)} \quad (5)$$

$$H' = \sum (pi * \ln(pi)) \quad (6)$$

$$SEP = \frac{Hd'}{H'} \quad (7)$$

where D = Simpson and H' = Shannon-Weiner diversity indexes (both based on density); ni = number of individuals of species "i"; N = total number of individuals in the sample; pi = proportion of individuals in the sample belonging to species "i"; SEP = Shannon-Weiner sustainability coefficient; and Hd' = Shannon-Weiner diversity index (based on dominance).

Subsequently, the areas were compared by Jaccard's binary asymmetric similarity coefficient (J). Based on the Jaccard coefficient, the similarity matrix was prepared and from it the dissimilarity matrix (1-similarity) was obtained, as follows:

$$J = \frac{c}{a + b - c} \quad (8)$$

$$Di = 1 - J \quad (9)$$

where J = Jaccard's coefficient of similarity; a = number of species in area "a"; b = number of species in area "b"; c = number of species common to areas "a" and "b"; and Di = dissimilarity.

The multivariate hierarchical clustering analysis was performed from the dissimilarity matrix by the UPGMA hierarchical clustering method (Sneath and Sokal, 1973). The critical level for group separation was based on the arithmetic mean of the similarities in the original matrix (Barbour et al., 1998), while not considering the crossing points between the same areas in the matrix (where $Di = 0$). Grouping validation was performed by the cophenetic correlation coefficient (Sokal and Rohlf, 1962), obtained by Pearson's linear correlation between the original matrix of dissimilarity and its respective cophenetic matrix. All coefficients and graphs were obtained in the statistical environment R (R Development, 2017).

All formulas and procedures, both for sampling and for describing the communities as well as species grouping, followed the recommendations by Barbour et al. (1998) for synecological analyzes.

IV. RESULTS AND DISCUSSION

Results should be concrete and meaningful for engineering scopes. You should describe limitations of your results.

4.1. Factor A – Cropping System

The absolute number of weed plants differed as function of the cropping system, being as smaller as the less intensive the soil preparation (Figure 1a), with 2108, 1963 and 1488 plants m^{-2} respectively for the conventional, minimum and no-till planting systems. The total weed dry mass, however, had opposite behavior; higher values were found in the less disturbed soils, with 223, 248 and 332 $g m^{-2}$, respectively for the conventional, minimum and no-till systems (Figure 1a). For the latter, even supposing the amount of weed seeds in the soil bank is high, the proportion of those able to germinate is reduced (Gomes and Christoffoleti, 2008).

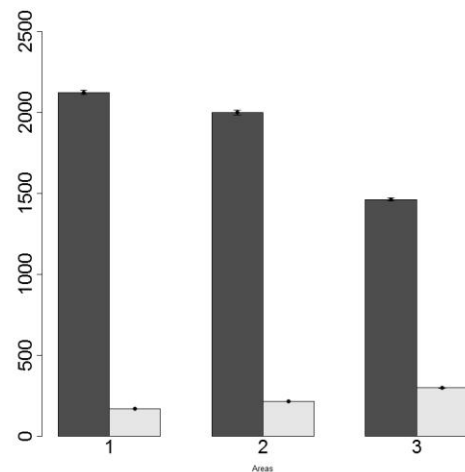


Fig.1a: Infestation and Indices of species diversity in Conventional cropping system, Minimum cropping system and No-tillage system. Density samplings ($n^{\circ} m^{-2}$) and dry mass ($g m^{-2}$)

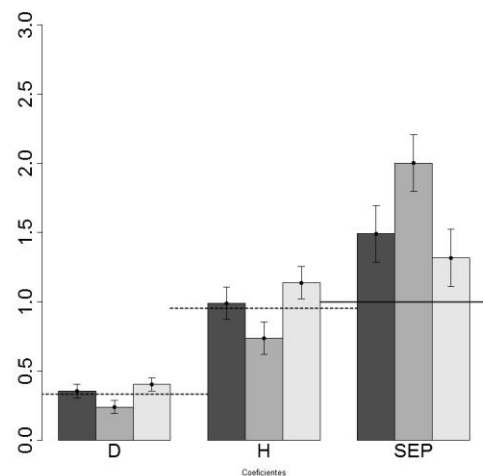


Fig.1b: Weed species diversity, D = Simpson diversity index; H' = Shannon-Weiner diversity index; SEP = Shannon-Weiner Evenness Proportion. Embrapa Clima Temperado, Pelotas-RS, 2017

Analyzing the diversity indexes of Simpson (D), one may infer that the minimum cropping system, by causing only small changes in soil structure due to the slight upturning in the autumn, probably does not eliminate those weeds most adapted to the mechanical management, while at the same time it eliminates species less adapted to disturbance, resulting in lower diversity coefficient (Figure 1b). As the diversity coefficient of Shannon-Weiner was also lower in this treatment compared to the others, it is assumed that the space supposedly open in the area by the light soil tillage in autumn is not sufficient for the establishment of other alien or rare species, which would be mostly mirrored by this coefficient (Figure 1b).

According to Barbour et al. (1998), the Simpson index (D) is less sensitive to species richness, being mostly impacted by changes in occurrence of dense species. The Shannon-Weiner index, on the other side, is mostly impacted by changes in occurrence of alien or rare species (BARBOUR et al., 1998). Thus, both coefficients should be considered, since they are affected in different ways (CONCENÇO et al., 2013).

Table.1: Density, frequency, dominancy and important value of weed species in Conventional cropping system, Minimum cropping system and No-tillage system. Embrapa Clima Temperado, Pelotas-RS, 2017.

Conventional cropping system				
Species	de	fr	do	vi
<i>Conyza sp.</i>	0.42	10.91	0.83	4.05
<i>Fimbristylis sp.</i>	1.04	16.36	9.74	9.05
<i>L. multiflorum</i>	78.66	29.09	67.26	58.34
<i>Polypogon sp.</i>	4.33	18.18	11.59	11.37
Others	15.54	25.45	10.57	17.19
Minimum cropping system				
<i>Conyza sp.</i>	0.2	4.55	0.31	1.69
<i>Fimbristylis sp.</i>	0.85	25	9.74	11.86
<i>L. multiflorum</i>	86.7	36.36	65.91	62.99
<i>Polypogon sp.</i>	8.35	15.91	14.81	13.02
Others	3.9	18.18	9.23	10.44
No-tillage system				
<i>Conyza sp.</i>	0.27	8	1.41	3.23
<i>Fimbristylis sp.</i>	2.05	16	6.93	8.33
<i>L. multiflorum</i>	75.51	32	66	57.84
<i>Polypogon sp.</i>	14.09	16	16.45	15.51
Others	8.07	28	9.21	15.09

Due to the high importance values (IV), the most favored weeds were *Fimbristylis sp.*, *Lolium multiflorum*

and *Polypogon sp.*, with no remarkable differences between cropping systems (Table 1). *Conyza sp.* was less evident in the minimum tillage compared to the other systems, due to inherent characteristics of the species, as pointed out by Concenço & Concenco (2016); on the one hand, this species is relatively sensitive to soil disturbance, which supports its greater occurrence in no-till. By being highly prolific, *Conyza sp.* occupies the available space, just as reported for the conventional tillage. In the minimum tillage, the small soil disturbance associated to the presence of straw cover ended up by reducing its occurrence.

In general terms, the no-till and the conventional systems were similar in terms of species diversity, while the minimum tillage differed; the latter seems to have not contributed for neither the elimination of the weeds present, nor the emergence of new weeds (Table 1). This reflected in the SEP sustainability coefficient, which was most distant from "1" (the theoretically ideal value) in this treatment, although none of the cropping systems presented adequate results (Figure 1b).

Cruz et al. (2009) reported that areas rotated with soybean, maize and irrigated rice in no-till, under central pivot irrigation, showed greater weed diversity. Thus, it can be hypothesized that crop rotation, succession and tillage system diversity contribute for adequate diversity and sustainability into a cropping system. The data corroborate with Ceolin et al. (2016), who reported that ryegrass, planted as winter cover crop in rice growing areas, was efficient in reducing weed occurrence. In flooded rice areas without crop rotation (rice / fallow) for more than five years, Erasmo et al. (2004) found higher prevalence of weeds from Poaceae and Asteraceae families. When rotated with soybeans, Cyperaceae also took importance.

The germination flow of weed seeds under no-till is mainly due to changes in soil temperature and moisture conditions, since there is no disturbance that could stimulate germination of certain species. During winter, the reduced soil temperature favors the germination of hibernal weeds, while estival species are favored during the warmer cropping season (Gomes et al., 2008).

In general terms, the cropping system does not seem to be the main factor in the definition of weeds occurring in lowland rice areas, since the importance values for the monitored species and also for the other species present in the areas were very similar between the three soil tillage systems (Table 1). This was corroborated by the similarity analysis (data not shown), which indicated $J = 100\%$ among all treatments, regarding exclusively species composition. As expected, ryegrass predominated because it was an introduced species, which

may have contributed to the suppression of weeds and the equalization of infestation between the different systems.

Comparing crop production systems, Pacheco et al. (2016) verified that for rice preceded by soybean in the summer and *Pennisetum glaucum* in winter, the conventional system resulted in fewer weeds established in the area during rice cultivation, compared to no-till. The author attributed the fact to poor soil cover provided by *P. glaucum*. Therefore, the no-till system seems to be efficient in weed suppression only if there is efficient soil cover and adequate straw volume, which can be achieved by additional sowing of some winter cover crop such as ryegrass. This is one of the few cover / grazing species adapted to floodplain environments, achieving high yields of dry mass with small addition of nitrogen. It presents high nutrient cycling capacity, which justifies its use prior to rice cultivation, besides being suitable for both for soil cover and animal grazing (Conte, 2007; Correia et al., 2013).

4.2. Factor B – Herbicide Application

There was reduction in weed density when subjected to herbicide application, but the weed dry mass remained unchanged (Figure 2a). In absence of herbicide application, around 2420 plants m^{-2} were reported, while in plots with herbicide application, less than 1500 plants m^{-2} were observed.

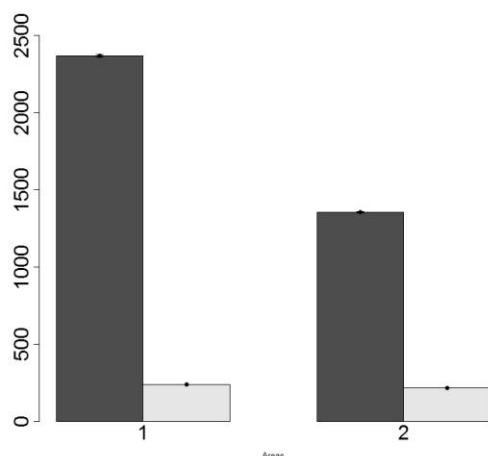


Fig. 2a: Infestation and Indices of species diversity when non-applied and applied herbicides. Density samplings ($n^{\circ} m^{-2}$) and dry mass ($g m^{-2}$)

Both the Simpson and Shannon-Weiner diversity indexes were higher when herbicides were applied compared to herbicide-free plots (Figure 2b). Considering that these indices take into account both the number of individuals of each species and the balance in occurrence between species, it can be inferred that in areas with no herbicide application, only certain species predominated

and inhibited the others, which reduced the "D" diversity coefficient. Plants with early establishment have advantage in the use of environmental resources; they can occupy the available space faster and inhibit later-emerging weeds (Fleck et al., 2003).

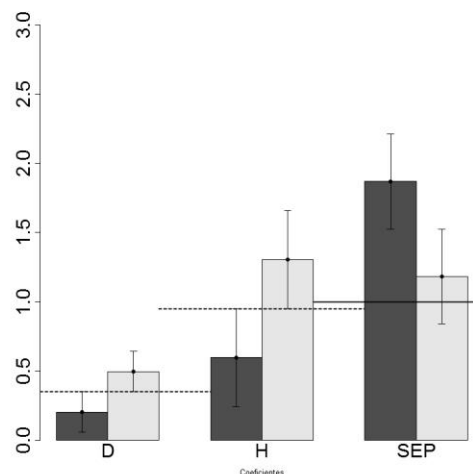


Fig.2b: Weed species diversity, D = Simpson diversity index; H' = Shannon-Weiner diversity index; SEP = Shannon-Weiner Evenness Proportion. Embrapa Clima Temperado, Pelotas-RS, 2017

The "D" index gives greater weight to the abundant species, and the data indicate that herbicide application may not have caused effective control over certain highly prolific species, increasing in this situation the abundance of these in the area. In addition, it was reported reduced emergence of rare species, which may have been eliminated due to the herbicide action spectrum, which affected the H' coefficient. From this point of view, the application of herbicides may have been positive in eliminating some plant species that could be harmful. This does not mean, however, that areas with herbicide application is always more interesting from the point of view of the productive system.

The SEP index showed that in plots without herbicides, most species invested more in dry mass accumulation (competitive strategy based on dominance) compared to the number of individuals, inferring that the environment is very likely rich in resources and able to supply the demand of the plants present. Moreover, the available space seems to be mostly occupied, since the increase in density was not the predominant competitive strategy. On the other hand, herbicide applications eventually balanced the population of the species, with equalization between density and dominance, which provided $SEP \approx 1.0$ (Figure 2b).

Regarding the phytosociological characterization, ryegrass showed higher values compared to the other species, most probably because it was planted on purpose,

for both treatments (with and without herbicide) (Table 2). *Fimbristylis* sp. and the other unidentified species, were more affected by herbicide residuals, showing reduction in all indices evaluated. However, by eliminating some species, others end up occupying the space, such as *Conyza* sp. and *Polypogon* sp., which were favored in treatments under herbicide applications. This advantage can be attributed to the fact that these species may present a certain tolerance to the herbicide, or even resistance, as in the case of *Conyza* sp. to glyphosate (Moreira et al., 2007; Lamego and Vidal, 2008; Trezzi et al., 2011).

Table.2: Density, frequency, dominancy and important value of weed species when non-applied and applied herbicides. Embrapa Clima Temperado, Pelotas-RS, 2017.

Non-applied herbicide				
Species	de	fr	do	vi
<i>Conyza</i> sp.	0.17	5.56	0.25	1.99
<i>Fimbristylis</i> sp.	1.27	29.17	11.61	14.02
<i>L. multiflorum</i>	88.71	33.33	74.76	65.6
<i>Polypogon</i> sp.	0.28	5.56	0.49	2.11
Others	9.57	26.39	12.89	16.28
Applied herbicide				
Species	de	fr	do	vi
<i>Conyza</i> sp.	0.54	10.26	1.66	4.15
<i>Fimbristylis</i> sp.	1.18	10.26	5.08	5.51
<i>L. multiflorum</i>	66.75	30.77	56.91	51.48
<i>Polypogon</i> sp.	22.38	26.92	30.48	26.59
Others	9.15	21.79	5.87	12.27

4.3. Factor C – Irrigation Management

Marchezan et al. (2004), evaluating the performance of rice genotypes submitted to different water management systems, verified that the continuous water layer from tillering start to harvest, when associated with adequate soil preparation, suppressed most grass weeds, mainly barnyardgrass (*Echinochloa crusgalli*).

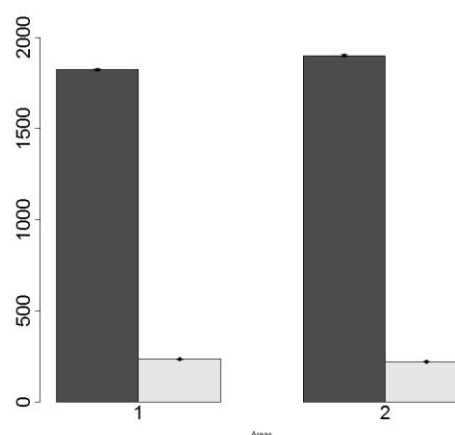


Fig.3a: Infestation and Indices of species diversity in continuous and intermittent water management. Density samplings ($n^{\circ} m^{-2}$) and dry mass ($g m^{-2}$)

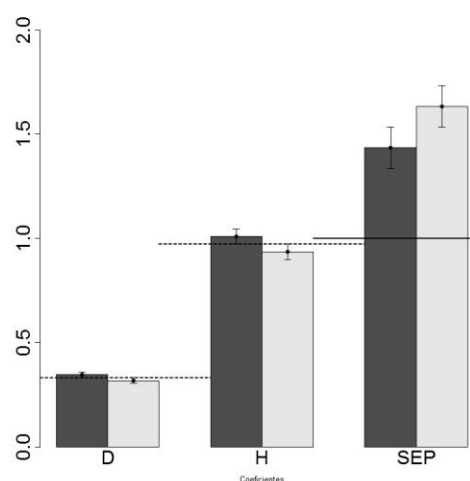


Fig.3b: Weed species diversity, D = Simpson diversity index; H' = Shannon-Weiner diversity index; SEP= Shannon-Weiner Evenness Proportion. Embrapa Clima Temperado, Pelotas-RS, 2017.

However, for the present study, when surveying the weed community after harvest in both irrigation managements, the variations were discrete for both species density and dry mass (Figure 3a). The species diversity indexes, both D and H', also suggest occurrence of the same weed species in both water management systems (Figure 3b). The SEP index indicated that the system with continuous water layer (continuously flooded) is most closer to the ecological sustainability compared to the intermittent water management (Figure 3b).

Table.3: Density, frequency, dominancy and important value of weed species in continuous and intermittent water management. Embrapa Clima Temperado, Pelotas-RS, 2017.

Continuous Management				
	de	fr	do	vi
<i>Conyza sp.</i>	0.33	20	0.87	7.07
<i>Fimbristylis sp.</i>	1.43	20	7.95	9.79
<i>L. multiflorum</i>	79.7	20	67.8	55.84
Others	9.91	20	9.64	13.18
<i>Polypogon sp.</i>	8.6	20	13.8	14.12
Intermittent Management				
	de	fr	do	vi
<i>Conyza sp.</i>	0.28	20	0.97	7.08
<i>Fimbristylis sp.</i>	1.05	20	9.11	10.05
<i>L. multiflorum</i>	81.66	20	64.69	55.45
Others	8.94	20	9.47	12.8
<i>Polypogon sp.</i>	8.07	20	15.76	14.61

The high SEP observed for both water managements show that the greatest investment of weeds in dry mass accumulation may be due to the favorable environmental conditions to which they were submitted, and the increase in density is natively limited by the presence of the water layer. Therefore, continuous and intermittent irrigation managements were very similar in density, frequency and dominance of the evaluated species (Table 3). It is proposed that, under flood conditions, competitive strategies based on dominance tend to be preponderant for success in establishment of a certain weed species.

V. CONCLUSIONS

In flood-irrigated rice cultivation, the no-till planting system provides the lowest levels of weed infestation and, together with the conventional cropping system, results in values closer to the ecological sustainability.

The application of herbicides in flooded rice crops reduces weed infestation levels, increases diversity coefficients and equalizes the ecological sustainability, compared to areas without the application of weed management methods. However, chemical control leads to the selection of resistant or tolerant herbicide species, such as *Polypogon sp.*

Both continuous and intermittent water management systems did not cause significant changes in the level of infestation, composition or diversity coefficients in rice areas.

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Text and Interaction: A Performance Analysis Written in Present Evaluations of Pedagogy Students in the Distance Mode

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Abstract— *This study aims to verify the use and mastery of linguistic knowledge in the writing process of Pedagogy students, in the form of Distance Education. The methodology was based on an exploratory analysis of texts produced in the face-to-face assessments that occurred in the first half of 2017. In the analysis of the answers, a descriptive graph of the errors and inadequacies observed was presented. The results show the commitment of writing to the meaning of the text, since this is a result of it. With this study, it was noticed that the university students have presented difficulties in expressing, in writing, their thoughts, their understandings and their opinions in an adequate and coherent way. Therefore, in order to minimize the anxiety experienced by these students at the time of writing, it is suggested that through the Instrumental Portuguese class, which part of the curriculum is, the linguistic aspects responsible for the production of meaning in texts and the interaction of the interlocutors. In order to meet the needs of undergraduate students, in the specific case of Pedagogy, since it concerns the training of teachers, professionals who will work in the literacy of children and young people and need to prioritize knowledge about language, reading and writing of these students.*

Keywords— *university students writing. language skills. Portuguese language. Distance learning.*

I. INTRODUCTION

Students who get in to higher education do not always demonstrate the ability to express their thoughts, understandings and opinions in writing in an appropriate and coherent way and not even perform basic tasks such as writing a report, reviewing or responding to a test (FARACO, 2009).

These deviations found in the writing process of the students are known and discussed by the education professionals. Although the basic education curriculum adds significant hours of instruction in the mother language, such difficulties do not seem to be overcome at the time.

Several factors can be considered relevant to this result, such as, teachers unprepared to deal with these obstacles, large classes, higher teacher work hours and little time for class preparation. And so, as a result, there is the lack of motivation (or even rejection) of the students to engage in the production of written texts, an activity that seems to be to them laborious.

According to the National Curriculum Parameters (NCP) of Portuguese Language (1997, p. 15), "the school has the responsibility of guaranteeing all its students access to the linguistic knowledge necessary for the exercise of citizenship, an inalienable right of all." However, the schools work on this linguistic knowledge in a limited way, using loose sentences to teach grammar rules, and the texts, when inserted in the activities, aim to serve as material for

grammar teaching, never used as main object, in which the elements languages that constitute it are presented as the language in use (BERNARDO and NAUJORKS, 2014).

Geraldi (2002) argues that the teaching of a language can be approached from two different perspectives: a) taking the language as an instrument of communication in interactive processes, which provides the development of the capacity for expression and comprehension - the use of the language; and b) considering language as a system of structural mechanisms, which results in a knowledge about the language. It is understood that it overlaps with that, since it guides most teaching practices, remedying difficulties such as grammar and orthographic rules, which are studied during elementary education, but which do not seem to be learned when analyzing the texts of the college students.

Grammar knowledge, such as the use of nominal and verbal regency and agreement, and the proper use of the basic rules of punctuation marks and syntactic and semantic parallelism should be mastered by undergraduates, especially those who attend graduate courses.

The writing of the academics, in addition to allowing the circulation of information in the scientific community, aims at exposing ideas and reproducing research results to the educational sphere, using specific conventions that differentiate it, for example, from literary writing. The production of this writing is a very complex process, and can cause difficulties for the writer, since it requires clarity and precision in the chain of ideas in the arguments, and time for its elaboration.

Taking this into consideration, Koch and Elias (2011, p. 31) affirm that writing a good text requires knowledge "of a varied nature (linguistic, cognitive, pragmatic, socio-historical and cultural)." Writing, therefore, is not only to put letters on paper, but to elaborate a global and precise sense of a given communicative situation and to make it understandable (DAMIANI et al., 2011, p. 456).

It is through writing that the writer promotes an adequacy of the message with the different readers. The author seizes the words, creating or modifying them according to their need, which reaffirms the relevance of the interaction of the text with the reader. Hence, interaction is the process that permeates the development of language and, consequently, writing.

For Travaglia (1998, p. 23), "language is a place of human interaction, of communicative interaction by producing effects of meaning between the interlocutors, in a given communication situation and in a socio-historical and ideological context." In this way, one can understand as text the production of meanings established by the interlocutors in circumstances of social interaction.

In the case of distance learning students, subjects of this study, once the face-to-face relationship is not established, communication occurs through writing in a virtual classroom, forums, chats, activities, etc.

Thus, we have also to think about the writing of these students, in which communication takes place in a universe filled with interactive resources, but the interaction will only happen if the tools are used by the interlocutors in a significant way. The role of the media tools, available on distance learning platforms, is only to mediate the processes of interaction between the participants, which will give sense and meaning to the teaching process.

Therefore, it was proposed in this research, to analyze the face-to-face assessments of the students of the 4th period of the Pedagogy Course in the Distance Learning mode of Center for Higher Distance Education in the State of Rio de Janeiro and State University of Northern Rio de Janeiro Darcy Ribeiro, noting the deviations occurring in the process of writing the language, the relevance of the linguistic elements and their knowledge of the Portuguese language in the process of meaning construction, in order to find out if these subjects have the communicative ability and if they were favored in the teaching-learning process of reading, writing and comprehension of Portuguese language texts in basic education.

II. REVIEW AND DISCUSSION OF LITERATURE

2.1 Language Skills

The learning process of Portuguese Language requires a creative ability of the student to elaborate the different types of texts as well as the mastery of communicative skills in the different social environments. For this, it is necessary to create mechanisms that help the student in the development of the capacity of representative construction of circumstances of the use of the language, both oral and written.

There is, however, a relevant factor that consists in the difficulty inherent in the act of writing itself, since the student, as Bruer states, has to provide information at different linguistic and conceptual levels to put the 'abstract essence' (thought) on the page. The fact of predicting the information that the reader may need and deciding what information to provide is what turns writing into a difficult task (BRUER 1992, p. 223).

Corroborating the idea of Bruer (1992), Flower and Hayes (1981) affirm that there are mental processes that intervene in the act of writing that, on the one hand have to do with the long-term memory (information that is stored in the

memory) of the scribe and, on the other, with the production context of the same act (situations that arose at the time of writing).

The school should enable students to create data that gives them access to the multiple functions that writing plays in our society. This suggests that the work to be done should focus on the skills that are activated for the production of a text, that is, textual competence.

Moreover, "textual competence" is the ability of every language user to generate own and typical language sequences, that is, the ability to generate an infinite number of grammatical phrases and, consequently, the user would have the "Communicative Competence" - the ability of the speaker to adequately use the language in the several communication situations (TRAVAGLIA, 1998, p. 19).

In the face of all these language requirements, one can also say that transforming oral language into written language and establishing an interaction between people separated geographically, but linked by the same technological support, as in Distance Education, it is not a very easy activity.

It is worth mentioning that Distance Education consists of the educational relationship established between the student and the professor, which is not direct but mediated by the technologies. This communication can be called Computer-Mediated Communication (CMC).

2.2 Distance Education

In Brazil, there is a great expansion of distance learning courses. The implementation of the Distance Education in Brazil began with the Law of Guidelines and Bases of Education, 1996. However, it was only structured from 2000.

The search for this type of education has been gaining more and more space in the educational field and has become commonplace among the population, due to the unavailability of time, the incompatibility of the schedule and even the difficulty of access to the regular school. Distance education emerges as an ideal education option to meet the educational needs arising from the changes of the modern world.

Thinking about education means becoming aware that today it is necessary to contextualize the teaching and learning process in the several modalities of teaching, situating the student in the contemporary scenario of which he is a part and where many reasons, do not have the opportunity to be in the classroom, but have a new modality of learning.

The Distance Education consists of non-presential classes or with few face-to-face meetings. Professor/student communication can be done in multiple ways, which are

amplified in the midst of technological advances, such as the Internet (with platforms, chats, online essays), in some institutions by mail, radio, television, video, CD-ROM, telephone, fax, cell phone, iPod, computer, among other similar technological tools. So it is considered an alternative modality to overcome limits of time and space.

In this way, it can be verified that the meaning of Distance Education consists in the educational relation that is established between the student and the professor, that is not direct, but mediated by the technologies.

Currently, this modality of teaching is as dynamic as the face-to-face, leaving aside the prejudice of many individuals, since it is not a facilitated way of acquiring diplomas, nor of training of low quality. The Distance Education is a system that meets the needs of a specific audience and is covering more and more segments.

For Scheer (1999), the democratization of knowledge and the introduction of new forms of education is an important fact throughout the world.

According to Madeira (2007), in Distance Education, the student is the builder of his own knowledge, becoming the active subject in his formation. This modality of teaching makes the student responsible for his/her learning, since the exchange of experiences between professors and students is not done in classrooms, but in a new communication format.

Therefore, the Distance Education came to benefit quality and functionality with individuals with certain needs, giving them the opportunity to study, train and become full citizens with all their well-developed social and cognitive capacities (LÉVY, 1999).

2.3 Licentiate Degree in Pedagogy - Center for Higher Distance Education in the State of Rio de Janeiro - CEDERJ/ State University of Northern Rio de Janeiro Darcy Ribeiro - UENF

The Center for Higher Distance Education in the State of Rio de Janeiro Consortium, scenario of this research, was conceived by Darcy Ribeiro during his term of Senator of the Republic, in the year of 1999, with the objective of carrying out free, the entire State of Rio de Janeiro. Its creation took place on January 26, 2000, through a document generated by the Secretary of State for Science, Technology and Innovation, together with a commission formed by two members from each university and signed by the governor of the state of Rio de Janeiro of that time and by the rectors of the consortium universities.

The Center for Higher Distance Education in the State of Rio de Janeiro (called in Portuguese – CEDERJ) belongs to the Foundation Center for Science and Higher Distance

Education of the State of Rio de Janeiro (CECIERJ in Portuguese), an agency linked to the State Secretariat of Science, Technology and Social Development. From 2006, CEDERJ joined the Open University System of Brazil and started to receive resources, also, from the federal government (COSTA, 2009). It is made up of seven public higher education institutions: State University of Northern Rio de Janeiro Darcy Ribeiro (UENF), State University of Rio de Janeiro (UERJ) Fluminense Federal University (UFF), Federal University of Rio de Janeiro (UFRJ), Federal University of Rio de Janeiro State (UNIRIO), Federal Rural University (UFRRJ), Celso Sukow Federal Center for Technological Education (CEFET) and Fluminense Federal Institute of Science and Technology Education (IFF). The CEDERJ is also constituted of 33 poles in different cities of the state of Rio de Janeiro.

The CEDERJ Consortium is a physical reference so that more than 30 thousand enrolled in its 15 undergraduate distance courses can carry out mandatory classroom activities such as classes in the laboratory, assessments, face-to-face tutoring, etc. The consortium offers 15 higher level courses between Bachelor, Undergraduate, Licentiate Degree and Technologist in the blended modality with a diploma issued by the consortium university without distinction of face-to-face education.

These courses allow the student to study at the place and time of his/her preference, following a schedule. For this, it counts on specially elaborated didactic material, besides the support of tutorial presence, in the own poles, and the distance, by telephone (0800) or by the Internet. There are no face-to-face classes, but some courses require a minimum number of poles to practice laboratory classes, fieldwork, group work, and compulsory curricular training.

In the curricular matrix are present the disciplines of Instrumental Portuguese Language, in the first period; Portuguese Language in Education I, in the third period; and Portuguese Language in Education 2, in the fourth period. However, the syllabus of these disciplines does not address the linguistic aspects that concern the written activity, in the sense of assisting the student in his deficiencies, naturally due to the complexity of the language.

The Licentiate Degree in Pedagogy distance learning program aims to train professionals to be educators committed to inclusive education and cultural diversity, as well as to train teachers to work in the following segments: elementary education, education vocational education, youth and adult education, secondary education (teacher training); management (administration, supervision and guidance) and non-formal teaching spaces.

The program of the Pedagogy Course is expected to last eight semesters; and the student can finish his studies in a maximum of 15 semesters.

The present study has as object of investigation the group of the 4th period of Pedagogy, enrolled in the Management 2 class, in the modality of Distance Education. The choice of this group was random and with the authorization of the coordinator of the class, to access the evaluations (AP1 and AP2) that would be analyzed.

III. APPLIED METHODOLOGY

The methodology of the research covered the quantitative and qualitative analysis of exploratory character, to identify the deviations of the linguistic elements occurred in the analyzed evaluations. A questionnaire with closed and open questions was used as a research tool.

The questionnaire was developed in Google Forms, in the Google platform and sent to the electronic address of each student by the tutor of the Management 2 class.

The questionnaire was applied to the students of the fourth period of Pedagogy, enrolled in the four poles belonging to the UENF (Bom Jesus de Itabapoana, Itaperuna, São Fidélis, and São Francisco de Itabapoana towns).

According to the enrollment records in the CEDERJ archives, there were 101 students enrolled in this discipline, but according to the number of evaluations, it was found that only 80 students were attending. However, according to the consent form sent to the questionnaire, 61 of them agreed to participate in the survey.

The *corpus* of this research was constituted, in addition to the questionnaire, also of 156 face-to-face assessments (AP1 and AP2), with closed and open questions elaborated by the coordinator of the discipline, possessing essay answers collected from February to July 2017.

Summing up, the results on the writing of undergraduate students of Pedagogy – Distance Education are given, presenting a reflection that can contribute with the discussions about the use of the language and the deficiencies in the writing that the students bring from the basic education to the higher education.

3.1 Profile of the students from CEDERJ/UENF Pedagogy course

To know the profile of the research subjects, a questionnaire was composed of nine closed questions and 12 open questions, focused on characteristics related to students' routine as academics and the interest and taste for writing in general.

The analysis of these data, in conjunction with the texts written by these university students, shows the great dilemma in which these subjects live when they are faced

with the need to write academic texts, respond to the assessments applied by CEDERJ or in different circumstances.

The age group of the students is divided into: 7% is under 20; a large part (36%) are in the age group of 21 to 30 years; 35% are between 31 and 40 years old and 22% of them are over 40 years old. Considering these data, it is evident that with the Distance Education, the opportunity is available to those who want to grow and learn, and makes it clear that there is no defined age to start studies, no one has to be embarrassed to enter a college with advanced age.

It was pointed out that the majority of students enrolled in the fourth period of the Pedagogy course in Management 2 (90%) were female. This data confirms the findings of several studies, such as Limonta (2009), which confirms that women still seek teacher training courses more than men, especially at the levels of Early Childhood Education and years elementary school.

It was also asked about the workload of these students and if they had children. Only 3.3% do not work; 13.3% work up to four hours a day; 46.7% work 8 hours daily and 36.7% work more than 8 hours a day. Of these, 36% do not have children; 38% have 1 child; 23% have 2 children; and 3% have 3 children.

Comparing answers 2, 3 and 4, it leads to the premise that teaching continues to be a profession for women, which refrains from dreaming of other areas because of the need for a reduced or adequate workload to care for the children and as a concept, that her income is complementary to that of her husband, who, for these young women dedicated to educational tasks, is an indispensable figure.

In the analysis of the data, the information stands out when faced with the majority: (90%) of the students are female; 64% have children, and most work up to 8 hours a day, extolling the theme that marks the insertion of women in teaching.

Only 15% of those surveyed already have an undergraduate degree in Fashion Design, Literature, Psychology, Bachelor of Law, Production Engineering, Bachelor of Economics with Postgraduate in Administration and Marketing, Nursing, Degree in Primary Teaching and Learning, Social Studies.

Even though they have a high school diploma and have been trained to practice a profession, they have decided to take up the Faculty of Pedagogy, offering a profession that suits their living conditions, offers more convenience, offers more jobs in the job market, and brings more comfort in the accommodation of time and domestic routine, with the eagerness of home and children.

The other students, that is, 85% are studying for the first time and also showed through the answers of the questionnaires that they chose the Pedagogy course for the same reasons as the other 15% who already have the upper course.

Many of them were without studying, remaining outside the university for some time, much of it was between 6 and 15 years outside the institution of education (27%), coming back later when they felt the need or had opportunity.

With regard to the main objective of the research, which is to approach the students' knowledge about the Portuguese Language, reading and writing, we inquired about the appreciation of reading and the frequency of writing.

According to the data, most people like to read (75.4%) and write (77%), read daily (70.5%) and write in different circumstances (23%). These data served as a basis for crossing the reality presented in the questionnaires and the writing analyzed in the evaluations, in order to verify if these graduates present good performance when answering the questions applied in the activities of the discipline under analysis.

IV. ANALYSIS AND RESULTS

The present research initially covered the quantitative analysis for the general observation of the occurrence of errors, in the essay texts produced in the answers to the questions of the Presencial Assessments. The students answered theoretical questions of Management Discipline 2, for example: "Defining the concept of Democratic Management of Education"; "Describe the specificities of each Education Council in the democratic management of education"; and "What is the difference between democratic administration and business management?"

The data were then counted from the evaluated source, verifying the writing errors categorized in phonological, morphological and syntactic, according to the typology of Cagliari (2006).

The errors mentioned here (slips of the tongue or incorrect propositions from the point of view of the formal language), without considering them as impediments of communication, are considered in this analysis as fundamental elements in the understanding of the functionality of written language.

It is important to point out that Bortoni Ricardo (2008) and Cagliari (2006) do not address the errors as a matter of "right" or "wrong", but in a denomination of "adequacy" or "inadequacy."

For this analysis, we sought to fit the inadequacies present in the *corpus* of this research, using Cagliari's criteria

(2006) in a descriptive table with the number of errors in each typology, according to graphs 1, 2 and 3.

From the total of 522 errors found in the texts produced as answers in 156 evaluations, 222 errors were phonological

(52%), 51 errors were morphological (7%) and 249 errors were syntactic (41%). The errors presented in these three classifications were also subclassified with the characteristics within each group, according to Table 1.

Table.1: Types of errors as typified by Cagliari (2006), adapted.

TYPICAL	CHARACTERISTICS	NUMBER OF ERRORS
Phonological	Transposition of speech to writing: exchange of phonemes; deletion of vowels and syllables; spelling (vowel, consonant, digraph), punctuation, accentuation.	222
Morphological	Violation of the morpic structure as a junction or concatenation, omission and separation of morphemes and different morpic form, inflection words.	51
Synthetics	Lack of cohesion, lack of order in the sentence; in terms of clause (members and accessories), in verbal and nominal agreement, in verbal and nominal regency, vocative, apposition, placement/ use of terms.	233
Lexical-semantic	Coherence: logical relation between ideas; inference of a meaning or idea through the articulation of their sentences and paragraphs and through linguistic resources (punctuation, vocabulary, etc.).	16

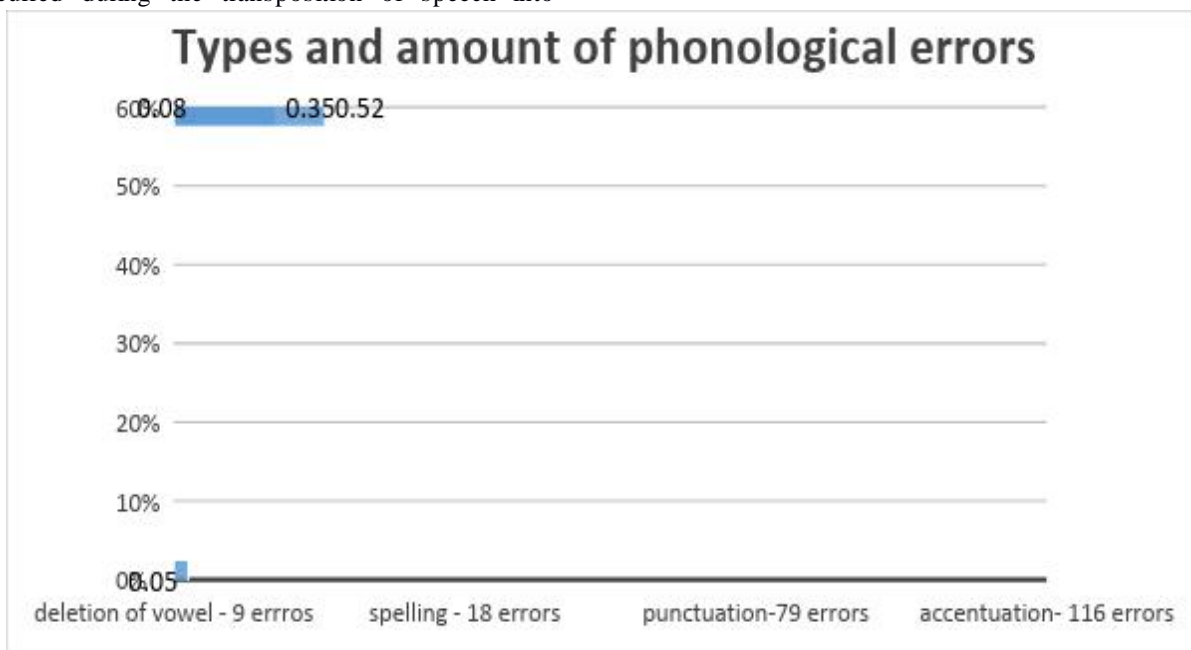
Graphs 1, 2 and 3 provide some examples of errors found in the corpus of this research, separated into three categories, according to the typifications presented in Table 1.

4.1- Phonological:

In the phonological typology, we deal with the inadequacies that occurred during the transposition of speech into

writing, such as the exchange of phonemes, exchange of phonemes, deletion of syllables; spelling (vowel and consonantal encounters, digraphs); punctuation and accentuation.

In this typology, there were 222 errors, as described in graphic 1.



Graph.1: Types and amount of phonological errors

Source: survey data

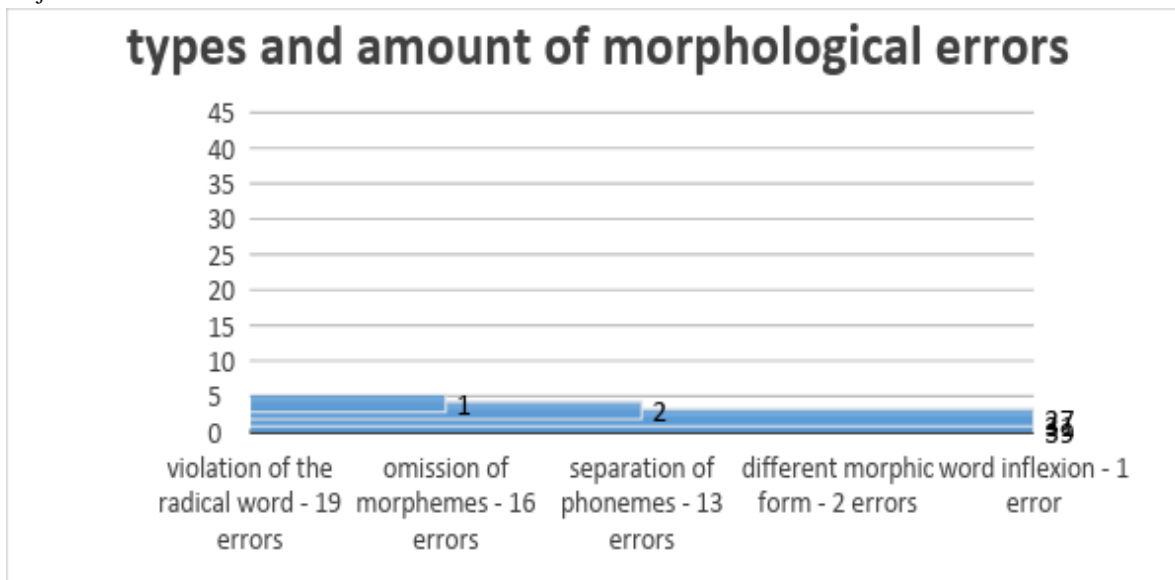
Examples of phonological errors:

- a) “**Pra** vários setores participarem da gestão ”= deletion of vowel.
- b) “A administração empresarial não **necesita** de segmentos da comunidade ” = misspelling.
- c) “Cada **município** tem o seu conselho” = error of accentuation.
- d) “Os conselhos municipais de educação, são formados por agentes do governo” = punctuation error, use of the comma after the subject.

4.2- Morphological

In the morphological typology, we deal with the inadequacies that occurred in the structure of words, such as structure violation, omission of morphemes, separation of morphemes, different morphic form, and inflexion of words.

In this typology, there are a total of 51 errors, as described in figure 2.



Graph.2: Types and amount of morphological errors

Source: survey data

Examples of morphological errors:

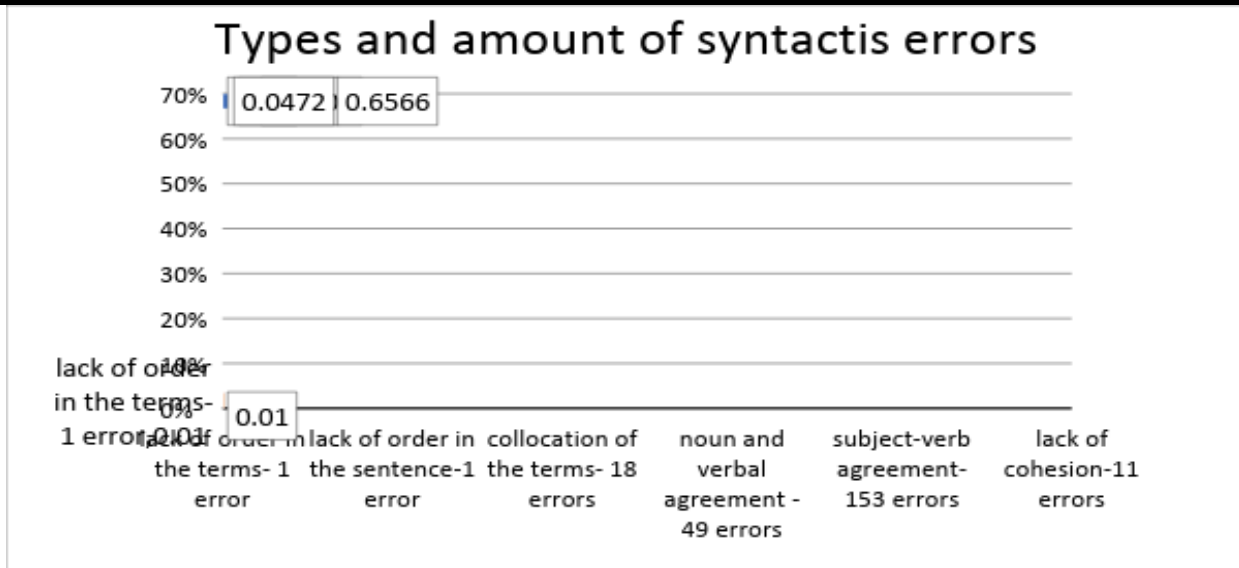
- a) “...**cordenar** as secretarias ...” = there was a violation of the word radical.
- b) “As escolas devem **trabalha** as lideranças” = There was omission of morphemes.
- (c) “... que haja **nece-ssidade** da participação...” = error in the separation of phonemes. The student did not know how to recognize the "ss" as a digraph, so he separated the word in the same way as the consonantal meeting, leaving both phonemes on the same syllable.
- d) “O conselho tem a função **fiscalizativa**” = different morphic form.
- e) “Todos **estavão** participando do conselho” = error in the flexion of the word. The student showed ignorance of two phonological-phonological graphemes presented in the

ending of the personal number of the imperfect tense in this verb, which lead to the same phoneme (descending nasal diphthong [ãm])

4.3- Synthetics

In the syntactic typology, we deal with the inadequacies that occurred during the construction of texts, such as the order of terms in sentences, the placement and use of terms in clause, subject- verb agreement, verbal and nominal agreement, as well as, the cohesion and coherence of the text, elements responsible for the interaction and production of the senses, which make the communication between the author and the reader.

In this typology, a total of 233 errors were obtained, as described in figure 3:



Graph.3: Types and amount of syntactic errors

Source: survey data

Examples of syntactic errors:

- a) Antes só era composto por nomeação política, **agora todos podem.**”= complete paragraph is missing, leaving the meaningless answer complete.
- b) “A administração vai atuar de forma **onde** que todos possam dar sugestões” = error in the collocation of the terms.
- c) “A Administração empresarial e clássica apenas **se** cumpre o que lhe é imposto **e não é** que **lhes** é dado o direito de se manifestar sobre qualquer **dicisão.**” = lack of order in the sentence, errors in employment and collocation of terms and violation of the word.
- d) “Os conselhos de educação **orienta e fiscaliza** as escolas **municipal**”. = error of subject- verb agreement.
- e) “Conselhos escolares são realizados na própria escola ou instituição e podem participar a comunidade, os

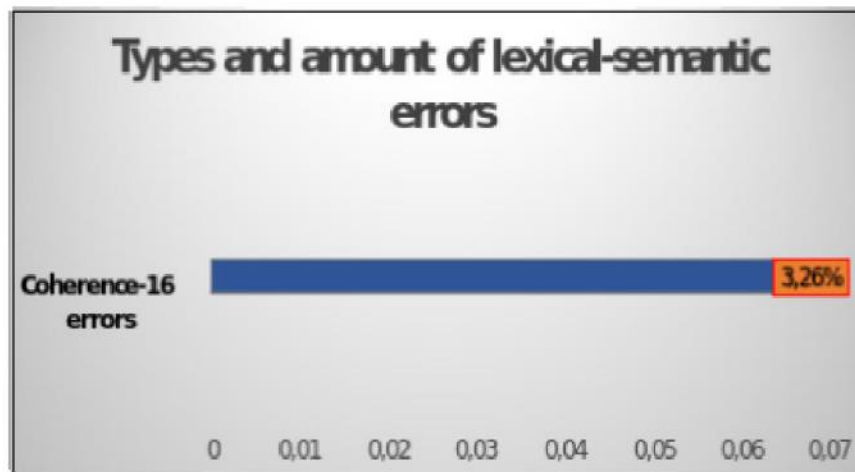
responsáveis, os funcionários e os alunos.” = error of agreement (**deles podem participar**).

f) “Gestão democrática da educação é uma gestão **onde** você expõe suas opiniões, **cujo, onde** os direitos e deveres são colocados.” = error in the use of terms.

4.4- Lexical-Semantics

The lexical-semantic typology deals with the use of words in the text, establishing their several relations in the many types of associations, which leads to a greater diversification of meanings, an enrichment of the reference universes, and greater ease in the logical a speech or text, facilitating the interaction between the interlocutors.

In this typology, there were 16 errors among the total of 522 observed in the responses evaluated, according to chart 4.



Graph.4: type and amount of lexical-semantic errors

Source: survey data

Examples of lexical-semantic errors:

- a) “Gestão democrática os professores, diretores, alunos, pais, membros da comunidade que é a sociedade, a participação no conselho para uma educação de qualidade para todos”. = Lack of semantic articulation, omission of words causing incoherence in response.
- b) “A administração democrática é utilizada em geral, a administração empresarial, a democrática é utilizada conforme a norma do espaço” = There was no semantic chaining, compromising textuality and leaving the answer meaningless.

The errors or inadequacies presented here are fundamental elements that compromise the production of meanings in the construction of the text, since people use the language for this purpose. Thus, it is conceived that syntax is part of this process as an essential element.

Taking back the typologies mentioned by Cagliari (2006), it is worth bringing up the characteristics of the syntax in which the elements of cohesion are approached, which intertwine resulting in a composition of coherent textuality. According to Koch and Travaglia (2007), coherence does not depend on cohesion to produce meaning, it is able to establish textuality through a linguistic sequence, enabling the interaction of the interlocutors, and cohesion gives sustainability in the construction of the text, facilitating the understanding, that is, promoting the act of communication. Understanding interaction as an important factor in any communicative context, it must be ensured that, in this evaluative environment, where Pedagogy students of the Distance Education modality are found, this factor is much more important, since the student needs to expose their answers, their understandings on the subject in a clear, objective and coherent manner with the questions presented. Investigating the linguistic resources that weave the text requires an approach of all the linguistic characteristics that compose or articulate the syntactic and semantic relations, in any textual type and genre. To all this articulating process to produce a text, one can stand out as a principle responsible for the sequence and meaning of the text: cohesion. The cohesive elements are the articulators responsible for the threads of sentences, utterances or major sequences of the text (KOCK, 2010).

Thus, it is possible to understand as syntactic error this excerpt present in the evaluation of a student of the research:

Ex: “A administração democrática visa o interesse de todos, foca as questões relacionadas à cidadania e administração empresarial científica **cujo** só um grupo tem acesso, **pois** a elite tem acesso”.

It appears that the relative pronoun is misplaced, loose, unrelated to any term and the cohesive element "pois", which should explain or exemplify what has already been expressed, in order to further complement the argument, did not have this function, creating confusion in the sentence statement and, consequently, compromising the coherence of the response.

This research, therefore, focuses on the reflection about the construction of meaning in the text. However, understanding the language as a system, a set of elements described in terms of their relations, it is assumed that this relation occurs in the correspondence between the linguistic signs that constitutes the language, that is, the construction of meaning happens from of the relations established in the use of the linguistic system. And, in the processes related to text production, we must also consider the situations of social interactions and the historical-social context, in which the voices that are interrelated in different ways are present.

Authors like Geraldi (1997), Fiorin (2003, p. 72) and Marcuschi (2010) emphasize language as a production of knowledge, in which the interlocutors understand and project their worldviews, considering also that the language goes through transformations through language, and thus, the communication of the subject with the other occurs at the moment in which the interaction between them happens. Based on these reflections, it is worth noting that, when analyzing the texts of the students in this research, several situations can be verified that demonstrate that many undergraduates do not have the domain of structuring of the syntactic entities in the sentences or the periods, so that there is a commitment in the interaction and in the production of sense of the text, that is, a combination of these units, as Neves suggests:

it is necessary to combine these syntactic units into efficient communicative pieces, which involves the ability to adapt the statements to the situations, the objectives of the communication and the conditions of interlocution. And all this, is integrated into the grammar (NEVES, 2002, p. 226). Student responses confirm the lack of these skills, when 63% reported writing under different circumstances, such as work, electronic mail, WhatsApp messages, Messenger, and other media, but noted their difficulties in writing. They also reported that they have little mastery of spelling (24.6%); many say they do not have much knowledge of agreement (38.6%); (36.8%) have difficulty in concatenating ideas, texts have problems of cohesion, (occurrence in which student creates disconnected and repetitive sentences), lack of coherence (construction of sentences and periods without meaning), that is, deviations

that hurt the rules of verbal and nominal agreement; problems of order in the sentence, in short, face barriers in elaborating a cohesive and coherent text, interactive and with full meaning.

On the other hand, most students say that they feel more comfortable when they can write freely in the forums, where the language requirement, according to them, is less rigorous. In this category (44.3%), he says he has more freedom to write; have more time to research and rectify possible errors; can be more objective; can interact with other colleagues; say that the issues raised in the forum are broader than in the Presential Assessments, which are limited by more specific responses.

They report that in the forum they can share the thoughts, discuss ideas, position themselves, dialogue; have more time to analyze the issues; exchange ideas with other students; feel freer and less apprehensive; have time to write a good text; they are more likely to express their opinions; they are less concerned with the formality of language; have an opportunity to express themselves better (explaining the answers).

Since in the Presential Assessments there is a limitation of lines and in most cases, there is no possibility of completing the answers, which interferes with the final grade; can enter the platform and respond at any time, with no time determined having time to research on the subject, if it is necessary; they become strained at the time of the Presential Assessments and have difficulty expressing themselves in the way they would like. This happens even when they read the subject matter before the evaluations.

It was also possible to verify that phonological errors (52%) matched syntactic errors (41%). This refers to the idea that both teacher and school seem to care about student learning, taking advantage of these errors only to reprove and not as teaching tool, when the opportunity for feedback would be the ideal to solve this great problem that crabs scuttle through from basic education to higher education.

In most cases, these difficulties in expressing themselves in writing appear when there is a need to elaborate answers in written evaluations, since, according to the answers of the questionnaire, they show a great deal of insecurity when responding to presential assessments, since in this, there is a need for more formal writing.

In this evaluative context it is imperative that the student makes himself understood, since his answers need to produce understanding so that there is interaction between author (student) - text (answers) - reader (tutor/coordinator).

A great and relevant question for the purpose of this research was:

"In your opinion, what are your difficulties in writing?"

In answers, several were the justifications, as for example:

"This problem stems from poor teaching in basic education"; "Lack of basic elementary and secondary education"; "Lack of reading incentive"; "Little practice of textual production in basic education" etc.

Thus, it can be seen that the problem of writing, as a subject so much discussed by researchers in the field, originates from the school base.

Based on Magda Soares (2016), it is necessary to prepare this teacher who goes to class with the function of literacy. It is at this moment that the student will have his first contacts with the language and, consequently, with the writing. The teacher will find children with complex cognitive abilities and to understand and master a system of representation of written language, the child goes through a process of very abstract understanding.

The author further says that the reflections about teaching are more concerned with methods than with process. It has long been known that oral language is innate and written language is cultural. Therefore, it is up to the literacy teacher to take care of directing the students to the paths that lead to the knowledge of the language, always understanding that literacy is not a problem only of pedagogy, but also of psychology and all linguistic sciences.

In order to do that, the National Curricular Parameters - PCN (BRASIL, 1999, p.125) declare that students must acquire the basic knowledge of the Portuguese Language in Primary Education, improving them in High School. In this second phase, with the improvement of the knowledge of the language, acquire interactive, textual and grammatical skills of the mother tongue. These competences range from the development of critical potential, the training of effective readers, as well as the use of language in the various circumstances of communication.

One of the main challenges facing both distance and classroom education today is to propose new ways of teaching how to use language systems and the structuring of syntactic entities in sentences or periods, so that there is a combination of these units, favoring the production of meanings of the produced texts and the interaction between the interlocutors.

In this sense, it is necessary to seek to innovate at all times, to explore the several resources that can motivate the student to read and write, to reflect and, through reflection, to be able to transform information into knowledge.

V. FINAL CONSIDERATIONS

The results obtained, which constitute studies of the language, became even more worrisome in undergraduate courses, when the student is required to have linguistic and textual skills which, in general, he did not learn. This concern increases even more in undergraduate courses, when these students are prepared to appropriate these skills as a working tool in their pedagogical practices.

To be a professional capable of acting in the area of education with greater aptitude, it is necessary to have autonomy of production of knowledge through reading and qualified writing.

Therefore, it is pointed out with more attention, for the undergraduate courses and, more specifically for the Pedagogy course, in which these graduates will act in the literacy of children and young people.

The analysis of the evaluations of the university students of this research places us before a worrisome situation, making us reflect on the need to prepare pedagogical professionals as critical and reflexive people and teachers capable of developing their teaching degree autonomously, if enabled to take their pupils to be increasingly competent readers and writers.

In this context, language is considered as the ability to utter collective meanings and to articulate their varied representations contextualized in everyday situations. The main reason for any act of language is the production of meaning.

Therefore, in order for these challenges at the moment of writing to be faced with more ease and security, it is suggested that through the Instrumental Portuguese class, which is part of the university curriculum, the linguistic aspects responsible for production of texts and the interaction of the interlocutors. This proposal aims at meeting all the needs of undergraduates and especially graduates in Pedagogy, who will be literacy professionals responsible for bringing children and young people to seek knowledge.

Literacy is much more than teaching reading and writing. Literacy is to direct the student to the different areas of knowledge and, especially, about the knowledge of the language, given that it is through the language that comes to global knowledge.

Therefore, all the possibilities of possible languages favorable to the fact in question - communication - must be taken to these graduates, demonstrating the relevance of studies on the production of text in oral and written practices of language use - and, more broadly, in language, in different social instances, therefore, pointing out the importance of approaching situations of interaction,

considering the ways in which the production of meanings is given and guaranteeing the much desired author-text-reader interaction.

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Application of the Quick Tool Exchange (QTE) System in Building Maintenance

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Abstract— *Quick Tool Exchange (QTE) acts to reduce losses and failures during the production process and throughput time, contributing to rapid response to market changes. The object of the work is a private school of the Municipality of Porto Velho, capital of Rondônia. The general objective is to study the building maintenance of a private school in the Municipality of Porto Velho / RO, focusing on QTE technology. Therefore, the specific objectives were to characterize the building maintenance in the study (1); compare the operational processes applied in the face of QTE concepts (2); and propose innovation for the operational improvement of building maintenance in operation (3). The building maintenance has a clear importance, since its compliance contributes to the preservation of life and health of users of any construction. Both the preventive and the corrective have been receiving the importance due to it, especially the preventive one, since this is always cheaper in comparison to the corrective one, since besides the damages caused to the physical structure of the building, there can exist to the users present in the occurrence of the fact. The methodological procedures consisted in carrying out a bibliographic survey followed by a case study. The results demonstrated measures approved and not approved by the QTE, suggesting simple innovations, but with significant consequences to the improvement of*

service rendering, minimizing costs in the area of building maintenance. This study is of interest to businessmen in general, especially the public or private educational sector, and those involved with the area of Production Administration.

Keywords— *Quick Tool Exchange. Educational Sector. Building Maintenance. Production Management.*

I. INTRODUCTION

This study deals with the application of the quick tool exchange before the building maintenance of a company of the educational sector located in the municipality of Porto Velho, capital of the State of Rondonia. The research can be observed the lack of studies related to building maintenance in companies of the educational sector and the convergence of thought of several authors on the subject.

The quick tool exchange, despite appearing in the nineteenth century, is important for the contemporary moment, both as an instrument for companies that seek to maximize their profits, in addition to becoming more competitive and managing to expand in front of the market, in that they can meet the needs of their customers, even in frequent changes.

This work began with an indication of the objectives of the research, followed by an explanation of the theoretical

and conceptual references that served as a basis for the interpretation of the case study, definition of methodological procedures, results achieved with research, conclusion and references. Therefore, the present aims to respond to the following research problem: How can the application of QTE contribute to the improvement of existing building maintenance in the company studied?

In order to answer, it is a general objective to study the property maintenance of a private school in the Municipality of Porto Velho, capital of the State of Rondônia, with a focus on QTE technology and for the results, it has as specific objectives to characterize the property maintenance of the establishment in study (1); compare the operational processes applied in the face of QTE concepts (2); and propose innovation for the operational improvement of building maintenance in operation (3).

II. THEORETICAL-CONCEPTUAL REVIEW

This task is based on the Theory of Scientific Administration in conjunction with Contingency Theory. Since the classic Frederick Taylor, studies on the factory floor were already deepening, demonstrating how the organization should work, what production means, the costs and time needed, which manpower would meet the need of the organization, noting that the increase of the effectiveness and qualification of the organizations promoted the expansion of the factories, which in turn struggled to change the disorganization by commercially optimized models, improving the working conditions and its products, maintaining a good relationship with its employees, according to Taylor (2015) .

It introduces the Contingency Theory that deals with organizations in general and the interferences of the external environment that provoke structural changes, demonstrating that there is nothing absolute in the organizational environment, as Moreno et al. (2016). It states that there are several ways to run an organization to achieve success, considering that the environments in which it is inserted are not equal, and its organizational structure must be confronted with the characteristics of its environment. Emphasizes the need for systems of managerial controls to visualize the adaptations that promote alignment with the internal and external environments, and the manager must promote the changes so that the performance of the organization does not suffer negative variation, being able to offer competitive products and / or services , both in quality and in selling price.

Survey in Fagundes et al. (2008) indicates that some factors that contribute to the decision-making process regarding the systemic evaluation of the situation in which the organization is facing the market are: division

of labor, centralization and decision-making process, work specialization, standardization of activities and organizational environment.

The aforementioned factors are contingent variables related to the organizational structure, which according to the highlighted theory, cooperate to define an optimized structure and the management systems most appropriate to the organization.

2.1 Concepts of building maintenance

According to Ribeiro (2015), building maintenance treats the infrastructure of a building in all its systems, whether electrical, fire and security, communication, air conditioning, among others. He also says that building maintenance must take place in a planned way, because it involves resources of the organization, and the better to apply them in the first maintenance, the less it will be spent in the second.

For Antonini (2011), building maintenance consists of a cluster of services and activities that allow reliable and safe conditions for the conservation of buildings, within technical norms and standards. We emphasize preventive maintenance that seeks to avoid simple problems to the most complex and harmful to the health and safety of users. Lack of planning to do this type of maintenance can affect the organization's finances, because, according to the authors, corrective maintenance, which happens after the problem arises, is more expensive and can have more serious consequences.

2.2 Concepts about operational processes and Quick Tool Exchange (QTE)

Process consists of the joining of functions and activities organized in a logical sequence, performed by machines or people, seeking to transform resources into goods and services, through a processing methodology, as prescribed by Martins (2012). All departments of the organization are considered a process, which, for good management, must be analyzed, studied and structured, because the intention with the management of processes is always to achieve the best possible results.

Fogliatto and Fagundes (2003) further argue that QTE aims to reduce or eliminate losses during the production process, resulting in an increasingly simplified and effective model in terms of cost minimization and the duration of the production process, as it provides a chain reaction as it is implanted in the organization, causing direct changes in several factors, among them: production model, unit costs, raw materials and secondary materials, labor quantitative in each phase of production, profit organization.

According to Moura and Banzato (1996), the focus should not be on the productive process, but rather on the time lost between machine stops, since the main objective is to meet the demands and demands of the customers.

2.3 Innovation concepts

According to the OCDE Handbook of Oslo (2005), innovation is defined as the improvement of a good or service, making it new or substantially improved, process, organization of the workplace or external relations.

The innovation is correlated to the increase in organizational performance, as well as to several administrative theories, mainly Contingency, since innovation tends to be a response to changes imposed by external and internal environments, as discussed by Amorim et al. (2013).

This author cites Sundbo and Gallouj (1998) to remind us that service innovation comprises an incremental phenomenon, easier for imitation by competitors and with less development time when compared to the innovation of materials; because these variants lead to constant changes in the performance of services, highlighting them in the consumer market.

According to Martins (2012), in the area of productive operations it is necessary to manage processes with the implementation of management controls, given the various advantages that the organization provides, among them: focus on the main business, determining the necessary resources and costs involved, but also the elucidation of customers and suppliers; delineating processes in the form of drawings allows the identification of problems or improvements; among others

III. METHODOLOGICAL PROCEDURES

This section presents the steps that were taken to develop the research. For Prodanov and Freitas (2013), scientific research is a planned study that aims to solve problems with the application of the scientific method, from hypotheses that will be confirmed or disregarded by the research.

According to the aforementioned authors, the research means the search for knowledge, using procedures capable of giving reliability to the results. This statement represents this study, which sought to establish how maintenance is performed, to confront operational processes with theory and, finally, to propose innovations for the improvement of the executed service, not only to present the results, but with them, the possible solutions of the problems encountered.

The work was developed under the aegis of the bibliographical review, because it sought to build a solid basis for the contribution of the continuity of the study, since the next step was the survey of the practical part of the object in question, leaving for another crop, the of the case study.

The case study is related to the instruction of one or a few objects and consists in the collection and analysis of information about a particular individual, studying their varied aspects, according to the subject of the research, according to the vision of Prodanov and Freitas (2013).

Table.1: Detail of the methodological procedures adopted

Aspects	Classification	Description
Nature	Applied	It aims to generate knowledge for practical application in solving specific problems.
Purpose of the Study	Exploratory	It is worth of bibliographical survey and realization of interview with people who have practical experiences.
Procedures	Bibliographic Survey	Elaborated from published material, with the aim of familiarizing the researcher with the topic addressed.
	Case study	Research, which aims to study a unit in depth.
Problem approach	Qualitative	Research has the environment as a direct source of data. The researcher maintains direct contact with the environment and the object of study in question, necessitating a more intensive field work. In this case, the questions are studied in the environment in which they arise without any intentional manipulation of the researcher.

Source: The authors. Adapted from Prodanov and Freitas (2013).

The research instrument was the conduction of an interview guided by a semi-structured questionnaire, following the prescription of Prodanov and Freitas (2013), applying intensive direct observation. The interview with the manager of the establishment under study was applied in order to obtain information about the research problem.

The tools used for interview transcription were the Windows Media Player audio player, along with the Microsoft Office Word text editing program.

IV. APPLICATION OF THE QTE SYSTEM IN BUILDING MAINTENANCE

The company under study has been in the educational sector for more than three decades and is located in the eastern part of the municipality of Porto Velho, capital of Rondônia State; provides services to over two hundred children in primary and secondary education. The institution operates under the modality of partnership by limited liability share to two partners. In its table it is estimated present forty employees, comprising professors and personnel of administrative support. In the area of the municipality where it operates, this is the only private educational institution, which is a positive point in terms of competitiveness.

4.1 Characterization of the building maintenance in the study

Initially it is incumbent to compare theories of the Scientific Administration and Contingency with the practice in the school researched. On-site observation of

the certificates was carried out in connection with the cleaning of water tank and artesian well, detention, air central maintenance, operating license, fire brigade and sanitary surveillance demonstrating concern with the structure physical, because Ribeiro (2015) points out that, when acting in a planned way, building maintenance manages to ensure the zeal for the existing infrastructure. So much so that Taylor (2015) deepened studies on the Theory of Scientific Administration, pointing out how the organization should work, which manpower would meet its needs, among others; and Moreno et al. (2016), when discussing Contingency Theory, states that nothing is absolute in the organizational environment and that external factors cause interference in the company, which in the present case corresponds to the search for vacancies above the capacity served, provoking the need for space expansion in order to offer more vacancies. Figure 1 and Table 2 below demonstrate the steps for making decisions in response to the new demands that arise.

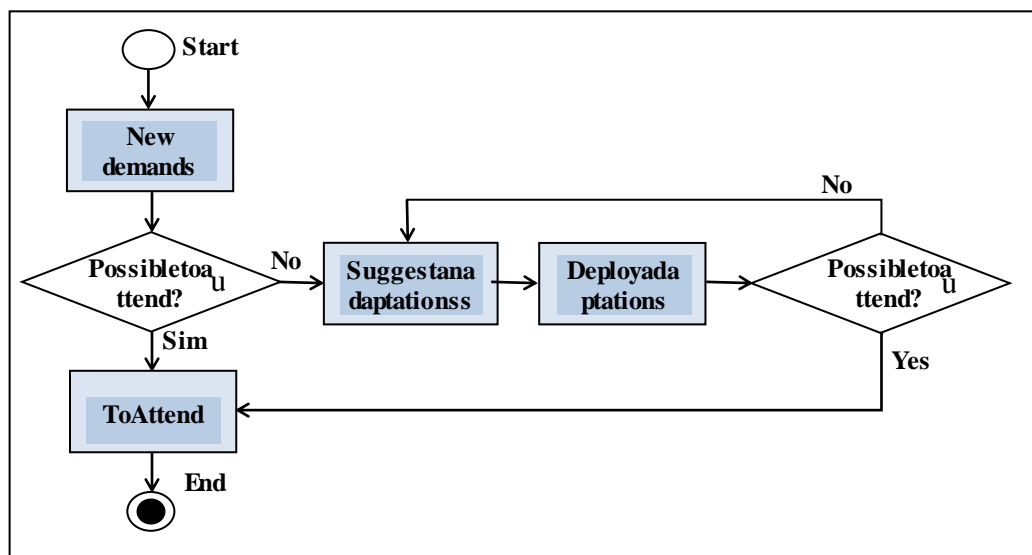


Fig.1: Reconfiguration of decision making in the face of new demands, in view of QTE.

Source: The authors.

Table.2: Specification of the steps of the process for decision making.

Process steps	Description
Start	It represents the phase in which the productive process of building maintenance has its start.
New demands	The emergence of new demands related to building maintenance may require market consultation.
Decision	At this stage, the decision on the systemic analysis to meet the new demands of the building maintenance, encompassing the financial, personnel, logistics, among others, will undergo changes to the faithful attendance of the demands to be implemented.

To attend	<ul style="list-style-type: none"> ✚ Phase in which the organization acts to meet the existing demands related to property maintenance and those recently implemented until the appearance of new ones.
Suggest an adaptation	<ul style="list-style-type: none"> ✚ After concluding in the systemic analysis that at the moment there is no possibility to meet the new demands, the organization will propose measures to be implemented in the production process, so that these new demands are met.
Deploy adaptations	<ul style="list-style-type: none"> ✚ At this stage, after the measures are listed, they will be inserted into the existing production process for further verification if they are sufficient to meet the demands that have arisen.
Decision	<ul style="list-style-type: none"> ✚ Another phase of systemic analysis, only this time in order to verify if the measures proposed to the production process are sufficient to meet the new demands related to land building maintenance. ✚ If yes, go to event 4 - Attend. ✚ If they are judged insufficient, return to event 5 - Suggest adaptations.

Source: The authors.

Still on the expansion, the organization acted in a positive way for the conservation of its patrimony, in complying with the mandatory norms to carry out the work, as on the CREA in Rondônia State, with architectural, electrical, sanitary and hydraulic projects, all of which are approved by the respective supervisory bodies. In view of this focus, it is verified that the researched establishment follows the prescription of Antonini (2011), when it conceptualizes the preventive maintenance, exposing on the guarantee of the safety conditions and reliability related to the conservation of the buildings, in the norms and technical standards required.

It was also studied the issues related to the maintenance of air conditioning equipment, such as air central, wiring, cabling distribution; it is still included in this study the maintenance of the communication system, namely the telephone and internet connections. With the expansion of the establishment, there was a need for interconnection in the network and cabling system, in order to meet the new internal demand of the organization. Another situation refers to corrective and preventive maintenance, including here the interconnection of the communication system between the two physical structures that starts to be operated after the renovation and building expansion. As far as this increase in the physical structure of the building is concerned, six more classrooms were constructed, and in the existing structure there are ten classrooms, four in the upper part and six in the lower part. The stairway leading to the upper floor is narrow to the size of the students, making them deliberate by deactivating the upper classrooms, reducing the number of classrooms in operation; instead of making sixteen rooms available, only twelve are being used.

The logical network undergoes maintenance as problems appear on the computers and cameras installed, increasing the frequency with the passage of time, possibly due to

the life of the materials and equipment. The cameras installed serve for the security of the organization, as well as for monitoring the children, and parents are allowed remote monitoring via a worldwide computer network. Maintenance in the hydraulic, electrical, architectural, sanitary, air-conditioning and communication systems is carried out by outsourced companies, due to the expense of financial resources to maintain a proper maintenance team to cover so many important areas, since the maintenance of buildings guarantees conditions reliable and safe for the conservation of the building. In this way, it reaffirms Antonini (2011) understanding that the lack of planning for preventive maintenance can affect the finances of the organization, which is not the case under study, since the organization is acting in a planned way.

4.2 Comparison of the operational processes applied to the concepts of QTE

In this subtopic will be confronted the concepts gathered from QTE in the face of the survey elaborated in this task. Significant is to consider the theoretical prescriptions with the practices observed, in order to interpret the coherence or not of the precepts of QTE. The study allowed to verify the degree of conformity in the operational processes carried out in the organization, which made possible the introduction of the innovation ahead.

Comparing theory with practice, it is possible to verify that in the physical expansion of the studied project, the legal norms necessary to avoid future disturbances or even imputation of fines due to their noncompliance were observed, besides reducing or even avoiding structural problems that have serious consequences, explaining in practice the concept of process, in order to carry out activities organized in a logical sequence, reaffirming the understanding of Martins (2012).

Another fact that deserves to be highlighted is the maintenance of buildings in the area of air conditioning, since in the view of Antonini (2011), corrective maintenance has higher values than preventive maintenance, which interferes with the expected profit margin, despite the fact that with the prevailing climate in the Amazon Region, it is necessary to monitor this issue, since lack of it will cause difficulties for its clients.

For the expansion of the physical space of the school, it was not conjectured the physical appropriateness of the existing staircase in the old part, which made that the management decided to deactivate the classrooms that worked in the upper part of the school. At this point, the organization acted contrary to the theory applied by the QTE, because according to Fogliatto and Fagundes (2003) and considering the number of vacancies that could be

offered, this decision resulted in financial losses, besides that this theory, when defending as beneficial the reduction of the time of duration and losses in the productive process, seeks the simplification of this and not make it idle. In this same sense is the understanding of Moura and Banzato (1996), stating that the organization's main goal should be to meet the demands and demands of customers, so if there is a demand, it should be sought. In order to corroborate that the application or not of QTE on land maintenance interferes in other areas of the organization, Table 1 below presents a comparison between the current scenario and the one considered as ideal in the view of the QTE, with hypothetical values and quantitative, but within of the local reality, expressing at the end the amount of the financial loss as a result of the decision taken.

Table.1: Confrontation between the current and ideal scenarios (in the view of the QTE).

Current scenario		Scenarioideal	
1. Students per room	20	1. Students per room	20
2. Monthly payment – Value in USD	200	2. Monthly payment- Value in USD	200
3. Total per room (item 1 x 2)- Value in USD	4.000	3. Total per room (item 1 x 2)- Value in USD	4.000
4. Used rooms	12	4. Used rooms	16
5. Total with 12 rooms (item 3 * item 4)- Value in USD	48.000	5. Total with 12 rooms (item 3 * item 4)- Value in USD	64.000
6. Possible shifts (morning and afternoon)	2	6. Possible shifts (morning and afternoon)	2
7a. Monthly Revenue (item 5 * item 6)- Value in USD	96.000	7b. Monthly Revenue (item 5 * item 6)- Value in USD	128.000

8. Monthly Difference (item7b–item 7a) - Value in USD	32.000
9. AnnualDifference (item 8*12) - Value in USD	384.000

Source: The authors.

The last item analyzed was by whom the building maintenance is carried out, either preventive or corrective, detecting that as a result of the disbursement to maintain a proper team for this purpose, it was decided to outsource the various necessary maintenance. This measure is adequate in the view of Martins (2012), stating that this allows the reduction of costs with property maintenance, evidencing its focus on the enterprise, mainly regarding the involvement of financial resources, which contributes to its maintenance in the competitive market.

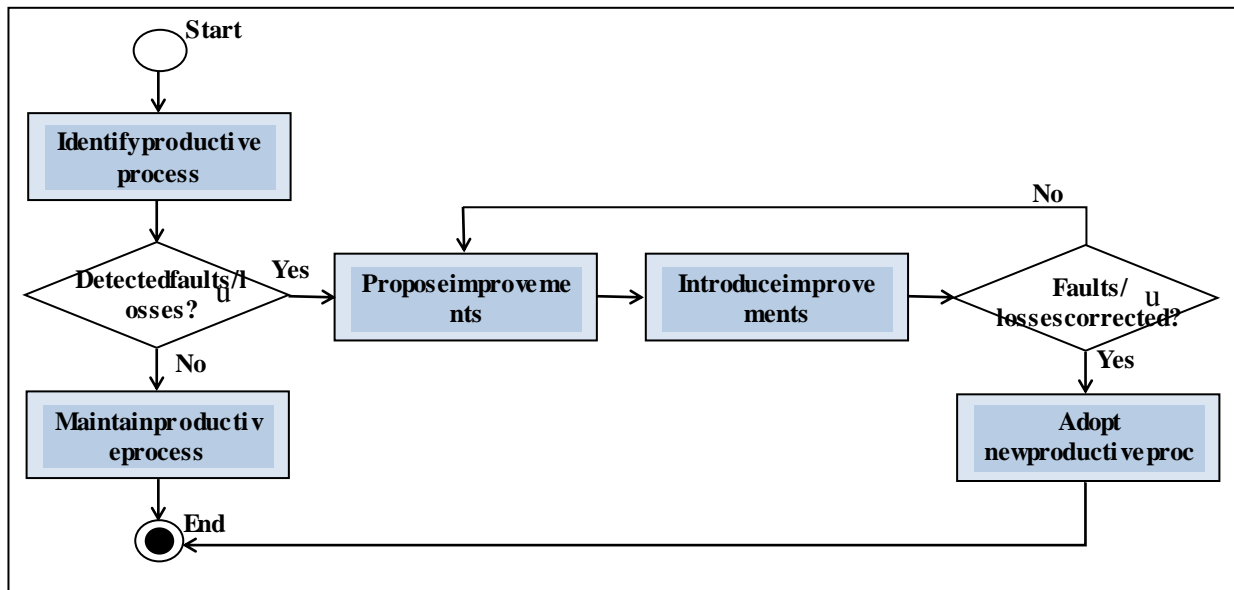
4.3 Innovation for operational improvement of building maintenance nowadays

In view of the findings verified during this research, some changes in the building maintenance are presented, thus promoting, according to the theoretical-conceptual revision explained in item 2.3, innovation to them.

As for the lack of communication of the existing logical network in the old part and with the extension, it is suggested the interconnection of the same and the creation of the Data Processing Center (DPC), in which all the devices that need access to the network will be managed computer world, such as: computers, monitoring cameras; internet and telephone services. In agreement with the one approached by Amorim et al. (2013), when citing Sundbo and Gallouj (1998) on the increase of organizational performance, this study considers that the application of the QTE through this approach of these authors, will lead to improvement in the prevention of failures, as well as the rapid identification of these in what refers to the exchange of materials and equipment in non-conformity or with a lagged useful life.

Another possible innovation would be the implementation of control of preventive and corrective maintenance of the air central, which are the most frequent in the two options, updating it to each maintenance, describing the maintenance date, the services performed and the parts replaced with their and thus the system can be analyzed in terms of the cost that each air station generates to the school, making possible the most beneficial decision making to the organization, according to Martins (2012). Regarding the deactivation of the classrooms that functioned at the top of the existing physical structure

before the expansion, due to the access ladder, it is suggested the accomplishment of an architectural project that promotes the improvement of access to the upper floor, so that improve the safety of employees and students, since the decision made interfered in the improvement of the physical structure of the building, property maintenance and income of the educational institution. Finally, we suggest the reconfiguration of the quick tool exchange, as shown in Figure 2 and Table 4 below.



Source: The authors. Adapted from Fogliatto and Fagundes (2003).

Fig.2: Reconfiguration of QTE.

Table.4: Specification of process steps for QTE reconfiguration.

Process steps	Description
Identify productive process	Phase in which the detailing of the productive process in execution related to the building maintenance occurs.
Decision	From the definition of the production process, its analysis must be performed in a systemic way, in order to verify the existence of failures / losses during the process.
Maintain productive process	In concluding that there are no failures / losses, the production process identified initially is preserved.
Propose improvements	If failures are detected, the necessary improvements should be listed in an organized and planned manner.
Introduce improvements	The improvements will be inserted in the pertinent phases of the productive process, seeking the correction of the failures / losses.
Decision	Promote observation of the productive process under test, aiming at a posterior analysis to ensure the absence of failures / losses. In the detection of failures / losses, return to event 4 - Propose improvements.
Adopt new productive process	Once there is no failure, the new production process is approved. The process should be run from then until further faults / losses occur.

Source: The authors.

These proposals are characterized as innovations, because according to ODCE (2005), the improvement of the existing service is being opportune, modifying the operational process, organization of the workplace, also contributing to the improvement of external relations, when a new offer customers.

V. CONCLUSIONS

The present work aimed to discuss the application of the quick tool exchange in the property maintenance of a company of the educational branch. In this sense, the research problem was to respond in what way the QTE can contribute to the improvement of the existing building maintenance of the school under study.

The relevance of the QTE to the organizations is also due to the competitiveness that increases each day and globalization of the economy, causing companies to seek the means to remain active in the market, acting in a rational way for decision making, mainly to property maintenance, as this reflects in the possibility of responding to the expectations of its customers, which is to be met with more speed, quality and reduced prices, as has been discussed in Rodrigues and Billar (2015).

Regarding the objectives proposed by the research, the first one was to characterize the property maintenance of the establishment under study and with the research process it was noticed that despite some failures, the same seeks, within its limitations, to meet the legal norms and techniques in the field of building maintenance, characterizing a rational use of resources, especially financial resources.

The second objective reached by the research was the comparison of the operational processes applied in the face of the concepts of quick tool exchange, being possible the visualization of measures approved and disapproved by this one. Nevertheless, the disapprovals consist of simple nonconformities, but their regularization will contribute to the improvement of the procedures and the consequent reduction of failures and losses in the productive process referred to the property maintenance, main objective of the QTE.

The last objective was to propose innovation for operational improvement of the building maintenance in operation, it was verified that it is necessary to interconnect the logical network of the two present physical structures (old and enlarged), converging to a data processing center; the implementation of control of maintenance of the central air would contribute to deliberations about the economic viability or not of other maintenance, either preventive or corrective; and finally, the physical suitability of the staircase present in the first

structure of the school so that the four classrooms that are idle can be reactivated.

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Electronic Transitions and Photovoltaic Properties of New Compounds as Organic Dye Sensitizers for Solar Cell

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Abstract—This work deals with electronic and photovoltaic properties of new compounds as organic dye sensitized for solar cell. The ground state calculations are carried out by employing the B3LYP-DFT method and the TD-DFT for excitation properties at the Gaussian 09 package of programs. The results showed the HOMO and LUMO are slightly different and this suggests that different structures play significant roles on electronic properties and improving the electron accepting ability. The obtained values of energy gap and the open circuit voltage are the parameters manipulating to improving the quality of solar cell devices. Also, the results show these compounds can be used as organic sensitizers for solar cell due to possibility of the electron injection process from the compounds to the conduction band of TiO₂.

Keywords—HOMO, LUMO, Open circuit voltage and excitation energy.

I. INTRODUCTION

The increasing energy needs in the world gave the solar energy to has high importantly [1,2]. In solar cell, some of organic and inorganic materials have been applied [3-7]. Dye sensitized solar cell was initially developed by O'Regan and Grätzel [8]. Low band gap polymers which are designed to improved match solar output have been studied, Polymers with alternating dithiophene and thiadiazolothienopyrazine units and other polythiophene derivatives have been discovered by several research groups [9]. Sanyin Qu et al have developed new materials based on diketo-pyrrolo-pyrrole for solar cells applications [10]. Beside the experimental works, theoretical studies have been investigated to create an important source of valuable information which complements the experimental studies, thereby contributing to the understanding of the molecular electronic structure as well as the nature of absorption and emission [11]. Dye sensitized solar cells have involved much care due to their probable applications in coating and fabrication technologies,

they are low cost and have high photoelectric conversion efficiency [12-14]. The contact between the electron donor and acceptor moieties in donor-acceptor can result in the hybridization of the highlying HOMO level of the donor and lowlying level of the acceptor, leading to small band gap material with new electronic structure. In recent years, interest in metal free organic dyes as an alternative to noble metal complexes has increased due to their advantages, such as the variety of molecular structures, high molar extinction coefficients, simple synthesis, as well as low cost. Tian et al. have reported a series of donor-acceptor- π -bridge-acceptor (D-A- π -A) structural organic dyes incorporating Benzotriazole into the triphenylamine framework, resulting in red-shift in absorption and weakening the de-protonation effect on TiO₂ film, which is beneficial for light-harvesting [15]. On the other hand, most recent papers are focused on the Carbazole (Cbz) [16-18], due to its significant photo-conductivity, photo-luminescence and hole transport properties. Current work, theoretical study by employing the DFT method on four conjugated compounds based on anthracene is described. Different electron subgroups were introduced to investigate their effects on the electronic structure.

II. METHOD

The relaxed structures of suggested different compounds series based on anthracene studied in this work are four and they are presented in Figure 1. Initially, the suggested compounds are designed at the Gauss View 5.0.8 program and then relaxed by performing the three parameters Lee-Yang-Parr B3LYP hybrid functional density functional theory DFT method together with 6-31G basis sets at the Gaussian 09 package of programs [19] to study of their ground state and spectroscopic properties. The excited states properties and the transition states of the relaxed structures are studied by using the time dependent density functional theory TD-DFT [20].

III. RESULTS AND DISCUSSION

In Figure 1, it exposes that the phenyl rings at the two sides of anthracene is clear and the π -electron delocalization between the molecule units and aromatic rings is also clear. The effect of adding subgroups in phenyl rings are studied. In order to examine the effect of asymmetry in comparison with the corresponding symmetry compounds, compounds 1 and 4 are designed. The effect of the electron accepting and electron donating groups are also studied. It was found that the geometrical parameters from DFT calculations are in a good agreement with those obtained from the x-ray data for cyclic carbon compounds. The relax structures for the compounds in Figure 1 show they all of the similar conformation, they have quasi planar conformation. The results showed the consecutive units have like dihedral angles (between 180o and -180o). The inter-ring bond distances are around the value 1.421Ao and the C-C-C bonds are around 120o, the addition of number of subgroups does not change these parameters.

The total energy ET in a. u for the studied compounds was calculated and listed in Table 1. As seen, the Et is approximately independent on the position of the same subgroups in the compounds but depends only on the number of electrons in the compounds, this a sign to that the total energy is a reflection of the binding energy for each compound. Et is inversely proportional with the number of electrons, it decreased with increasing the number of electrons in the compound. In Table 1, the corresponding calculated values of virial ratio (-V/T) for the studied compounds showed they lie in the same range for such compounds, in which the experimental value for hydrogen atom (-V/T=2.0032). Above results indicate to good relax was found without any imaginary frequency for each one of the studied compounds by employing the DFT method. Figure 2 illustrates the Et for the compounds.

To interpretation and understanding of the behavior of the absorption spectra of the compounds, it is necessary to studying the electronic structure. Table 2 shows the calculated frontier orbital energies (High Occupied Molecular Orbital HOMO and Low Unoccupied Molecular Orbital LUMO) and LUMO-HOMO energy gap Egap of the studied compounds. The results in Table 2 noticed that all studied compounds display destabilization of the LUMO and stabilization of HOMO. The results showed the HOMO and LUMO are slightly different and this suggests that different structures play significant roles on electronic properties and improving the electron accepting ability, and the effect of symmetry and distribution of aromatic

rings on the energies of HOMO and LUMO cannot be ignored. The ranking of LUMO energy is as:

$$2 < 4 < 3 < 1$$

The results showed the presence of the electron attracting subgroups in the compounds leads to lower the LUMO and therefore reducing the energy gap. Also, the presence of triple and double C-C bonds causes a lower of the LUMO and decrease the energy gap due to destabilization of LUMO energies, this result agree with the experimental data[3,21].

The calculated energy gaps were decreased in the following order : 1(3.438 eV) > 4(2.818 eV) > 3(2.616 eV) > 2(2.599 eV). The compound 2 observes a lower energy gap than the other studied compounds due to asymmetric terminal ends in the compound. Inserting a triple C-C bonds between the anthracene and the phenyl rings in both donor and acceptor sides decreases the energy gap, this increases the conjugation length of the compound and therefore capable well charge transfer properties. The high energy gap for the first three compound is due to symmetric of adding subgroups in terminal ends of phenyl rings at the donating and accepting sites, in which the CH3 subgroup in compound 1 has the same behavior of the OCH3 subgroup. Figure 3 shows the LUMO-HOMO gap. The open circuit voltage Voc was calculated in Table 2 as the TiO2 is a good acceptor.

The contribution of the frontier molecular orbitals FMO is the key of determining the charge separated states of the compounds under study. Figure 4 illustrates the HOMO and LUMO distributions of the studied compounds. As shown, all the studied organic dyes have respectable electron separated states. It is strong localization of the HOMOs occurs on the phenyl donor subunits of the backbone of the compounds, and strong delocalization of the LUMOs occurs on the bridges between the subunits proving the flow of electron density along the backbone of the compounds. The electron density of LUMO is mainly localized on the acceptor units, so the electronic transitions of the studied compounds from HOMO to LUMO could lead to intra-molecular charge transfer from the donor units to the subgroups at the acceptor units through the conjugated bridge between the two sides.

Table 3 declare the results of the calculated values of chemical potential X, the global electrochemical hardness H and electrophilic index W of the studied compounds. As seen in Table 3, these compounds have low values of X in which indicates to that the electrons in the compounds under study have a large escaping tendency. The results showed all the studied compounds have low values of global hardness. The

reducing of hardness is the main future as an indication to the band gap of the compounds to be rather more soft and leads to reducing the resistance of the compounds to lose an electron. In other words, these results refer to that these compounds have high ability to an electron transfer. Figures 5 and 6 illustrate the chemical potential and hardness of the compounds. The electrophilic index W is a factor to determine the ability of the molecule to interacts with other molecules or species. From Table 3 and figure 7, the order of W for the studied compounds is as:

$$2 > 4 > 3 > 1$$

Figure 8 illustrates the shapes of the total electron density ED distribution drawn from the calculations of the self-consistent field SCF. The shapes showed the distribution of ED completely depends on the point group symmetry for each compound, uniform distribution of ED was found around the anthracene back bone molecule with different areas of densities at the two sides of anthracene according to high/low ED due to presence phenyl rings at these areas. In the two ends of each compound, the ED was localized highly depending on large number of electrons in such end. The determine of the high ED area assistance to control the active site of electron transfer process.

Figure 9 illustrates the 2-D counter distribution and 3-D distribution of the electrostatic potential ESP surfaces of the studied compounds. The yellow color represents the ESP surface and the red color represents

Tables:

Table 1: The total energy E_t and $(-V/T)$ for the compounds.

Compound	E_t a. u	$-V/T$
1	-1384.30205	2.0057
2	-1611.62170	2.0056
3	-1675.54321	2.0056
4	-1574.07524	2.0056

Table 2: The HOMO, LUMO and E_{gap} for the compounds.

Compound	HOMO eV	LUMO eV	E_{gap} eV	V_{oc}/TiO_2 eV
1	-5.2149	-1.7760	3.4389	1.8239
2	-4.7703	-2.1706	2.5997	1.4293
3	-4.7104	-2.0941	2.6163	1.5058
4	-4.9646	-2.1458	2.8187	1.4541
TiO_2	-5.928	-3.900		

Table 3: The X , H and W for the compounds.

Compound	X eV	H eV	W eV
1	3.4954	1.71945	3.5528
2	3.4704	1.29985	4.6327
3	3.4022	1.30815	4.4241
4	3.5552	1.4094	4.4841

the surface dragged potential. As seen, the surface of ESP around the anthracene back bone is uniform and the potential was dragged towards the areas of highly electronegativity. In compounds 1 and 3, the ESP was distributed uniformly. While, in compounds 2 and 4, the ESP was dragged towards the active sites of high electronegativity.

The UV-Vis spectra of the compounds in present work were studied and analyzed using the TD-SCF method with the same hybrid functional and basis sets. The key factor for the compounds can have applications as the photovoltaic materials is the absorption spectra of the studied compounds equivalent to the solar spectrum. Table 4 illustrates the calculated values of absorption energy E_{abs} (eV), absorption wave length λ_{max} (nm), the oscillator strength O.S and the molecular orbital character MOC %. As shown, the calculated wave length λ_{max} of the compounds under study increases in the following order(see figure 10):

$$1 < 3 < 2 < 4$$

IV. CONCLUSIONS

From above results, one can conclude that the used method for the relaxation of the studied compounds is a suitable theoretical investigation. The suggested organic compounds have energy gaps as for semiconductor materials. These compounds are appear absorption energy and wave length correspond to the solar spectrum.

Table 4: The absorption spectra calculations of the compounds.

Compound	E_{abs} eV	λ_{max} nm	O.S	MO Character %
1	2.5915	478.42	0.2821	HOMO→LUMO(99)
2	2.1891	566.36	1.0814	HOMO→LUMO(100)
3	2.2072	561.74	1.0573	HOMO→LUMO(100)
4	1.9782	626.75	0.0021	HOMO →LUMO (14) HOMO →L+1 (84)

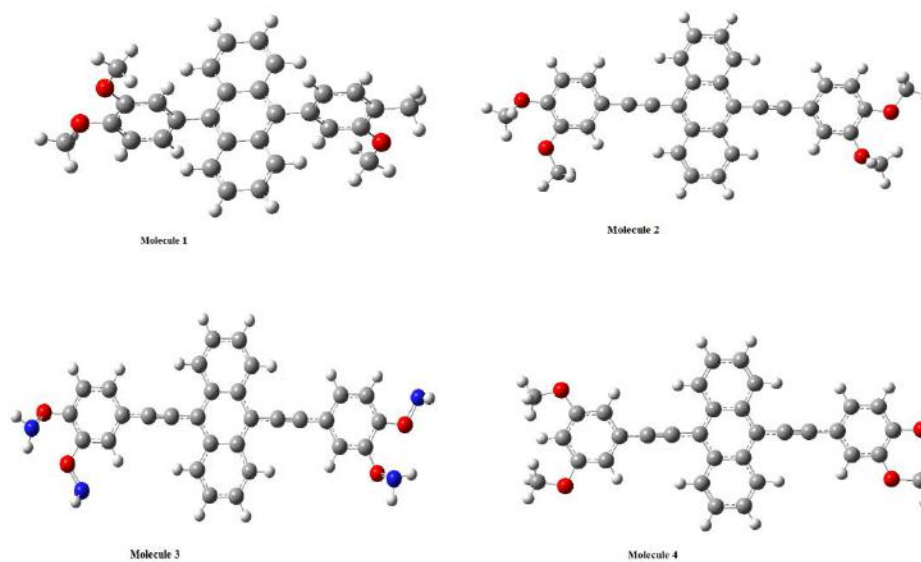


Fig. 1: The relax structure of the compounds.

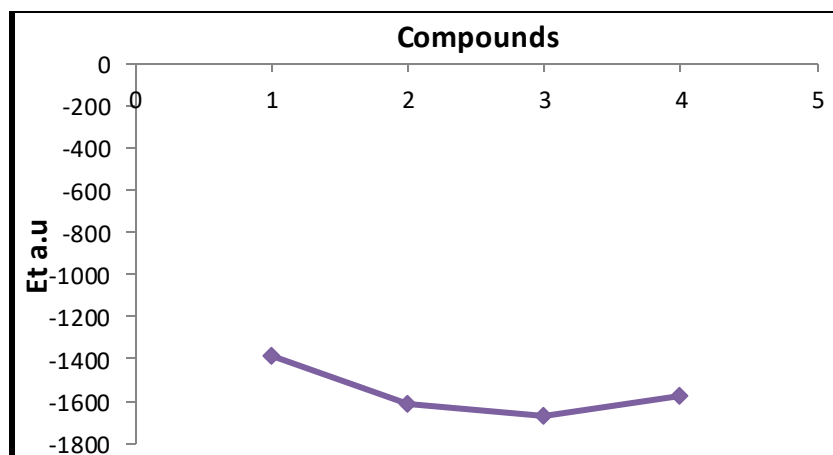


Fig. 2: Et of the compounds.

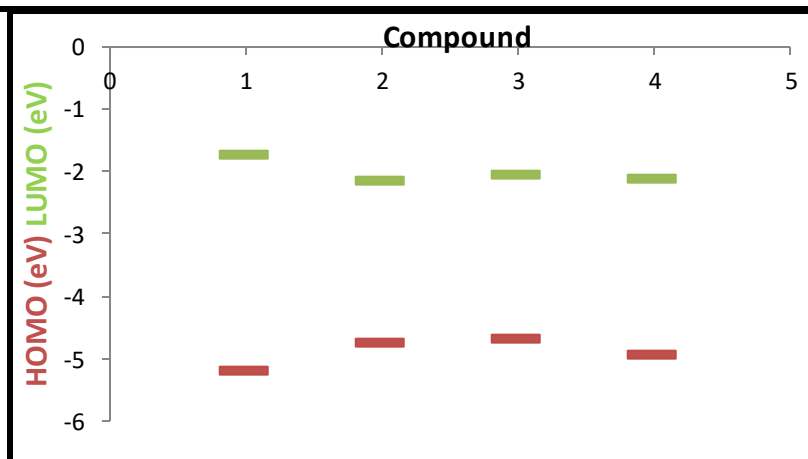


Fig. 3: LUMO-HOMO gap of the compounds.

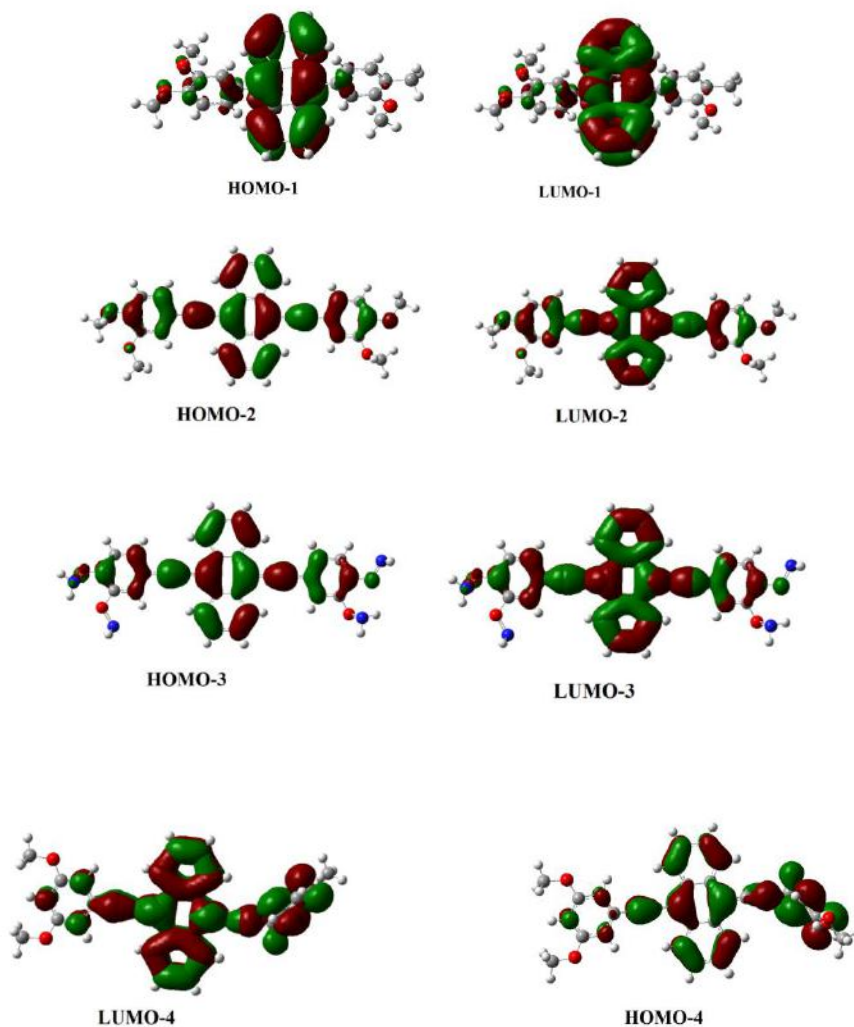


Fig. 4: LUMO and HOMO distribution of the compounds.

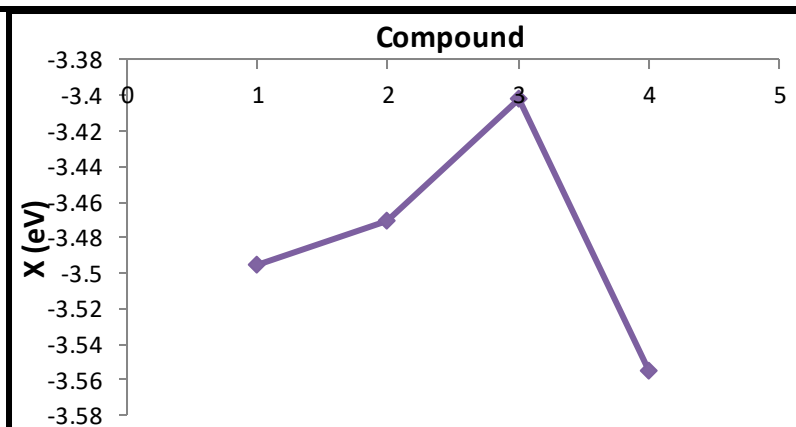


Fig. 5: Chemical potential of the compounds.

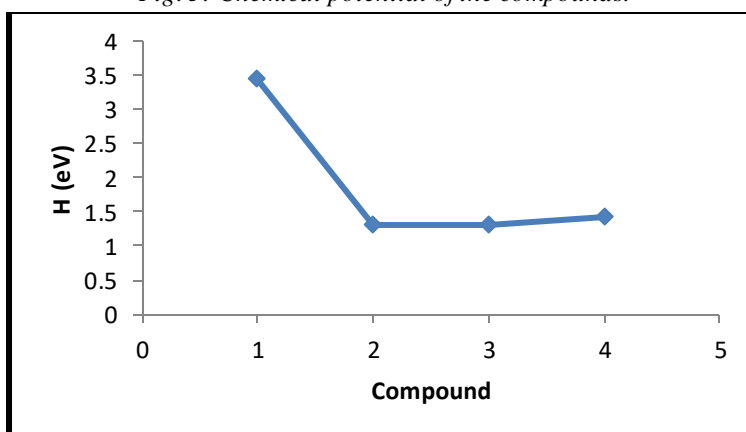


Fig. 6: Hardness of the compounds.

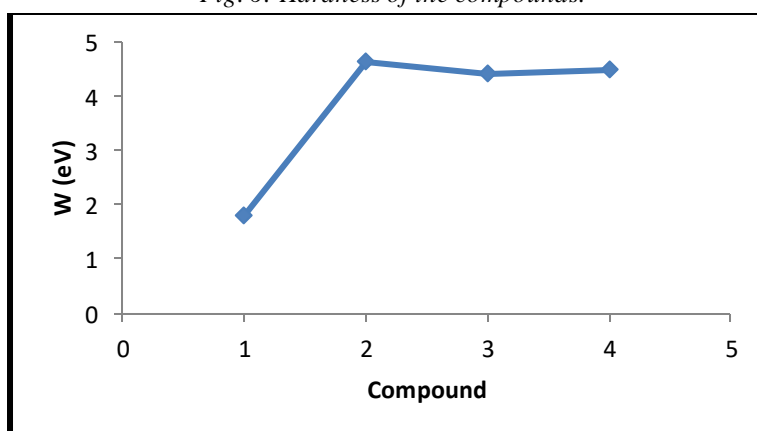
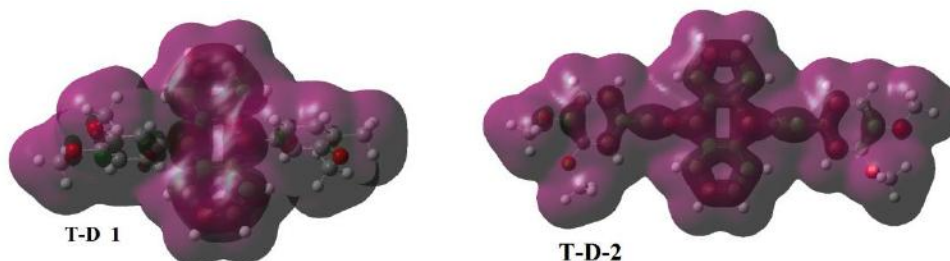


Fig. 6: Electrophilic index of the compounds.



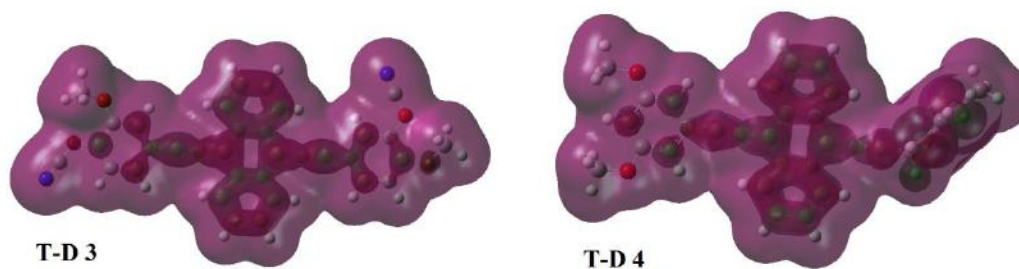


Fig. 8: Electron density distribution of the compounds.

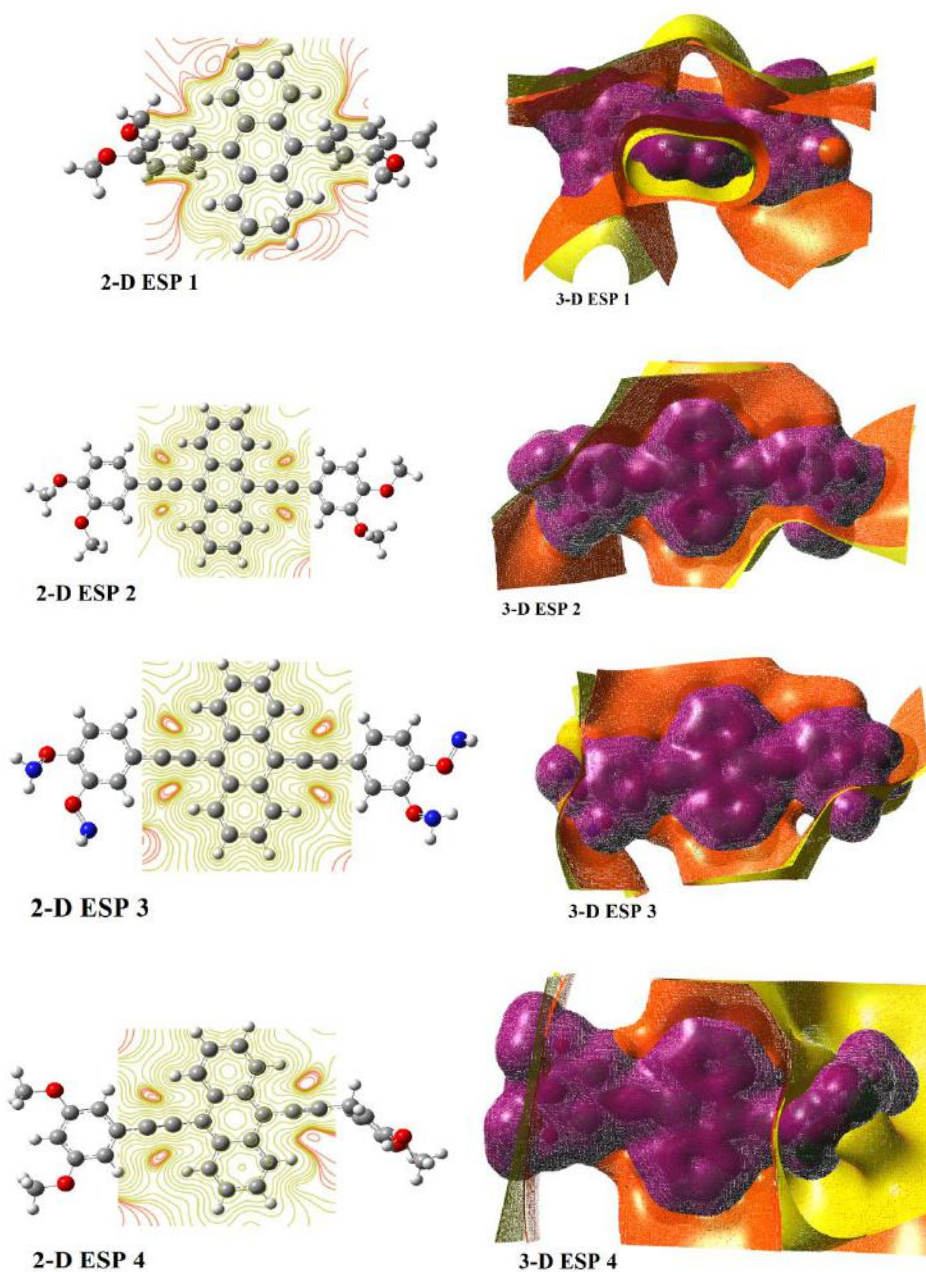


Fig.9: Electrostatic potential distribution of the compounds.

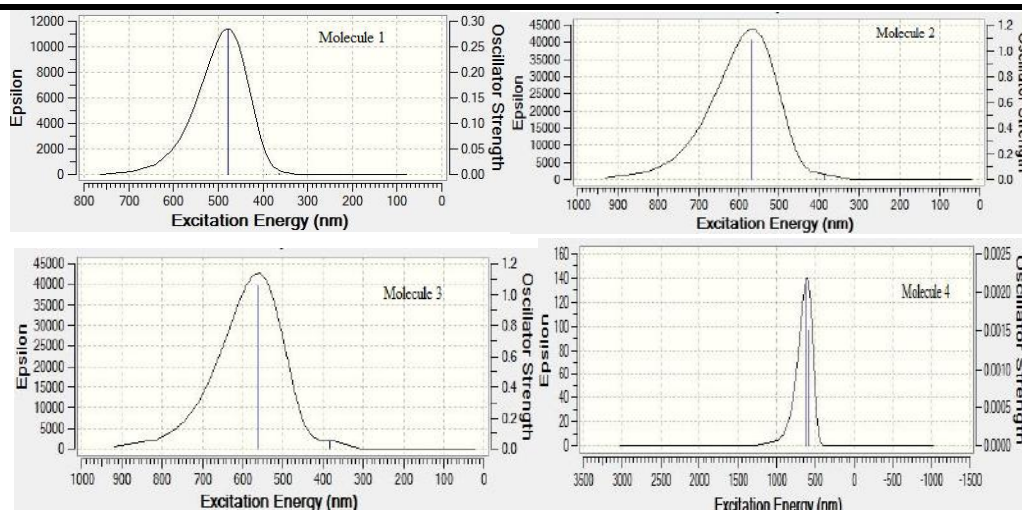


Fig. 10: UV-Vis spectra of the compounds.

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Performance of Different Models for Estimating the Global Solar Radiation in Brazil

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Abstract— Global solar irradiance (Q_g) is an important variable of the physical environment that has been constantly used in agrometeorological models, either for climatic characterization or to give support to radiometric studies developed for irrigation planning and crop weather modeling approaches. The current study aimed to compare measured daily values of Q_g with estimates of this variable by means of four different methods. For that throughout the period comprised between March 28th of 2008 and August 8th of 2011 at Ponta Grossa, PR, Brazil, a simple linear regression study confronting radiometric data measured by a pyranometer and estimates of Q_g was proposed herein. Global transmittance was conditioned by atmospheric cloudiness. The models based on mean global transmittance in daily basis performed more satisfactorily and generated values of Q_g with accuracy and exactness at the site in study, as confirmed by the statistical parameters employed to validate the usage of models proposed by Angström-PreScott. However, the performance of the methodologies based on the determination of mean global transmittance under extreme atmospheric conditions, showed the highest Willmott coefficients, which was to be close to 1, reflecting then precision and reliability for the calculated values of Q_g , when compared to observed values monitored at an automatic weather station.

Keywords—Solar radiation, global transmittance, modeling, sustainable agriculture.

I. INTRODUCTION

Solar irradiance is responsible for triggering great part of the chemical, physical and biological processes in the soil-plant-atmosphere system. However, not all solar irradiance can effectively reach terrestrial surface, for by passing through optical mass and interacting with the atmospheric components it suffers action of reflection, diffusion and absorption processes. From such, approximately 51% of the extraterrestrial solar irradiance is available to be utilized in processes of the biological and physical environment (Ometto, 1981), depicting the fraction of radiation that effectively reaches soil surface or global solar radiation (Q_g).

Q_g is an important variable of the physical environment that is constantly employed in studies of water requirement of irrigated crops, modeling of growth and crop yield, climate changes, optimization of environmental comfort, among other applications. The great problem dealing with collection of Q_g data is the high cost of the pyranometer, a radiometric equipment responsible for recording global solar irradiance at a given site (Souza et al., 2011). Moreover, the Q_g quantification requires the usage of recorders or data acquisition systems, as well as skilled and specialized people making the cost of such information high at operational level.

The lack of Q_g observations has been a persistent problem in studies of biophysical processes in agroecosystems. The number of weather stations recording the daily irradiance is small compared to the number of weather stations that monitor temperature and rainfall. In the United States of America the ratio of weather stations that measure solar radiation components and those that measure air temperature is greater than 1:100; in global terms such a ratio is of 1:500 (Thorton and Running, 1999). In the northeast of China, region of the country of a great agricultural importance, there are 109 weather stations, being that among those only 13 perform routine radiometric measurements (Wu et al., 2012). In the state of Paraná, Brazil, there are 37 automatic weather stations and 22 conventional weather stations responsible for the records of solar irradiance components. However, the electronic sensors are not always calibrated, showing record failures for a long period and lack of accurate radiometric information in studies related to micrometeorology and optimization of irrigation in agriculture.

Ratio between global solar irradiance and solar irradiance at the top of the atmosphere represents global solar transmittance, which in conjunction with insolation ratio might be employed in the Angström-PreScott equation to estimate the a and b empirical coefficients (which reflect the factors that affect absorption and diffusion of solar radiation) and that are considered as an input variable in estimation models of global irradiance for sites that do not

count on equipment and specialized labor throughout the collection of such a variable (Paulescu et al., 2008).

The Angström-Prescott equation proposed to estimate global irradiance from insolation ratio was idealized by Angström in 1924 and modified by Prescott sixteen years later with the purpose of circumventing the difficulty of obtaining the Angot value (Penman, 1948). Such equation, besides referring to a time interval higher than 70 years has demonstrated satisfactory performances for small periods all over the world and has been largely used in studies of solar radiometry (Li et al., 2011; Kolebaje and Mustapha, 2012; Wu et al., 2012; Sabziparvar et al., 2013), although some limitations are to be taken into account especially due to cloud thickness.

Recently Li et al. (2011), making use of the classical model of Angström-Prescott for estimating global solar irradiance in Tibet, China, from a series of 15 years of radiometric data at four different weather stations, obtained estimates of the variable in question with errors lower than 10% in all studied sites. Wu et al. (2012), using the same model for assessing Q_g throughout the crop growing season at the northeast of China, concluded that such a calculation procedure is not only effective and reliable but also an economic means to obtain radiometric data where the collection of such an environmental variable is scanty.

Kolebaje and Mustapha (2012) obtained a high accuracy for the Q_g estimation model proposed by Angström-Prescott at four different climatic regions of Nigeria. The reliability and performance of the Angström-Prescott model were also evidenced by Namrata et al. (2013), by comparing such a model to other six empirical models for estimating global irradiance at the region of Jharkhand, India. Sabziparvar et al. (2013) made use of the model proposed by Angström-Prescott to estimate global irradiance at 15 sites of Iran with the purpose of using it for the calculation of reference evapotranspiration and verified that such a classical estimation model was precise to assess Q_g .

Aiming at examining the performance of different models for the calculation of monthly and daily solar irradiance at a horizontal surface in Kuala Terengganu, Malaysia, Muzathik et al. (2011) observed that by means of the mean percent error, mean squared error of the Fisher correlation test and t-test the estimation model proposed by Angström-Prescott was ascribed by low dispersion measures, revealing a high precision and reliability under the studied climatic conditions.

Scientists from all over the world have been incorporating modifications into the Angström-Prescott classical model by means of the insertion of physical variables or alterations in the mathematical expression of Q_g calculation in order to improve accuracy and exactness of the estimates so that reliability and feasibility might be assured under specific atmospheric conditions at several

sites of the globe (Newland 1989; Ampratwum and Dorvlo, 1999; Almorox and Hontoria, 2004; Şen 2007; Bakirci, 2009; Chineke and Okoro, 2010).

In order to meet the needs of knowing solar energy availability at the region of Campos Gerais of Parana, Brazil, we come up with mathematical models developed to estimate global solar irradiance, which differ among themselves in terms of complexity and number of input variables of the model. It is important to consider that such models are in general applicable to environmental conditions where they were originally developed, showing therefore problems of transferability when not properly gauged and calibrated (Borges et al., 2010).

Faced with that, the current work aimed to determine global transmittance, evaluate and compare the performance of four different models for estimating Q_g under the climatic conditions of Ponta Grossa, State of Parana, Brazil, in order to maximize crop yield at production fields with environmental protection.

II. MATERIAL AND METHODS

The field trial was carried out at the Experiment Station of the State University of Ponta Grossa, Ponta Grossa, PR, Brazil (altitude of 880m, latitude of 25°5'S and longitude of 50°3'W). The local climate was classified according to Köppen's classification as of the type Cfb – humid subtropical climate.

Global solar irradiance daily data was measured by a silica photodiode pyranometer, LI-COR, model LI-200X, with a spectral response within the interval of 0.4 and 1.2 μm , with a typical absolute error of $\pm 3\%$ (Federer and Tanner, 1965) from a automatic weather station throughout the period comprised between March 28th of 2008 and August 24th of 2011. The pyranometer was coupled to a Campbell Scientific Inc., model CR-1000, data acquisition system programmed for taking readings with a 60 s frequency and storing averages at each 30 minutes. Initially instantaneous values of Q_g were integrated (W m^{-2}) over the course of a day in such a way as to express them in $\text{MJ m}^{-2} \text{day}^{-1}$.

In order to estimate the extraterrestrial solar irradiance in $\text{MJ m}^{-2} \text{day}^{-1}$ the following expression was used:

$$Q_0 = 37.6 (d/D)^2 \left[\left(\frac{\pi}{180} \right) hn \sin \Phi \sin \delta + \cos \Phi \cos \delta \sin hn \right] \quad (1)$$

$$(d/D)^2 = 1 + 0.033 \cos (\text{DOY } 360/365) \quad (2)$$

where:

Φ = local latitude (degrees); δ = solar declination (degrees); hn = hourly angle at the sunrise (degrees); d/D = Earth-Sun relative distance, being d the average distance and D the actual distance; DOY = day of the year.

The photoperiod duration was determined by means of Pereira and Villa Nova (2008) and effective

astronomical insolation was measured by a Campbell Stokes heliograph daily integrated from heliograms during the period of analysis.

In order to calculate daily global transmittance daily values of global solar irradiance were divided by daily extraterrestrial solar irradiance. Afterwards the same calculation procedure was repeated so as to classify the radiometric data into cloudy and sunny days as a function of insolation ratio, which was lower than 0.3 for cloudy days and higher than 0.8 for sunny days.

To estimate Q_g four different models were employed in the current research.

1st Model – Q_g estimation as a function of the mean global transmittance (\bar{T}_g) for clear and completely overcast days (Pereira et al., 2002). Taking into consideration a series of radiometric data available at the studied site for clear days, \bar{T}_g was expressed by: $\bar{T}_g = a + b = 0.618$. For completely overcast days, $\bar{T}_g = a = 0.143$. Based on such empirical regression equation coefficients, global solar irradiance was obtained by:

$$Q_g = Q_o * [0.143 + 0.475 * n/N] \quad (3)$$

where,

n/N is the insolation ratio given by the rate between effective astronomical insolation (n) and photoperiod duration (N).

2nd Model – Q_g estimation as a function of the daily mean global transmittance (\bar{T}_g) for clear days in compliance with the first model, and considering the latitudinal dependence of a proposed by Glover and McCulloch (1958). Thus, global solar irradiance was obtained by:

$$Q_g = Q_o * [0.262 + 0.356 * n/N] \quad (4)$$

3rd Model – Based on the maximum global transmittance obtained from only one radiometric measurement taken at solar noon ($Tgmax_{(112)}$) (Pereira et al., 2003):

$$Q_g = Q_o * [0.262 - b' * n/N] \quad (5)$$

where:

$$b' = Tgmax_{(112)} - 0.262 \quad (6)$$

4th Model – Based on the classical proposition of Glover and McCulloch (1958), being defined by:

$$Q_g = Q_o * [0.29 * \cos\phi + 0.52 * n/N] \quad (7)$$

The accuracy of the estimates of Q_g was expressed by the coefficient of determination (R^2) (Legates and McCabe, 1999). Its exactness might be observed by the dispersion of the data around the fitted line of the estimates in a 1:1 graph, which was quantified by means of the agreement index (d) proposed by Willmott et al. (1985), once the values of coefficient of correlation and determination analyzed separately can lead to interpretations not always suitable for the performance of the studied model.

In this paper, a new index c proposed by Camargo and Sentelhas (1987) was also adopted to indicate the performance of the Q_g model, putting together the accuracy R and exactness d indices, being defined by the multiplication between both statistical indices.

In order to evaluate the error of estimates two statistical parameters were calculated, such as the mean absolute percentage error (MAPE) and smoothed absolute percentage error (SAPE), as described by Goodwin and Lawton (1999). Moreover, to compare observed and predicted data of global solar irradiance the following errors were adopted: mean error (ME), mean absolute error (MAE) and root mean square error (RMSE) (Borges et al., 2010).

III. RESULTS AND DISCUSSION

Daily global solar transmittance (T_g) represents the proportion of global solar irradiance determined at the extreme limit of the atmosphere that effectively reaches soil surface. Since T_g comes from the interaction of Q_o with the terrestrial atmosphere it is certain that optical mass thickness varies in compliance with zenithal angle, which therefore brings about instantaneous fluctuations in T_g throughout the day, showing low values at sunrise and sunset and maximum values at noon, time of the day in which there will be the maximum incidence of solar energy at the Earth surface.

Another factor that it is to be of a great deal of concern on daily global solar transmittance of the atmosphere is cloudiness, once reflectivity of the clouds is greater than reflectivity of the atmosphere under cloudless conditions (Dantas et al., 2000). The influence of the clouds on T_g during the different seasons of the year was observed by Pereira et al. (2002), evidencing that T_g values were always lower under cloudy days (0.265) than under sunny days (0.770) at the municipality of Piracicaba, SP. In Ponta Grossa, PR, for all radiometric data series in study we verified that under cloudy days daily mean values of T_g were corresponding to 0.143, whereas under sunny days the highest daily mean values of T_g were of 0.618. Under cloudless conditions cloudiness is minimal or absent and insolation is maximum, being conducive to the highest possible T_g values.

In order to determine a clarity index under climatic conditions of Akure, Nigeria, Adaramola (2012) analyzed radiation ratio (Q_g/Q_o) and came up with the lowest values of T_g for the period of time comprised between April and August (wet season), being capable of observing the opposite during the dry season at the studied site. Such an author along with Chaar and Lamont (2010) verified at three different regions of Abu Dhabi, United Arab Emirates, that during the months with a more pronounced cloudiness index (January through April) global transmittance was the lowest in conjunction with the

highest T_g values obtained during those months under the lowest cloudiness condition.

Faced with a seasonal analysis on T_g calculated at Ponta Grossa, PR, it was possible to observe that T_g values under cloudy days were higher during spring/summer seasons, whereas under sunny days T_g was higher during fall/winter seasons (Table 1). The highest T_g values under sunny days throughout fall/winter time might be ascribed to the lowest cloudiness index for the region of Ponta Grossa at this time of the year, characterizing a dry season at the site. The lowest T_g values under sunny days during spring/summer seasons might be attributed to the highest amounts of rainfall at such a time of the year, which resulted in an increase in the atmospheric humidity in such a way as to accrue cloudiness conditions at the studied site.

Divergent outcomes of T_g were reported by Querino et al. (2011) in a radiometric study conducted in Alagoas State, where during the summer months atmospheric transmissivity was always higher than that observed during the period of time comprised between May and June (fall/winter seasons), with T_g values higher than 70%.

In a similar study, Pereira et al. (2002) calculated T_g for the same seasonal periods, however under climatic conditions of Piracicaba, SP. In a comparative study between both distinct local climatic conditions and taking into consideration the same period of time in analysis, we reached the conclusion that regardless of the season of the year Piracicaba, SP, showed a higher T_g in relation to Ponta Grossa, PR. The lowest T_g values for the studied site might be explained by the interference of cold fronts, probably the Atlantic Polar Mass or air masses coming from the ocean, as well as by the action of wet maritime winds influenced by the anticyclone from the South Atlantic, which in turn cause orographic rainfalls at Serra do Mar and also at a large extension of the State of Parana, Brazil (Beruski et al., 2009).

Table.1: Daily global solar transmittance (T_g) calculated for both cloudy and sunny days under the climatic conditions of Ponta Grossa, PR. Average throughout the studied period.

Global Transmittance	Ponta Grossa - Brazil	
	Spring/Summer	Fall/Winter
Cloudy days	0.152	0.142
Sunny days	0.610	0.622

Discrepancies in the variation of T_g also might be noticed as a function of local latitude. Thus, at sites of low latitudes the incidence of solar radiation is quite nearer the perpendicularity in relation to equator plan and, therefore, the saturation period of energy diminishes with the increase

in latitude. Variations in global transmittance as a function of local latitude were also observed by Yousif et al. (2013), by comparing two distinct sites of Europe: Marsaxlokk in Malta and Valladolid, in Spain.

All Q_g estimation methods assessed in the current research showed values consistently close to those measured by the pyranometer (Figure 1).

By comparing the coefficients of determination (R^2) and the Pearson correlation (R) we noticed that all models studied demonstrated a high precision. The 4th model showed the highest value of R^2 , with 99.8% of the measured Q_g variations being explained by a simple linear regression equation, evidencing therefore a high precision for such a model. Either the coefficient of determination or Pearson correlation one bring only information about the precision of the mathematical models used, but nothing reveal about its exactness (Pereira et al., 2003; Pereira and Villa Nova, 2008). Therefore, by means of the calculation of the agreement index (d) proposed by Willmott et al. (1985) it was possible to notice that the 1st and 2nd models were related to values of d corresponding to 0.982 and 0.989, respectively, indicating that the estimated values of Q_g were extremely close to the observed ones. Although the agreement indices obtained for the 3rd and 4th estimation models had been low in comparative terms, such statistical parameters were also high for such models, assuming values close to 1, given the small dispersion of the data around the fitted 1:1 line (Figure 1).

The performance index (c) of the mathematical models, defined by the multiplication between R and d , was of 0.980 for the first model, 0.979 for the second, 0.839 for the third, and 0.942 for the fourth model. Taking into account the interpretation criterion of performance of agrometeorological models proposed by Camargo and Sentelhas (1997), the performances obtained by the 1st, 2nd, and 4th estimation models were excellent ($c > 0.85$), whereas only the 3rd model was classified as that one with a very good performance (c ranging from 0.76 to 0.85).

Wu et al. (2012), making use of the Angström-Prescott model to estimate Q_g in the northeast of China, obtained values of coefficient of determination (R^2) between 0.77 and 0.89, depicting in average 83 % of the variations in observed values of Q_g and being explained by regression models proposed from radiometric data collected from automatic weather stations installed at the studied site.

Kolebaje and Mustapha (2012), by analyzing the performance of different Q_g estimation models for four distinct sites in Nigeria, verified that the model proposed by Angström-Prescott showed a coefficient of correlation of 0.953 and 0.872 for the regions of Port Harcourt and Lokoja, respectively, and concluded that Q_g values estimated by the model in study were those that the most depicted reality observed under the environmental

conditions of this work. Similar results were obtained by Muzathik et al. (2011), who have found a coefficient of the Pearson correlation corresponding to 0.855 for the classical

model employed to calculate Q_g , making it possible and feasible for assessment of the physical variable in question at Kuala Terengganu, Malaysia.

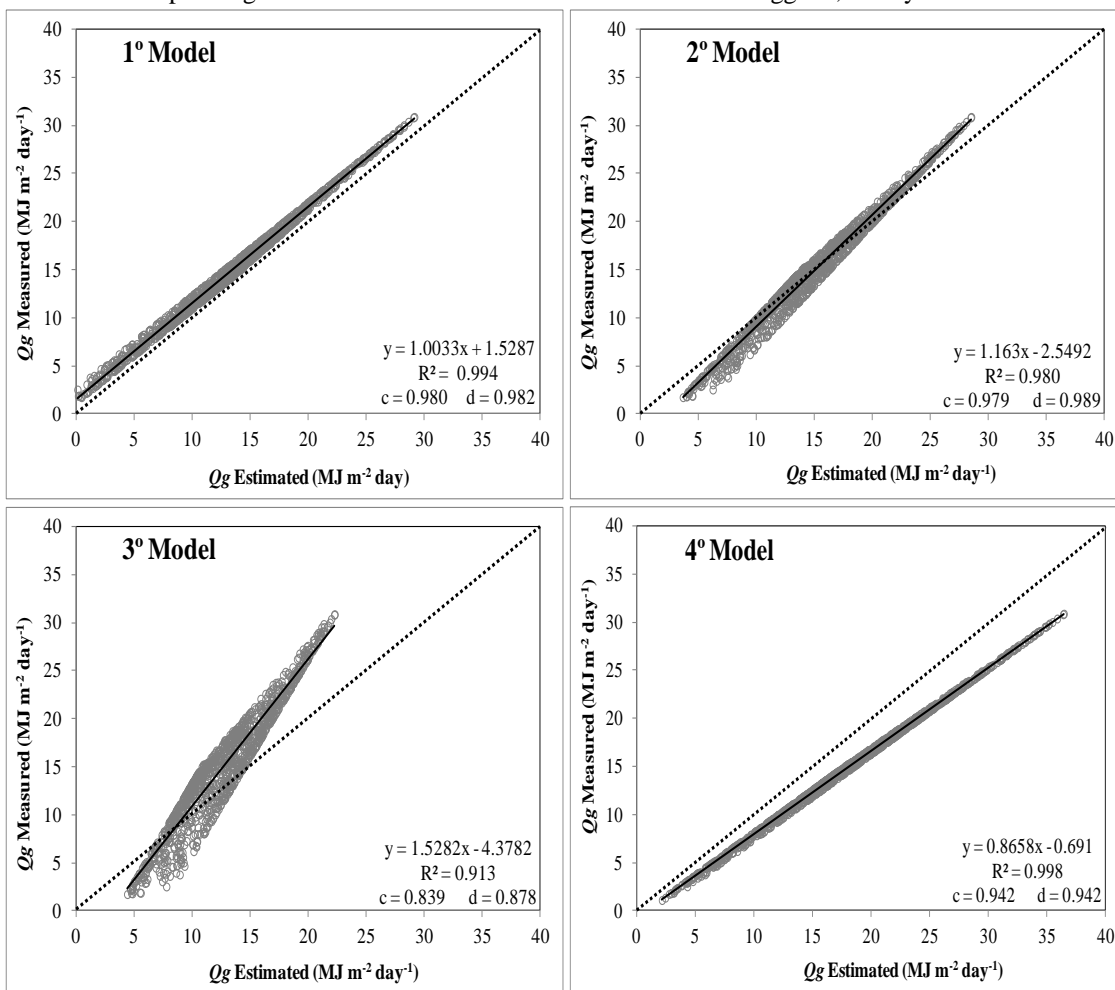


Fig.1: Relationship between daily global solar irradiance (Q_g) measured by a pyranometer and estimated by four different models under the climatic conditions of the municipality of Ponta Grossa, PR, Brazil.

Values obtained for the errors of estimates expressed by both mean absolute percentage error (MAPE) and smoothed absolute percentage error (SAPE) firm up the feasibility of utilization of four mathematical models proposed to estimate global solar irradiance under the climatic conditions of Ponta Grossa, PR, Brazil (Table 2).

Nevertheless, the first and second models showed the lowest values of MAPE and SAPE, being lesser than 16%, whereas for the 3rd and 4th models such dispersion measures oscillated around 20 to 23%, reinforcing the recommendation of the two first models for radiometric and agrometeorological studies at the studied region.

Table.2: Mean absolute percentage error (MAPE), smoothed absolute percentage error (SAPE), mean error (ME), mean absolute error (MAE), and root mean square error (RMSE) calculated from the comparative analysis between daily global solar irradiance (Q_g) measured by a pyranometer and estimated by four different models under the climatic conditions of the municipality of Ponta Grossa, PR, Brazil.

Models	MAPE	SAPE	EM	MAE	RMSE
	%		MJ m ⁻² day ⁻¹		
1 st	13.64	15.63	0.86	1.58	1.64
2 nd	10.61	9.25	1.06	0.99	1.21
3 rd	22.32	22.22	0.93	3.03	3.56
4 th	22.60	20.17	1.23	3.12	3.27

The confirmation that both first and second global solar irradiance estimation models were those that most reflected reality of radiometric data measured at an automatic weather station installed in Ponta Grossa, PR, Brazil, might be evidenced by the lowest values of mean absolute error (MAE) and root mean square error (RMSE) associated to such models (Table 2).

In general all models employed to estimate Q_g under the climatic conditions of Ponta Grossa, PR, demonstrated a trend to overestimating such environmental variable. The Q_g values of overestimation based on MAE varied from 0.99 MJ m⁻² day⁻¹ for the first model up to 3.12 MJ m⁻² day⁻¹ for the fourth model. Corroborating MAE, calculated values of RMSE also revealed a low error in the estimates of Q_g from the use of models 1 and 2 (Table 2).

Bakirci (2009), using a series of radiometric data for 18 sites of Turkey, calculated different estimation errors from a comparative study between measured and estimated global solar irradiance to determine the best Q_g estimation model. The same author verified that even with models showing the highest coefficients of the Pearson correlation obtained by means of a regression analysis between Q_g measured and estimated values, the statistical parameters that reveal the estimation errors were high, leading to the proposition of adjustment factors to be incorporated into the models for the studied sites.

Determining which model turns out to be the best to calculate Q_g as a function of the estimation errors scupper the utilization of estimation equations indiscriminately and bereft of scientific criteria of selection at a given site. In a study carried out in Tibet, China, Li et al. (2011) confirmed the utilization feasibility of different models designed to estimate global solar irradiance as a function of the calculation of dispersion measures that express the estimation errors and obtained good approximations of Q_g , with errors below 10% under the local climatic conditions.

The best performance revealed in the current study, either for the first or second models, is intimately related to the direct interference of atmospheric cloudiness conditions, expressed by global solar transmittance

determined locally under extreme cloud cover situations from the monitoring of radiometric data collected at weather stations.

Fittings in the Angström-Prescott classical model to estimate Q_g were proposed by Toğrul (2009) by means of the addition of geographical and meteorological data collected at the region of Bishkek, Kyrgyzstan, being able to notice that such a model showed good estimation results of global solar irradiance.

A similar study was developed by Chen and Li (2012) in the northeast of China, by analyzing radiometric data collected from 13 weather stations. The fitting of the Angström-Prescott classical model was obtained from the calibration of the a and b coefficients as a function of variations of the global transmittance at the studied site. Even under the influence of non significant differences among the installation sites of weather stations and estimation methods employed, the aforementioned authors observed that alterations in the empirical coefficients of the regression equation increased accuracy of the Q_g estimation model.

Despite the third Q_g estimation model has demonstrated a performance index lesser than the other models, such a model was to be quick and practical for evaluation of Q_g as a function of only one radiation maximum flux density measured at solar noon, which is irrespective of daily integrations and does not require a large number of radiometric measurements in projects of solar engineering.

IV. CONCLUSIONS

Daily global transmittance was conditioned to atmospheric cloudiness, being amenable to estimate global solar irradiance for sunny days.

The Angström-Prescott classical approach might be used to calculate daily global irradiance with accuracy and exactness in the municipality of Ponta Grossa, PR, Brazil.

Models for which the a and b coefficients were locally obtained as a function of daily mean global transmittance showed estimates more close to radiometric

data measured by pyranometers, being such models therefore more reliable for agrometeorological purposes.

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Sustainable Horticulture: A bibliometric Study

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Abstract— *This paper examines the scientific researches regarding "sustainable horticulture" to identify research flows with potential for future investigation. Through a bibliometric and content analysis for the 2011-2015 periods and the 2016 first semester, 12 articles, according and relevant to the theme, were selected. The results obtained from the analysis demonstrated the importance of the subject for both academic research and for the practice, since it elucidated scientific production and trends, impact factor, relevant scientific periodicals, contribution by countries and its institutions, methods and research tools, keywords. It stands out that the theme "sustainable horticulture" is used in most cases to address only the environmental dimension and, in a few cases, in the economic and social dimensions. Based in the analysis of the keywords, the terms production, systems and sustainability formed the main research clusters, attracting great attention during the study period.*

Keywords— *Sustainability, sustainable horticulture, sustainable agricultural production, bibliometric analysis.*

I. INTRODUCTION

Around three decades ago, the Bruntland Report has defined "sustainable development as a development that meets the needs of today's generations without compromising the ability of future generations to meet their own needs" (WCED, 1987). Since its conception in the late 1980s, sustainability and sustainable development have become popular words, used in various contexts; to become a motto for international aid organizations; a slogan for environmental and development activists; the jargon of State heads; and the theme of academic

conferences and research (Karrazi et al., 2013; Sartori et al., 2014).

People have different ideas about sustainability in different contexts and thus "solutions tend to be sustainable within sectors rather than across society" (Kajikawa, 2008). According Bell and Morse (2008), to understand sustainability it is necessary to recognize and work with units or areas of interest, which we, as observers, are also part. So, this research is directed to horticulture.

Horticulture is an agriculture branch and, therefore, the basic concepts of sustainable agriculture also apply to it (Lal, 2008). However, to achieve sustainable agriculture, observance and balance between the economic, social and environmental dimensions are essential (Elkington, 1994).

Agriculture by itself can be a major villain responsible for environmental degradation, but it is also a key element in mitigating this degradation. It is responsible for the production of the food necessary for human consumption, but traditional methods of production, besides unbalancing ecosystems, still alter the social structures of rural life (Capellesso, Cazella, 2013; Moreira, Carmo, 2004; Neto et al., 2008).

Since the second half of the 20th century, agriculture has been based almost exclusively on economic aspects, with negative effects on natural resources, soil pollution, water and air pollution, and the reduction of biodiversity (Scialabba, Müller-Lindenlauf, 2010). This reflected, years later, in an intense search for a sustainable agricultural production, less harmful to human health that recognizes the social importance of the activity (Stolze, Lampkin, 2009).

Within agriculture, horticulture stands out as an activity of great social importance (Pudup, 2008). This is

corroborated by the strong presence of horticulture in the context of family farming, where several families depend on this type of activity for their survival. It is a crop that needs a small land extension to be economically viable, when compared to other agricultural crops (Castelo Branco, Alcântara, 2011; Faulin, Azevedo, 2003).

In the last decades, there has been an exponential increase in the quest to reduce chemical inputs in horticultural systems, also to prevent the contamination of the waters in subterranean rivers. Governments and horticulturists are constantly seeking alternative means to reduce this type of contamination, given the large number of accidents caused by contamination to ecosystems (Phogat et al., 2014).

In this context, this paper aims to promote a mapping of publications on the theme "sustainable horticulture". The objective is to form a set of articles (Bibliographic Portfolio - Appendix) aligned with the researchers' view on the subject; and establish the most prominent journals, contribution by countries and their institutions, methods/research tools and keywords on this topic. Lastly, directions for future research are presented.

II. MATERIALS AND METHODS

The method chosen for this research was bibliometry. This method, according to Pritchard (1969), is the characteristics study of scientific publications. Quantitative aspects of the production, dissemination and use of the registered information are considered in it. This research modality is applicable in all areas of knowledge. In the agrarian sciences field, this method has been widely used in recent years as in the researches of Castelo Branco and Alcântara (2011); Cousins and McDowell (2012); Dias et al. (2015); Krauskopf (2012); Pautasso (2016); Randolph (2013); Vargas and Vanz (2014).

The used instrument to obtain the data was based on the Knowledge Development Process - Constructivist (Proknow-C), proposed by Ensslin et al. (2010), and used in researches such as Afonso et al. (2011); Rosa et al. (2012) and Loss et al. (2016). This paper emphasizes that the directions were inspired by the two initial stages of Proknow-C. Through these, two roadmaps were developed to conduct the research. It is the "selection of the Bibliographic Portfolio" that will provide the literature review and the "bibliometric analysis of the Bibliographic Portfolio" that will provide the analysis of the results.

2.1 Bibliographic Portfolio Selection

To develop a paper and produce knowledge, the researcher's first step is to review the literature on the subject. The selection of bibliographic references through ProKnow-C is conducted recursively through the following steps: a) definition of scientific articles in databases; B) establishment of a Gross Articles Database,

filtering and selection of the relevant Bibliographic Portfolio and aligned with the researcher's theme (Afonso et al., 2011).

2.2 Gross Articles Selection

Aiming to define the gross articles database, one begins with the axis determination of the research, according to the researcher's perception. In this paper, there are two research areas: Sustainability and Horticulture. The selection of the Gross Articles Database is composed of: a) Definition of the key words: "sustainability" and "horticulture"; "sustainable" and "horticulture"; B) Definition of databases: ISI Web of Knowledge and Science Direct. Regarding the content of these 2 databases, it has to be registered that the keyword combinations were searched, using the title, abstract, topic and keywords. The period of analysis is 5 years (2011 to 2015), also being considered articles of the first half of 2016; C) Survey of the articles in the databases with the keywords: after completing the search of the keywords in the 2 databases, publications were selected to compose the Bibliographic Portfolio called the Gross Articles Bank. Only journal articles were used as the subject of analysis. The searches were conducted in July/2016.

2.3 Gross articles database filtering

In the filtering process of the Gross Articles Database, 105 publications were analyzed regarding the following aspects: a) repeated articles; B) titles of articles aligned to the research theme; C) articles with scientific recognition; D) abstracts aligned to the research theme; and e) full text of articles aligned with the research theme.

The spreadsheet was used to tabulate selected publications in the searched databases. In the redundancy analysis, duplicate articles were removed, leaving 98 articles in the Gross Articles Database.

Analyzing the alignment of the title in relation to the research theme, a large number of articles were detected outside the relationship between sustainability in horticulture and also not available for reading. Consequently, there were 18 non duplicate articles with a title aligned to the research theme, which were submitted to scientific recognition in Google Scholar. Considering the aims of this analysis, scientific recognition of an article is understood to be the number of citations found for the article after checking them at Google Scholar.

Thereafter, the 18 selected articles were analyzed in relation to the alignment of the abstract and later to the full text with the research theme. From the 18 articles, 2 did not have the full text available for reading, and were deleted. The remaining 16 articles had their texts analyzed in their entirety, and then 4 articles were excluded because they were not aligned. The remaining 12 articles were considered relevant and aligned to the

theme and made up the Bibliographic Portfolio of the research (Appendix).

For these Bibliographic Portfolio articles, it is presented the descriptive analysis and characteristics in terms of the selection of the most outstanding articles, periodicals, quoted authors, research methods / tools and the most used keywords in the subject.

In order to map specific research areas, themes or topics, the similarity mapping technique (VOS) by VOSviewer computer program (<http://www.vosviewer.com/>), of Leiden University, Netherlands (Van Eck, Waltman 2007). In order to generate this scientific map, representing by cluster, the articles abstracts and titles of the Bibliographic Portfolio were used.

III. RESULTS AND DISCUSSION

This topic presents the characteristics analysis of the articles that formed the Bibliographic Portfolio aligned to the theme: "Sustainable Horticulture" in terms of the selection of the most prominent journals, quoted authors, research methods/tools, the most used keywords and subjects covered in the surveys.

Bibliometric analysis. The Bibliographic Portfolio bibliometric analysis consists of the statistics survey of the defined set of articles for the management of information and scientific knowledge of the research theme (Ensslin et al., 2012). The bibliometric analysis main objective is to arrive at a set of consistent indicators (Van Raan, 2005). The analysis of the Bibliographic Portfolio was developed in five stages: i) to evaluate the relevance degree of the periodicals; ii) evaluate the scientific recognition of articles; iii) the research institutions origin from the Bibliographic Portfolio; iv) research methods and used tools; and v) evaluate the most commonly used keywords and terms.

Evaluating the relevance degree of periodicals refers to identifying in which journal the largest number of articles among those that compose the Bibliographic Portfolio was published. 10 different journals were found, among them the Journal of Cleaner Production stands out, with 4 published articles (Figure 1).

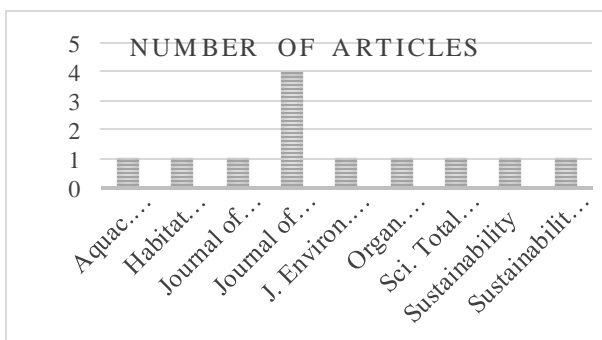


Fig. 1: Number of articles per journal

As a complement to the journals relevance degree, it has been searched the Journal Citations Reports (JCR) index of the journals that formed the Bibliographic Portfolio - BP. The JCR provides a perspective for periodical evaluation and comparison through the accumulation and tabulation of citation counts. It is a globally accepted and respected index. Figure 2 presents the indexes for the year 2015 of the Bibliographic Portfolio – BP journals.

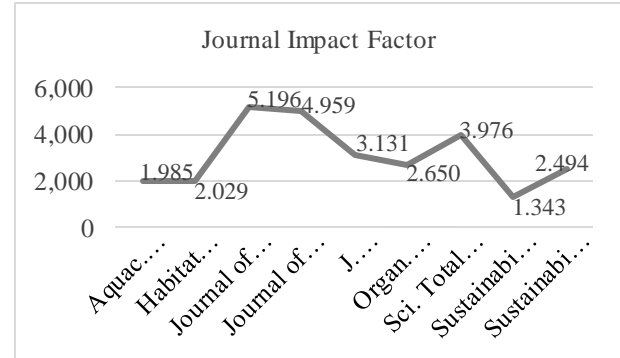


Fig. 2: Journal impact factor – 2015

From the articles in the Bibliographic Portfolio (Appendix), the "Journal of Applied Ecology" is noteworthy, with a 5.198 index, followed by the "Journal of Cleaner Production" with 4.959 and the "Science of the Total Environment" with 3.976, as the three Journals with the highest Bibliographic Portfolio indexes.

As for the scientific recognition degree of the articles that make up the Bibliographic Portfolio (see Appendix), a query was made regarding the citations number of the articles in the Google Scholar databases, according to the surveys of Afonso et al. (2011); Loss et al. (2016) and Sartori et al. (2014). Evaluating the scientific recognition of the articles in the Bibliographic Portfolio (Figure 3), the following articles stand out: Girija Page, Brad Ridoutt and Bill Bellotti "Carbon and water footprint tradeoffs in fresh tomato production" with 81 citations; and "Environmental life cycle assessment of Ethiopian rose cultivation" by Abiy Sahle and Joseph Potting with 28 citations.

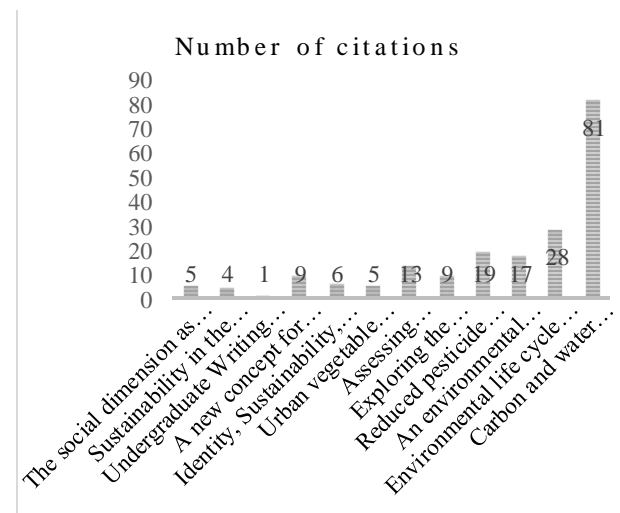


Fig. 3: Number of citations (BP articles)

The following analysis (Figure 4) bring forward the present and cited journals relevance in the bibliographical references of the articles that make up the Bibliographic Portfolio, emphasizing, again, the “Journal of Cleaner Production”, followed by the “International Journal of Life Cycle Assessment”, “Agriculture, Ecosystems and Environment” and “Journal of Environmental Management”.

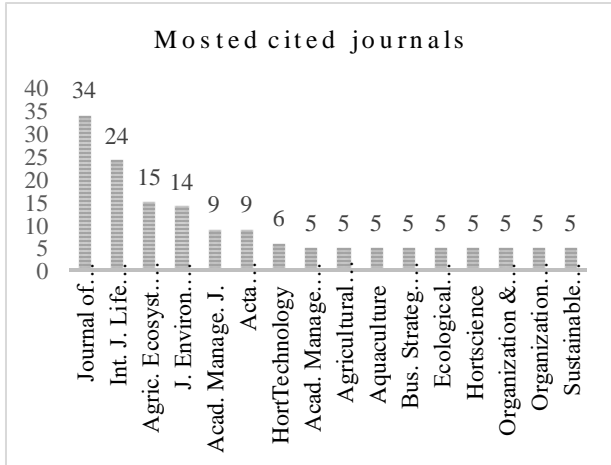


Fig. 4: Number of citations (BP articles)

The most cited authors were mapped in the same way of the journals in the bibliographical references present in the set of articles of the Bibliographic Portfolio - BP. In this sense, 1.254 authors were found, of which 200 authors were cited twice or more. Figure 5 presents the authors with more than six citations, with emphasis on: Assumpció Antón, from the Institute for Research and Technology in Food and Agriculture, Spain; Gabriele L. Beccaro and Giancarlo Bounous, both researchers from the Department of Agriculture, Forestry and Food Science of the University of Turin, Italy; Alessandro K. Cerutti of the Department of Agriculture, Forestry and Food Science, University of Torino, Italy; And Emilio Galdeano-Gomez, Department of Economics and Business, University of Almeria, Spain.



Fig. 5: Most cited authors in the BP references

In terms of the research institutions origin from the Bibliographic Portfolio articles, it can be noted that New Zealand presents with the largest number of institutions, four in total, being Lincoln University, University of Otago, Agricultural Research Group on Sustainability (ARGOS) and Land Care Research, the last aiming to boost innovation in the terrestrial resources and biodiversity management. Australia is also present with two research institutions (University of Western Sydney, Sustainable Agriculture National Research Flagship - CSIRO).

The United States is also present with two institutions (University of Michigan and University of Minnesota). In Europe, five countries are also on the list. Germany with two institutions (Leibniz-Institute of Freshwater Ecology and Inland Fisheries and Humboldt University); Spain also with two (University of Almeria and Institute of Agriculture and Food Research and Technology - Barcelona); Italy with two institutions (University of Turin and Institute for Environment and Sustainability - ISPRA) and, finally, the Netherlands and Sweden respectively with one institution each (Wageningen University; KTH Royal Institute of Technology).

Brazil represented South America with two research institutions on the list: State University of Campinas and the Pontifical Catholic University of Rio de Janeiro. The research institutions origin and percentage on the Bibliographic Portfolio are presented numerically according to table 1.

Table 1: Informations about research centers

Origin of institutions	Number of institutions	Percentage %	Cumulative frequency %
New Zealand	4	22.2	22.2
Australian	2	11.1	31.3
United States	2	11.1	44.4
Germany	2	11.1	55.5
Spain	2	11.1	66.6
Italy	2	11.1	77.7

After analyzing the search methods and tools, the keywords analysis was performed with the VOSviewer program, in which seven clusters were automatically identified. The results are presented and demonstrated graphically through colors in their respective cluster (Figure 6). The most prolific keywords found in these clusters were: Production, System and Sustainability.

Cluster four, for example, has the keyword "Sustainability" and it is connected to words "horticulture", "barrier", among others. In this way, the preponderance of the following keywords was identified:

- Cluster 1 - system (red) is connected to family farm, grower, case study, country, interest;
- Cluster 2 - use (green) is connected to contribution, farm, emission, fertilizer, abiotic depletion, input;
- Cluster 3 - project (blue) is connected to allotment, aim, range and Rio de Janeiro;
- Cluster 4 - sustainability (yellow) is connected to horticulture, number, practice, benefit, barrier, interview, understanding;
- Cluster 5 - productivity (violet) is connected to aquaponic system, tomato unit, water, water use;
- Cluster 6 – production (light blue) is strongly connected to tool; calculator and environmental impact
- Cluster 7 - density (turquoise) is connected to orchard and directed to application.

These keywords found in articles are important because they represent the concepts that authors want to communicate and draw the readers and the scientific community attention. According to Ercan and Cicekli (2007), the keywords are concise representations of a certain text, which allows the reader to identify the relevance of the theme in advance.

In this sense, the following analysis presents the articles distribution of the Bibliographic Portfolio regarding the coverage of the subjects in relation to sustainability. Although the term sustainability is highlighted in the keywords analysis and be the research topic, it was verified in the bibliographic portfolio that 4 articles (33.33%) tried to research the three dimensions of sustainability - environmental, economic and social.

The remaining eight articles (66.66%) assessed sustainability by the lens of the environmental dimension. When dealing with the environmental sustainability dimension, it returns to a condition of equilibrium, resilience and interconnection, which allows society to meet its needs without exceeding the capacity of ecosystems (Morelli, 2011), according to the Bibliographic Portfolio studies described below.

The article by Kloas et al. (2015) assesses greenhouse gas emissions in the agricultural sector, specifically in the

tomatoes and fish production; Torrellas et al. (2013) developed an environmental support tool to determine the environmental impacts of protected crops; the work of Beccaro et al. (2014) assesses the environmental impact of a nursery and also an orchard; Page et al. (2012) evaluated the carbon footprint of tomato production in Australia; Sahle and Potting (2013) conducted a life cycle assessment (LCA) for growing roses in Ethiopia.

Nakajima and Ortega (2015) present the environmental behavior of different horticultural production systems. MacLeod et al. (2012), describe that a complete conversion to an organic system may not be necessary to improve biodiversity in agroecosystems. These authors advocate that the transfer of specific land management practices to benefit biodiversity in organic systems has the potential to increase biodiversity in other more intensively managed systems. Silva and Forbes (2016) assess sustainability in the New Zealand horticulture industry. This research focuses on the producer's views of sustainability, the types of sustainability practices adopted, the benefits of implementing those practices, and the obstacles to implementing additional practices.

Regarding the three dimensions of sustainability, Johnson's research (2012) investigates environmental, economic and social initiatives in United States botanic gardens. Galdeano-Gómez et al. (2016), address in their research the social dimension as an important driver in sustainable development. Social factors in agriculture in southeastern Spain are analyzed, identifying how family farms and their networks can integrate socioeconomic and eco-social issues, promoting the generation of synergies between the dimensions of sustainability.

Anderson and Kelly's (2011) research assess the incorporation of sustainable production into the course syllabus of an existing horticulture course at the University of Minnesota through intensive writing tasks. The objective was to promote understanding of the complex sustainability issue, as to provide students with the knowledge about the specific cultivars development of each country within a sustainable production framework.

Rego (2014) evaluates an urban model of vegetable production based on organic farming techniques. His research involves: (i) production methods from a local supply perspective considering the political feasibility of the project; (ii) the capacity of continuous production in small and medium urban areas using specific techniques of organic cultivation; (iii) the economic and social sustainability of the productive system.

Thus, it is clear that all these researches seek to highlight sustainability in horticulture, aiming at maintaining or improving the natural resources situation within the scope of production restrictions. However, the challenges faced by current and future generations of horticultural

producers remain the same: to seek sustainability by minimizing the effects of past production practices, by identifying more environmentally friendly production methods that foster social and economic empowerment of horticulture dependent communities.

IV. CONCLUSIONS

Sustainable horticulture considers the environmental, social and economic production implications, seeking to use the best and least harmful practices that contribute to the producers and consumers quality of life. In this sense, this study characterized an examination on "sustainable horticulture" research in the 2011-2015 periods and during the first semester of 2016. The number of citations and Impact Factor show that the quality of the examined articles contributes to the scientific academy and to the community at large.

However, most of the articles focus only on the environmental dimension, that is, despite the increased awareness about the conceptual definition and practices of sustainability, there is a lack of applications to monitor and evaluate impacts on horticulture in all dimensions (economic, social and environmental).

Regarding the scientific gaps that can promote and guide future studies, these gaps include the need to expand existing theory, as well as the proposal of sustainability models in horticulture. In this sense, future studies may:

- Address aquaponic systems to achieve sustainability, increase productivity in different production systems and reduce environmental impacts, as highlighted in the study by Kloas et al. (2015);
- Develop a model for the life-cycle assessment (LCA) that includes the economic evaluation of crops, that is, to address the economic and environmental issues together, as presented in the study by Beccaro et al. (2014), Sahle and Potting (2013) and Torrellas et al. (2013). Address the need for inclusion of several types of pollutants, such as pesticides, which are few considered in the footprint or LCA - a gap highlighted in the work of Page et al. (2012);
- Address the different productive sectors and organizations can behave responsibly in relation to the natural environment, which means, there is a need for studies on environmental behavior as highlighted by Johnson (2012);
- Address the lack of knowledge about the benefits of farmers' practice of sustainability is a prominent gap in the research by De Silva and Forbes (2016);
- Consider studies that address the transformations required to fulfill sustainability in relation to

family agriculture compared to industrial agriculture is an important gap identified in the Galdeano-Gómez et al. (2016);

- Suggest solutions for urban vegetable production, involving recovery areas, disused areas, recycling of organic matter, community participation, and in turn, development of tools to control activities to ensure continuous production, social and economic viability (Rego, 2014).

In addition, it is necessary to develop broad research projects in line with governments, companies, universities and other stakeholders. Research on horticulture sustainability is increasing due to the diverse stakeholders, which include the growing demand for pesticide-free food and the reduction of economic, social and environmental impacts. Finally, as limitations of this research, some studies may not have been found in the search process, due to variations in the keywords.

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APPENDIX

BIBLIOGRAPHIC PORTFOLIO – BP

Article's code	Autors/year	Title	Journal
A1	Galdeano-Gómez, E. et al (2016)	The social dimension as a driver of sustainable development: the case of family farms in southeast Spain	Sustainability Science
B2	De Silva, T. A.; Forbes, S. L. (2016)	Sustainability in the New Zealand horticulture industry	Journal of Cleaner Production
C3	Anderson, N. O.; Kelly, J. A (2011)	Undergraduate Writing Promotes Student's Understanding of International Sustainable Development in Horticulture	Sustainability
D4	Kloas, W. et al. (2015)	A new concept for aquaponic systems to improve sustainability, increase productivity, and reduce environmental impacts	Aquac. Environ. Interact.
E5	Johnson, V. (2012)	Identity, Sustainability, and Local Setting at U.S. Botanical Gardens	Organ. Environ.
F6	Rego, L. F. G (2014)	Urban vegetable production for sustainability: The Riortas Project in the city of Rio de Janeiro, Brazil	Habitat International
G7	Beccaro, G. L. et al. (2014)	Assessing environmental impacts of nursery production: methodological issues and results from a case study in Italy	Journal of Cleaner Production
H8	Nakajima, E. S; Ortega, H. (2015)	Exploring the sustainable horticulture productions systems using the emergy assessment to restore the regional sustainability	Journal of Cleaner Production
I9	MacLeod, C. J. et al. (2012)	Reduced pesticide toxicity and increased woody vegetation cover account for enhanced native Bird densities in organic orchards	Journal of Applied Ecology
J10	Torrellas, M. et al. (2013)	An environmental impact calculator for greenhouse production systems	J. Environ. Manage.
K11	Sahle, A.; Potting, J. (2013)	Environmental life cycle assessment of Ethiopian rose cultivation	Sci. Total Environ.
L12	Page, G. et al (2012)	Carbon and water footprint tradeoffs in fresh tomato production	Journal of Cleaner Production

The Effectiveness of Discovery Based Learning Implementation through Improving Students' Innovative thinking Skills in solving Open-Ended Task of Pattern Generalization

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Abstract— *The aim of this study is to know the result of Discovery Based Learning Implementation through Improving Students' innovative thinking skills in solving open-ended task of pattern generalization. The method used in the study is a combination between quantitative and qualitative method called mixed method. Learning model of discovery based learning in the research manages to improve students' innovative thinking skills in solving open-ended task of pattern generalization indicated by the insignificant difference t-test score between the pre-test score of control class and experiment class [$t(48) = -6.897, p > 0.005$]. It results post-test score of control class 71.88 ($SD = 5.944$) and experiment class 83.88 ($SD = 6.110$). Hence, it indicates that both of the average post-test score are significant [$t(48) = -12.00, p < 0.005$]. Discovery Based Learning (DBL) model in this study may improve students' innovative thinking skills to solve open-ended task based on the result of questionnaire and interview. In addition, students are able to observe, to find new patterns and to present what they obtain.*

Keywords— *Discovery Based Learning, Innovative Thinking Skills, Open-Ended, Pattern Generalization.*

I. INTRODUCTION

The development of education in current globalization and technology era demands the students to improve their innovative thinking ability. Innovative thinking ability is one of the demands of 21st century education implemented into curriculum of 2013. It is aimed to prepare youth generation to be able to deal with globalization era. It has four basic skills, namely (1) critical and problem solving skills, (2) collaboration skills, (3) communication skills, and (4) creativity and innovation skills commonly called as 4C's. This is part of

developmental international movement focused on the skills needed by learners to get ready for the success in rapid transformation of digital society.

The concept of learning in this model leads students to have authorities to arrange and to run the learning program as well as carrying evaluation on the program independently. Therefore students do not only have skill, but also it is good way in solving a problem. One of the model which is going to be applied is Discovery Based Learning (DBL) learning model. It is a learning theory interpreted as a kind of learning process which happens if students are not delivered with a lesson in its final form, yet they are expected to organize it by themselves. "Discovery Learning is an inquiry-based approach in which students are given a question to answer, a problem to solve, or a set of observations to explain, and then work in a largely self-directed manner to complete their assigned task and draw appropriate inferences from the outcomes, discovering the desired factual and conceptual knowledge in the process" (Prince et al, 2006:123)

The discovery based learning model places more emphasis on previously unknown findings by providing problems engineered by the teachers, as it has similar principle with inquiry. The problem is not engineering result, therefore students have to exert their skills and thought to get findings in the problem through the research process.

Innovative thinking skills can be defined as students' skills in delivering several possibility answers and solving the problem. To find out the students innovative thinking process, lecturers may give an open-ended mathematic problem to the students. It is based on the Mihajlovic and Dejjic statement that one of the advantages of using open-ended problems is to develop

students' innovative creative thinking. Russeffendi also reveals that in order to encompass the creative people, it is better to use open questions (divergent) called as divergent questions. It demands the interviewees to presume, to hypothesize, to check hypothetically, to review the completion thoroughly and then make decisions.

Number pattern on discrete mathematics based on this image pattern selected by a consideration of task which exist in this sub-subject is open-ended. Either mathematic open-ended questions or problems can lead students to find different answers through different ways (discovery). Pattern generalization material can be used to measure the students' innovative thinking ability. Meanwhile, the research subject is students of Universitas Jember.

As formulation of the problem, the objective of this research is to describe discovery based learning model in solving an open-ended problem toward students' innovative thinking as well as to figure out the students' skills effectiveness which is based on each indicator criteria whether they are able to finish well and correctly or not.

In this research, the control group receives a traditional teaching model (lecture), while the experimental group receives discovery based learning model. Researcher uses pre-test and post-test design and mean scores comparison. Findings obtained by students reveal that discovery based learning model has significant effect on mathematic achievement. In their experimental study, researcher compares the effect of a discovery based learning model with a traditional teaching model (lecture). The aim of this study is to identify discovery based learning model effect in students' mathematic achievement explained as follows: (1) to examine the influence of discovery based learning model in improving students' innovative skills to solve pattern generalization problem, (2) to identify on discovery based learning model in improving innovative skills by performing an open-ended task.

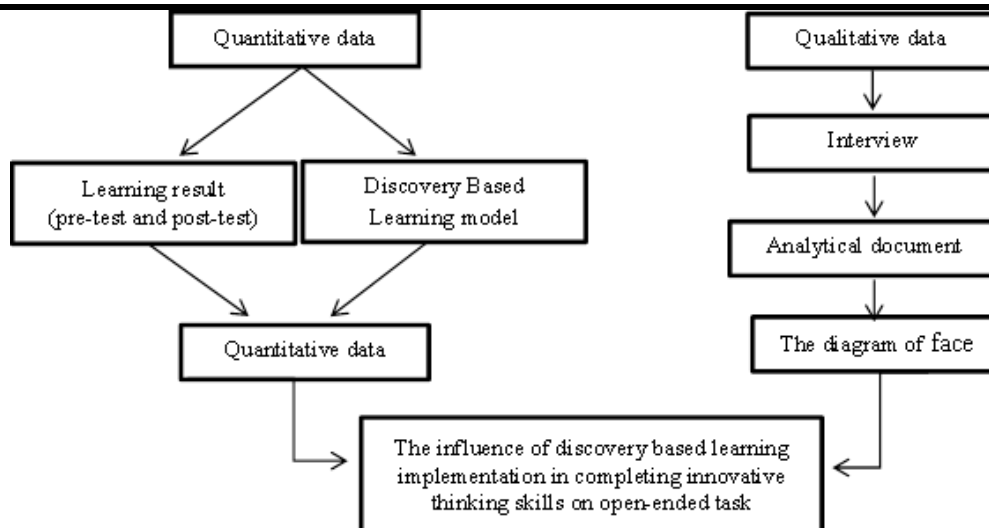
II. METHOD

This research uses quantitative and qualitative research. Quantitative research used in this research is quasi-experimental design, while triangulation method comes from qualitative research. Triangulation method is multi-method conducted by a researcher when collecting

and analysing data. It demands to examine and to analyse students' capability in solving an open-ended problems with qualitative approach, so the researcher tries to collecting the data from lecturers and students. The population in this study are 2 classes of PPG students who take discrete mathematics courses, which is totally 48 students. Sources of this research are discrete mathematics lecturer, validator, and questionnaires. The researcher uses observation, interview, test and documentation as method of data collection, while the research instruments are interview guide, validation sheet, questionnaires sheet, and test result.

There are three stages in this research namely preparation stage, implementation stage, final stage of the research. Preparation stage includes establishing research group and developing LKM, and then implementation stage covers learning process; Research Activity Test (RAT). In this stage, it includes (1) giving main information about materials, (2) showing results of lecturers' research in research group related to material which is going to be used, (3) giving assignments about (a) main research content, (b) research process, (c) analysing process, (d) drawing conclusion, (e) scores of research content (4) collectively drawing conclusions with the lecturer. In addition, researcher get more involved, so lecture becomes a facilitator in the stage. Last stage is to process the data and analyses the data as well as drawing a conclusion.

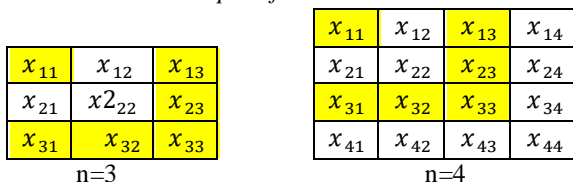
This research is used by measuring result data of students' innovative thinking ability test through research activity test. It shows students' ability in establishing new different pattern for each student, thus every single students has their own pattern. Meanwhile, the results of open-ended LKM afterward are collected and analysed since it is needed to find out the effectiveness of discovery based learning on students' innovative thinking skills based on three indicators as follows: (1) think creatively, (2) work creatively with others, and (3) implement innovation. Whereas analysing quantitative data is conducted by normality test with a technique of one-sample kolmogorov-smirnov. If normality test shows distributed test score is normal, then statistical analysis used is parametric statistical analysis, which uses independent sample t-test technique. Otherwise if it is concluded that the data is not normally distributed, then the statistical analysis used is nonparametric statistical analysis which uses mann-whitney test technique.



III. TASK

In this research, the researcher gives next task to the students related to discrete mathematics namely pattern generalization. Term of pattern in this case is colouring pattern on numerical pattern such as triangle, square, rectangular. The colouring pattern is based on numerical pattern which can be exploited until n-th and can be uncovered the formula, so that any n-th can be counted. A field is defined as exploited pattern among some required colours, but it forms colouring pattern in the field. If it is exploited, the colouring pattern automatically is exploited as well. n is term of -th or order of -th from a numerical pattern

Picture.1: Example of Pattern Generalization



There is a colouring pattern (x_{ij}), so it is gained the yellow function pattern on

$$n = 3 f_{(x_{ij})} = f(x_{11}, x_{13}, x_{23}, x_{31}, x_{32}, x_{33})$$

and white function on

$$n = 3 f_{(x_{ij})} = f(x_{12}, x_{21}, x_{22},)$$

IV. RESULT AND DISCUSSION

The respondent in this research is PPG students of class A and B as many as 48 students, which are divided into 24 students on experimental group in class A and 24 students on control group in class B. This research runs for one month with 4 meetings. First meeting for experimental class, it focuses on observation about students' ability level in pattern generalization (pre-test). Second meeting is to distribute first students' worksheet, third meeting is to distribute second students' worksheet, and the last meeting is post-test. Meantime, to class

control in the first meeting is also an observation toward student's ability level in pattern generalization (pre-test). Second meeting is continued with conventional teaching by delivering initial material such as colouring pattern along with the n-th formula. Third meeting talks about material to build function of colour variation, and the last meeting is post-test.

V. INSTRUMENT

Instruments used in this research are the test of student learning outcomes, students' worksheet, research activity test and interview.

VI. DATA COLLECTION AND DATA ANALYSIS

Control class and experimental class have completed pre-test and post-test, and resulted mathematics score as well as attitude value toward mathematics. The data of students' innovative thinking learning outcomes are analysed using kolmogorov-Smirnov with SPSS version 23 to know whether the data of students' innovative thinking learning outcomes are normal or not. Here are the outcomes of normality test by using kolmogorov- Smirnov test.

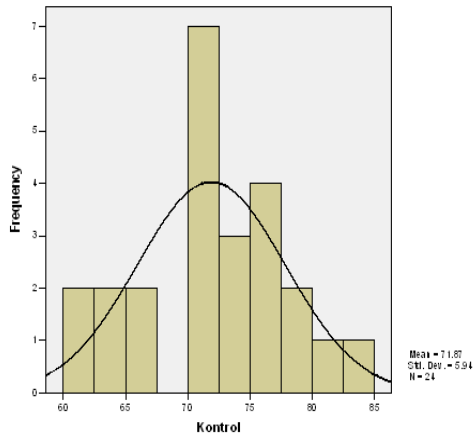
One-Sample Kolmogorov-Smirnov Test

		Kontrol
N		24
Normal Parameters ^{a,b}	Mean	71,88
	Std. Deviation	5,944
Most Extreme Differences	Absolute	,126
	Positive	,099
	Negative	-,126
Kolmogorov-Smirnov Z		,618
Asymp. Sig. (2-tailed)		,839

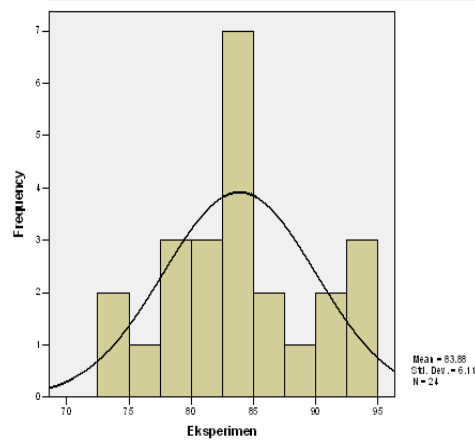
a. Test distribution is Normal.

b. Calculated from data.

According to histogram image below, it appears the data (histogram) following normal curve pattern so that can be concluded the data distribution is normally distributed. It is similar with the kolmogorov- Smirnov statistical test outcome shown at the table 1 that score of sig. in Asymp. Sig. (2-tailed) is 0.839 for control class



and 0.583 for experimental class. Sig. score on experimental class and control class are > 0.05 (level of significant). Therefore, it can be concluded that students' innovative creative thinking learning outcomes on the control and experimental class is normally distributed, so it can be conducted Independent Sample t-test.



VII FINDINGS

The aim of this study as previously explained is to test the effectiveness of discovery based learning model in completing open ended task based on students' innovative skills. Independent Sample T-test is used to analyse pre-test and average score of students' post-test on control and experimental class. It is determined through examining of data normality. The students' learning outcome comes from pre-test and post-test score

for each 48 students. Pre-test has a limitation of 0.05 and it indicates 0.3 for pre-test score. Since the limitation is between -1 and +1, the distribution is normal (Morgan et al, 2001). Second test for normality is divided by standard slope error which must be in negative two and positive two (SPSS, 1999). As it is shown on the table 1, pre-test mean score for control class is 71.88 (Std Deviation = 5.944) and experimental class is 83.88 (Std Deviation = 6.110).

Group Statistics

Kelas		N	Mean	Std. Deviation	Std. Error Mean
Nilai	Kontrol	24	71,88	5,944	1,213
	Eksperimen	24	83,88	6,110	1,247

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Nilai	Equal variances assumed	,001	,977	-6,897	46	,000
	Equal variances not assumed			-6,897	45,965	,000

Independent Samples Test

		t-test for Equality of Means			
		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
				Lower	Upper
Nilai	Equal variances assumed	-12,000	1,740	-15,502	-8,498
	Equal variances not assumed	-12,000	1,740	-15,503	-8,497

Based on the table 4 above, it is clarified that Sig. score is $0.977 > 0.05$ on Levene's test for equality of variances, thus the examination result of students innovative thinking skills is accepted as homogeneous. It

means that to make a decision, it is used equal variances assumed method. In this method, Sig. score (2-tailed) reaches $0.000 < (0.05)$. Hence, since the significance score is less than 0.05, it means H_0 is rejected and H_a is

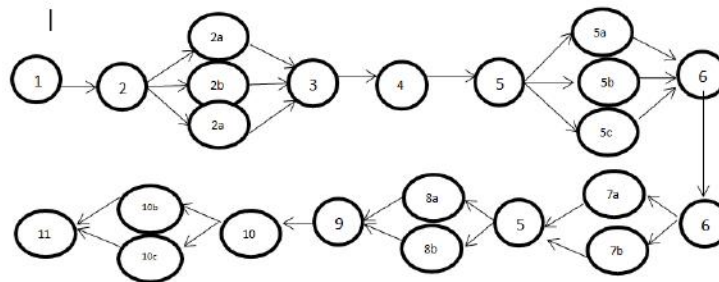
received. If it is connected with decision-making method, the examination result of students innovative thinking skills on experiment class is better than control class. Above quantitative analysis can be concluded that students innovative thinking skills on experiment class is better than control class. This happens because in the experiment class, it is used LKM which is included open-ended method with discovery based learning model, whereas in the control class, it applies LKM which has been prepared by the lecturer.

The data analysis from some sources helps the researcher to comprehend deeply the discovery based learning model. In this study, the researcher identifies some levels of understanding on discovery based learning model which emphasizes on task to find new ideas or concepts and to discover new patterns in a square.

Initial Point	Ending Point	Color
x_{11}	x_{14}	Yellow
x_{21}	x_{23}	White
x_{31}	x_{33}	White
x_{24}	x_{24}	Yellow
x_{34}	x_{34}	Yellow

Initial Point	Ending Point	Color
x_{11}	x_{11}	Yellow
x_{12}	x_{12}	White
x_{21}	x_{22}	White
x_{13}	x_{13}	Yellow
x_{23}	x_{23}	Yellow
x_{31}	x_{33}	Yellow

According to the data taken from discovery based learning model, estimation process of students in solving the problems is started from some steps such as, stimulation, problems statement, data processing, generalization, and then students internalizing the actions to be a process of finding, predicting the patterns, and discovering formula of function from specific coloring pattern determined. Research structure is served in phase diagram as follows.



1	Doing observation	7	Understanding provided patterns
2	Comprehending several generalization toward provided patterns.	7a	How many similar patterns obtained in the area
2a	Understanding the definition	7b	Restrictiveness of expansion in the patterns
2b	Knowing characteristics	8	Searching new coloring patterns from the surroundings
2c	Comprehending the function	8a	Appropriate with numerical pattern
3	Completing coloring pattern	8b	Inappropriate with numerical pattern
4	Observing coloring pattern from some provided patterns	9	Making one specific pattern
5	Finding out coloring pattern as well as numerical pattern shaped from several provided patterns	10	Considering nth-formula and function formula
5a	Determining nth-term	10a	Odd and even formula
5b	Deciding nth-formula	10b	Proving the formula
5c	Considering function formula	10c	Proving through coloring
6	Completing provided patterns	11	Expanding the patterns

1st Subject (High-score students)

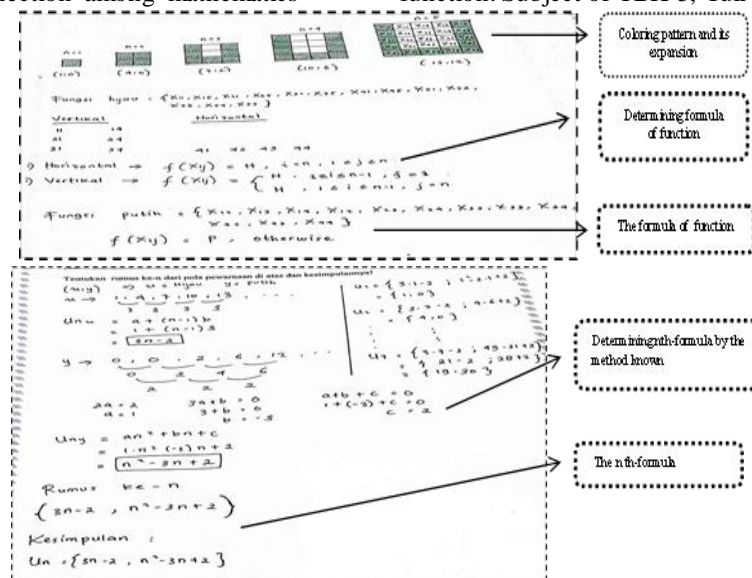
According to innovative indicator (anonymous, 2015:3), students use wide range thinking to create ideas such as, debating, creating something new either good concept or extraordinary concept which is beneficial, collaborating their ideas, completing their ideas, analyzing

their ideas, and evaluating their ideas in order to enhance innovative results. In addition, it also improves, implements, and communicates new ideas to others open-endedly as a response toward something new and different as well as working intensively in a group can give input and feedback as the result. To demonstrate a

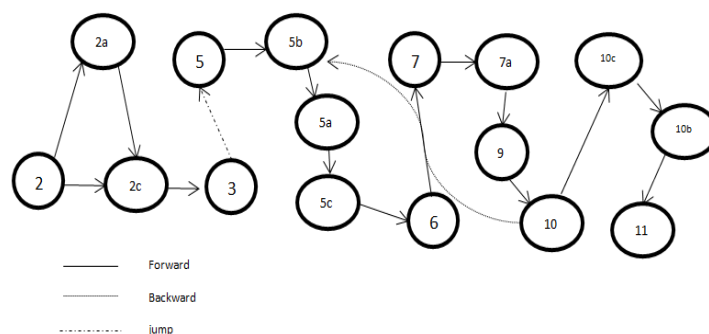
newness is included as a sophisticated work in which it must know the boundaries of its application in adapting new ideas. They can see a failure as an opportunity to learn more and understand that a long-period innovation is cycle process begun from a little success and fault. Working in creative thought to produce obvious and useful creation in a study can make the innovative work happened. By understanding problems to convey the relation among mathematics ideas perceived is to solve 1st and 2nd problem which has used problem-solving strategy. In this stage, students work with some concepts, for instance progression and numerical pattern. The students connect progression and numerical pattern concepts to discover coloring patterns that has not been known in the problems. Next, students are able to operate nth-formula that has been obtained from the patterns. The students succeed to employ the connection among mathematics

ideas involving the concept, nth-formula, and also the formula of function. In the step of making a plan, students apply concept of ordinary numerical pattern to illustrate coloring pattern detected in 1st problem. Besides, high-ability students utilize nth-formula which the operation uses progression to seek the expansion. The relation of mathematical ability that connects to material and everyday life can be identified from 1st problem. High-ability students link problems with everyday life such as aesthetics and patternly uniqueness. Students are able to connect the result with the problems given. High-ability students succeed in solving open-ended problems on generalized pattern material well and using formula and possible changes in the issues.

The result of sustainable LKM 1 and LKM 2 starts from coloring pattern determination to formula of function. Subject of TBK 5, Yuli Fajar Wati N.T.



The diagram of 1st subject phase (high-score students)



2nd Subject (Medium-score students)

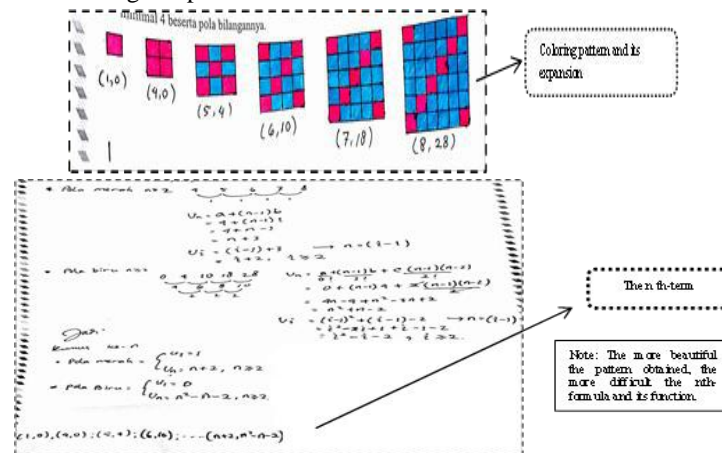
Medium-score students that use the concept of numerical pattern in solving LKM 1 as the step to figure out the problems are considered as the appropriate strategy for problem solving. Students can pour the ideas owned in accordance with problem solving provided in the stage of preparing the plan. However, the medium-

ability students tend to calculate numerical patterns at their first step, and then it is applied to coloring patterns. Thus, students are less accurate in recognizing and applying that have been owned to finalize problems delivered on LKM 1 in the stage of doing students' plan. In this stage, the medium-ability students do not understand the concept of material and cannot link the

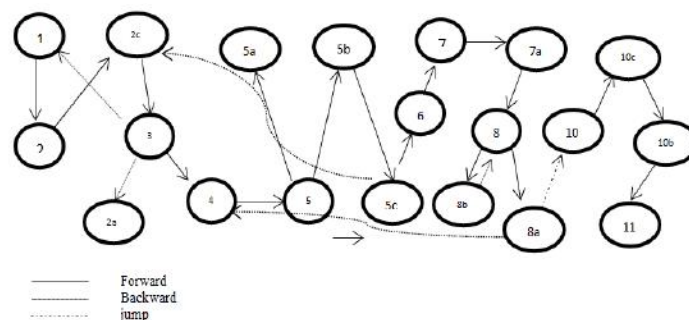
concept contained in LKM 1, so as in finishing LKM 2, they cannot achieved it. The mathematical ability connected between material and everyday life can be known from solving LKM 1. On LKM 2, students seem incapable to complete the problems with right answer and to associate with some problems known previously. Students are good enough in understanding the problems

and making plans, but it still needs to increase thoroughness in implementing the plan.

The result of LKM 1 has apparently developed better, but it has no continuation in LKM 2 as the so-called formula of function. Subject of TBK, Dhika Elvira M.



The diagram of 2nd subject phase (medium-score students)

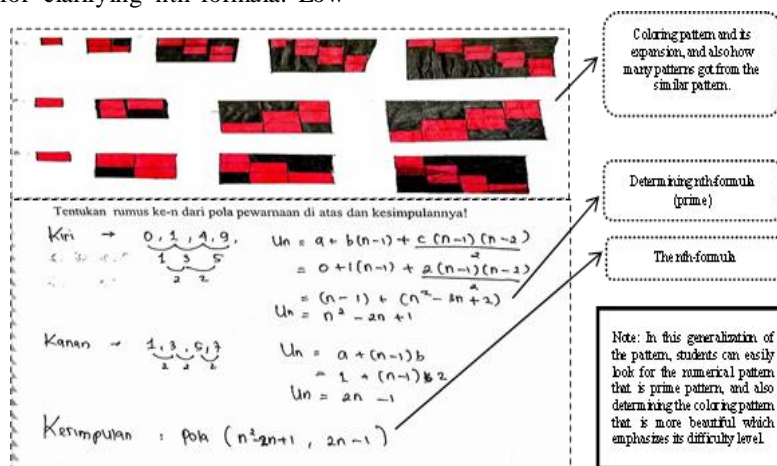


3rd Subject (Low-Ability Students)

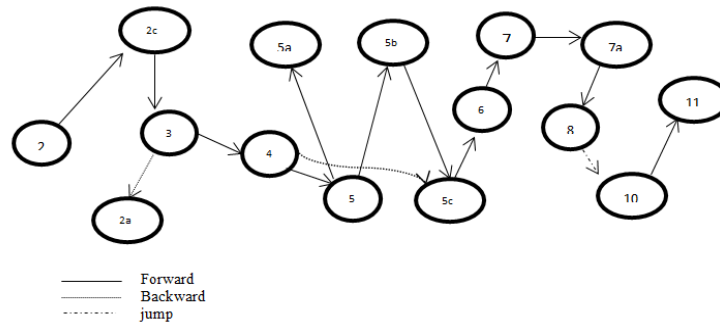
Low-ability students are in the stage of understanding the problems by explaining ideas that are known in connecting the concept and the ideas owned by medium-ability students. These low-ability students are still hard to define the coloring patterns in determining an easy numerical pattern for clarifying nth-formula. Low-

ability students are less creative and innovative therefore they utilize prime pattern which can be easily guessed its nth-formula.

The result of LKM 1 is good, but LKM 2 (the formula of function) cannot be continued. The subject of TBK 2, Frisdianti Krisa Gotama.



The diagram of 3rd subject phase (low-ability students)



To discover students' opinion in this research, the researcher had interviewed and given questionnaire to a student in experimental class. This is one of following results obtained from open-questionnaire to the students:

- 1) What are the applications of staining square arrangement? Please, explain it briefly!

Answer: For the pattern of floor tiles, wall tiles, color on the carpets and clothes, and tiles' color.

- 2) When you color it, describe what strategies do you use so that you can get beautiful arrangement or configurations color!

Answer: I dabble to organize the pattern on tile boxes by combining the thoughtful forms.

- 3) Does the color pattern that you find quite beautiful or complicated? Link this statement whether the more complicated will be the more beautiful color patterns or not.

Answer: I think the patterns found are medium patterns which are not too complicated. I think more complicated patterns are indicated more beautiful as long as the colors are well-designed and the aesthetics includes as subjective matter.

- 4) Will any patterns be always generalizable to the formula? So, what will you do if you do not find the generalization?

Answer: 1) Yes, it will. As each patterns are regular, it can be generalized its formula. 2) Looking for another easier pattern to discover formula's generalization.

- 5) If you find a certain pattern, do you figure out other better patterns, but with high complexity? Which one do you want to choose? Give a reason why you choose particular pattern.

Answer: Yes, I do. I sometimes think the other patterns. I prefer to choose my pattern since I am confident that this pattern is good enough.

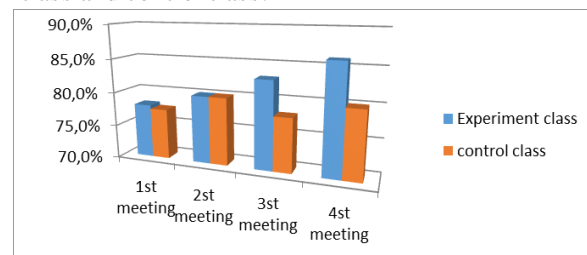
- 6) When you find a pattern after examining carefully, is it possible to find the generalization of formula?

Answer: Yes, it is. I can detect the formula's generalization.

- 7) Do you always color the rectangular arrangement until you see the regularity of the pattern and there is no doubt to exploit it?

Answer: Yes, I do. There is no doubt for me in exploiting it as it has already looked well-ordered and beautiful.

From those responses above, students had been suited with the steps provided and each students can reply with different answers as a demand for completion of open-ended questions in accomplishing the problems of LKM 1 and LKM 2. Nevertheless, there are several students becoming the concern to improve their innovative thinking in solving the problems. As for the recapitulation of students activity shows on experiment class and control class.



VIII. DISCUSSION

This research is held to enhance the students innovative thinking skills and to apply discovery based learning. As the findings of this study, it is clarified that there are some improvements on students to present their interest to study. On pre-test done in control class, there are 7 students reaching medium level and 13 students on high level. In addition, there are 9 students attaining medium level and 18 students on HOTS level in the experiment class as regards to Ming and Manaf's research (2014). After examining the effectivity in applying discovery based learning, The post-test result signifies improvement on control class as it is shown that there are 4 students reaching medium level and 16 students on high level. Besides, there are 4 students on medium level and 18 students on high level in the experiment class. Therefore, the effectivity in applying discovery based learning research has met valid criteria including simple and effective. After examining kolmogorov smimov test, it can be uncovered that Sig. score on Levene's test for equality of variances in the amount of $0,977 > 0,05$. Thus, the result of students innovative thinking skills is claimed

homogeneous so that the decision-making uses equal variances assumed method. In this method, it acquires 0.000. (<0.05) of Sig. score (2-tailed). Because the significance score is less than 0.005, it means that H_0 is rejected and H_a is received, hence the study of students innovative thinking skills with discovery based learning model on experiment class is better than control class.

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Index Set Green Cover Method for Automated Identification of Vegetation

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Abstract— *The objective of this study was to generate a new methodology for the generation of vegetation index by drone cameras for the quantification of green cover area. For this study a drone of the DJI Mavic PRO quadricopter model was used. The flight plan was made using the Drone Deploy application and a total of 56 images were obtained, with a 60% side cover and 70% front cover. The images were processed in the professional Photoscan software version (1.4.2) resulting in mosaic area. The following ICVA equation was applied: $((p_{Green}-p_{Red} / p_{Green} + p_{Red}) * L)$ through the map algebra of ArcGis 10.3. The vegetation index was thus generated, without the need to use satellite images or multispectral data and thus generates a new way of identifying vegetation with the use of drones, Vants and RPAs, being a landmark in the advancement of studies of geotechnologies. The equation used will still be tested in new areas and different situations to show its capacity, and if necessary will be improved according to the observations made.*

Keywords— *Geotechnology, Drone, Mapping, Vegetation.*

I. INTRODUCTION

Aber et al. (2010) presents an extensive history of applications and development using small format photographic images. Ramos and Bueno (2007) present some pioneering projects in the country. Recently, systems based on Remotely Piloted Aircraft have evolved with the development of flight controller boards, some with open hardware and software, such as the APM (APM, 2016) and Pixhawk (MEIER, 2016) boards. This development allowed the appearance of cheap platforms and easy operation. Jorge and Inamasu (2014) present the current state of technology and applications in agriculture.

For the field survey of the soil cover by woody species one of the most used sampling methods is the intersection in lines. In order to do so, it is not necessary to use more than one scale and the estimates for the estimation are simple, and the result is expressed by the percentage of area covered by woody vegetation (MELO et al., 2010).

However, the soil cover presents a great potential to be verified by remote sensing, since the spectral response of the forest cover is a prominent feature in aerial images obtained with diverse sensors.

The information from platforms such as drones, Vants and RPAs have peculiar characteristics in relation to the set of data traditionally used in Remote Sensing for allowing to work in low altitude, generating data of high resolution. Due to the low image acquisition altitude, spatial resolutions can be in the order of magnitude equivalent to a unit of centimeter. At this level of detail, a single flight can generate up to 100 ha depending on time, altitude, speed and flight planning.

The traditional vegetation indexes allow us to generate very precise results when well rectified and adjusted, since most satellites have within their spectral region the ability to work with infrared allowing the generation of IV. Drone cameras are programmed in the region of the visible and factory do not have the ability to perform IV, but there is the ability to purchase cameras specifically for this purpose. In this situation, the need arises to use methodologies for the generation of Vegetation Indices without the need of the infrared region.

In this sense, work like the one of (NEVES et al., 2017) present a proposal of a method to generate a Green Coverage Index (ICV) for application from images of very high resolution. It can be applied to images acquired by ordinary cameras, without the need to use the infrared channel. It uses the color space represented by the hue, saturation and brightness components, referenced in the

literature as HSB or HSV (Hue, Saturation and Brightness / Value) (CHANG et al., 2010). This space easily allows the separation of a certain color (hue), initial step in the proposed method. The features of this index allow you to obtain information on the relative amount of pixels with green tones in an area. A more specific application for agriculture is to accompany the development of a crop from its germination / sprouting, perceiving the failures in planting and problems in its development.

So the objective of this study is to generate a new methodology for the generation of vegetation index by drone cameras for the quantification of green cover area.

II. APPLIED METHODOLOGY

For this study a drone of the DJI model model Mavic PRO (Figure 1) of 12.35 Megapixels was used. This aerial vehicle is equipped with a sensor 1 / 2.3 "CMOS RGB (Red, Green and Blue) has a camera metric type of angular Supergrande format with opening of approximately 88 °. The images were obtained on May 14, 2018 flying at an altitude of 75 m.



Fig.1: Drone Mavic PRO.

Source: (DJI)

A of the most significant advantages of using this equipment for this experiment is that it incorporates in its characteristics concerns related to traditional photogrammetry such as flight stability by inertial sensors and GPS, constant height, information records of the entire route flight scheduling, image georeferencing, and flight planning scheduling ease.

The study area was on the campus of the Para State University (UEPA) campus Paragominas, with coordinates 47° 21' 32 "at 47 ° 21' 33" W longitude and 02 59 '05 "at 02 59' 10 South latitude with an area of approximately 1.6 hectares.

The flight plan was done using the Drone Deploy application and in total 56 images with 88 ° capture angle were obtained, with a 60% lateral cover and 70% frontal cover. The images were processed in the professional Photoscan software version (1.4.2) resulting in mosaic of the area, and later the orthophoto was georeferenced with 15 control points distributed in a way that can control the

limits of the property, this collection was done by transporting coordinates by topography with the use of total station so it was exported in *GeoTiff* format with a resolution of 2.5 cm / pixel.

For the generation of the Adjusted Green Coverage Indices (ICVA) term used in this work, the software ArcMap 10.3 (ESRI) was used that from the orthophoto exported by the photoscan software, the following equation was proposed:

$$\text{ICVA: } \text{PGreen} - \text{PRed} * (\text{L}) \\ \text{PGreen} + \text{PRed}$$

PRed: Reflection of the Red region

PGreen: Reflection of the Green Region

L: Opening the equipment lens

The spectral bands used in the calculation of the index make a relation between the greater absorption of the electromagnetic energy by the active vegetation in the spectral range of red and the greater reflection in the green region. The index varies from -1 to +1, and negative values are associated with greater presence of exposed soil, water and infrastructure (constructions) and positive values for the presence of vegetation. As there was no information available on the Mavic Pro drone sensor, it was not possible to convert the digital number to reflectance. However, the index was calculated directly with this equation bringing satisfactory results.

III. RESULTS AND DISCUSSION

The results of this study were surprising and proved to be effective with the equation used, the work of Neves et al. (2017) who used the green tint to approximate the vegetation cover result, stated in his study that the application shows that the method is not effective to differentiate areas completely occupied by vegetation. This fact, which with this new proposal of equation, can better adjust the vegetation coverage information, but classifying it at successional levels is not yet possible, because the vegetation reflectance is not well differentiated within the drone camera.

The characteristics of this new set of information and the challenges associated to its use, such as deformations and image degradation, can be rectified using techniques and methods available in areas related to Remote Sensing, such as computer vision, in typical problems of stereographic vision, multiple views, Digital Land Models, object reconstruction, among others. This new reality does not represent a threat to orbital SR and airborne by manned vehicles, but rather, it expands its possibilities, being a great challenge the development of new methods and approaches more appropriate to this

dataset. Below in figure 2 and 3 we have the representation of the processes and their due results.



Fig.2: Composition between orthophoto and ICVA.

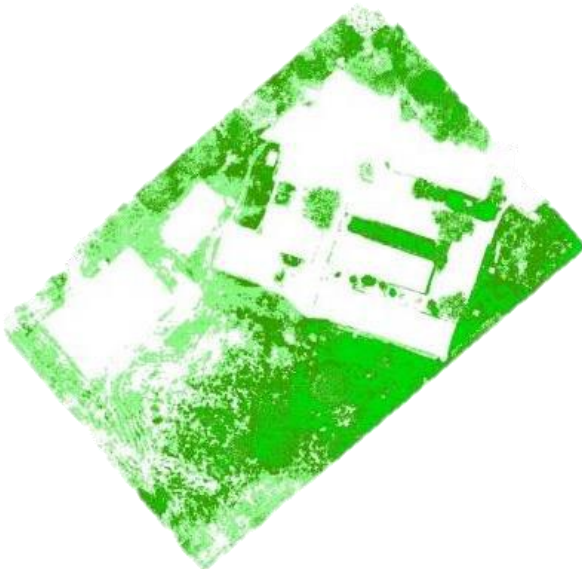


Fig 3: Extraction of vegetation area

In figure 2 we can observe the ICVA overlapping the orthophoto and can make clear its interaction and its prominence where exposed soil and buildings did not generate a confusion matrix, in figure 3 we have the extraction only of the green cover, in this case it is not possible to classify the vegetation in successional states, since we observed that the behavior of the green cover does not take into account the leaf area or the spectral response, but rather the reflectance of the green cover.

We can observe that the methodology of Green NDVI, used by Gitelson et al. 1996, a variant of NDVI, is used to identify different rates of chlorophyll concentration in vegetation, since the green band is more sensitive to detect nutritional levels of a plantation. This index is

widely used at the beginning of the harvest period, where nutritional levels are varied. However, the SAVI index, proposed by Huete (1988), decreases the effect of soil on different densities of the vegetation cover in the soil, that is, it considers the influence of the soil on the vegetation. Considering the use of sensors, several authors found good correlations in the late stages of the plant. Teal et al. (2006) find better correlations between NDVI and productivity at these stages. Clay et al (2006) showed that the recommendation of N based on NDVI collection in the final stages was more accurate than models based only on productivity. In addition, when using the sensors it has the benefit of quantitatively identifying the spatial variability of the culture (MARTIN et al., 2007). Thus, we can observe that some works correspond to the ICVA proposed in this study.

IV. CONCLUSION

This study generated satisfactory results and proved effective in generating the Adjusted Green Coverage Index, without the need to use satellite imagery or multispectral data. Thus this is a new way of identifying vegetation with the use of drones, Vants and RPAs, being an advance of the studies of the geotechnologies.

The equation used will still be tested in new areas and different situations to show its capacity, and if necessary will be improved according to the observations made. The method can be used to generate green cover and identify tree targets.

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Proposal of a virtual collaborative news environment: an interdisciplinary study

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Abstract— *The main objective of this work is to demonstrate the advances made by the CATI research group with regard to the proposal to create a virtual collaborative news environment (AVNC)¹, to be initially implemented at the Northern Fluminense Darcy Ribeiro State University (UENF) through the Postgraduate Program in Cognition and Language. This interdisciplinary environment involves concepts from the area of communication, administration and information technology and seeks to meet the demands of generation, storage, retrieval, processing and transmission of information in this digital age. The AVNC involves three research fronts: rethinking the logic of news production, structuring a platform that is collaborative and defining what a business and management model should be that can give sustainability to this environment. In today's world, it is important to consider the reader's increasingly active participation in journalism, through information and communication technologies, thanks to the social changes that come with them. In times of cyberspace and cyberculture, it is necessary to rethink the dynamics of journalistic production. For this, authors like Pierre Lévy, Lúcia Santaella, Henry Jenkins, Caio Túlio Costa, among others were searched. In an era in which forms of collaborative ownership prevail, the platform being considered in this research follows the 3C collaboration model, according to Michalsky, Mamani, and Gerosa. A global platform where individuals interact, communicate, collaborate and gather information requires a business model and management that assists in*

managing the collaborative virtual news environment. For this, we used authors such as Alex Osterwalder, Eric Flamholtz, Siqueira and Crispim, Campos, among others. With this, an increasingly intelligent and collaborative environment is expected, with the active participation of all the agents involved. That is, what is proposed is the total interaction of the Internet user-reader.

Keywords— *news production; collaboration; business and management model; cyberspace.*

I. INTRODUCTION

The rapid advance of technologies has brought about sudden changes in the most diverse sectors, revolutionizing the way of working, of relating, of having fun, of informing oneself. Analyzing more deeply the area of communications, this scenario, propitiated by the internet, with numerous technological resources and digital social networks, has been changing, in a significant way, the routines of journalistic production and dissemination. The processes are more flexible, faster and more dynamic, which results in greater possibilities of counting, processing and publication, in an increasingly shorter period of time.

And just as it facilitates the production of news, technological progress also facilitates consumption, which has been increasingly interactive and participatory by users, now known as prosumers, interactors, users, among other nomenclatures (ROST, 2014). A new kind of collaborative journalism emerges, in which citizens or groups of citizens actively participate in the process of collecting, reporting, analyzing and disseminating news and information (BOWMAN and WILLIS, 2003) at all times through the internet.

¹ *Ambiente Virtual de Notícias Colaborativo (AVNC).*

All this technological transformation, as well as the revolution in the process of generation, storage, retrieval, processing and transmission of information in this digital age, has impacted the world of business and even more intensely and privately the business of the journalistic industry.

This scenario has required the development of new business models for digital journalism (COSTA, 2014), since the virtual environment leads us to look at the media business in a new way, which requires innovative business that helps to better navigate in this convergent world (OSTERWALDER, 2011; JENKINS, 2009).

This paper aims at demonstrating the advances made by the research center Communication, Administration and Information Technology (CATI)², registered at CNPq by the Postgraduate Program in Cognition and Language of the Northern Fluminense Darcy Ribeiro State University (UENF), which has the proposal of creating a collaborative virtual news environment, abbreviated as AVNC (in Portuguese). This environment is being thought in an interdisciplinary way and involves three fronts of research: rethinking the logic of news production, structuring a platform that is collaborative and defining how should be a business and management model that can give sustainability to this environment.

II. SCENARIO ON THE CONSUMPTION AND PRODUCTION OF NEWS IN BRAZIL

The consumption of news on the Internet is motivated by the increasing access of people to this medium. The Domicílios ICT research, published by the Internet Management Committee in Brazil (CGI)³, has been registering, over the years, a growing trend in the number of Internet users, and in 2016 reached an estimated of 107.9 million individuals. "This number corresponds to 61% of the Brazilian population of 10 years old or more (a proportion that was 34% in 2008)" (CGI, 2017, p. 149).

The same research also reveals that of the total number of internet users in Brazil, 50% say they read newspapers, magazines or online news. That is, almost half of the respondents, out of a total of 67.038.766 households, get informed on the internet.

The reading of newspapers, magazines and news online, consequently, contributes to the decrease of the sales of printed newspapers. Data provided by the Communication Verification Institute (IVC) in the last 10 years reveal that printed newspapers (both single-label

and subscription) are being increasingly used less frequently, while digital newspapers are proliferating in the internet, according to Table 1:

Table.1: Circulation of newspapers in Brazil (2007 to 2016) – by thousands

Year	Printed newspapers (single sale)	Printed newspapers (subscription)	digital news
2007	2.032	2.159	1
2008	2.225	2.277	6
2009	2.151	2.083	7
2010	2.181	2.104	28
2011	2.298	2.126	72
2012	2.273	2.146	164
2013	2.119	1.993	232
2014	1.934	1.549	535
2015	1.602	1.362	680
2016	1.288	1.385	740

Source: Rodrigues (2017).

Analyzing the data above, it can be seen that the last five years (2012 to 2016) were a fall in single sales, accompanied also by the fall in sales by subscription (2013 to 2015), with a small growth in 2016; concomitantly, digital newspapers grew exponentially in this period.

The changes in news production and delivery made possible by the virtual environment are clear. Pierre Lévy (1999) explains that "this new medium [cyberspace] has the vocation to put in synergy and interface all the devices of creation of information, recording, communication and simulation" (LÉVY, 1999, p. 95) and bets that "the perspective of the general digitization of information is likely to make cyberspace the main channel of communication and memory support of humanity from the beginning of the next century" (LÉVY, 1999, p. 95).

For bringing profound changes,

[...] we can not regard it [the Internet] only as a media that has emerged to enable convergence between radio, newspaper and television. The internet is another thing, another truth and consequently another media, very linked to the technology and with unique peculiarities (FERRARI, 2008, p. 45).

The following will address some changes coming from the internet.

III. THE MULTIPLE ROLES OF THE READER IN THIS DIGITAL AGE

The reader/viewer of news has occupied other roles, participating in the agenda (when suggesting a topic

² Comunicação, Administração e Tecnologia da Informação (CATI).

³ Comitê Gestor de Internet no Brasil (CGI).

to be approached in a future journalistic edition), the news itself (when sending photo and/or video about what is being reported), edition (when commenting, criticizing or correcting the news) etc., thanks to information and communication technologies, which allow him to record an event, send it to a newsroom, share it, comment on it, etc..

Digital equipment and the Internet have put into the hands of people with no academic background the necessary tools to carry out this function, while creating the need for collaboration, almost an alchemy, between the crowds who know little and the few who know a lot (CASTILHO e FIALHO, 2009, p. 143).

Barbeiro and Lima (2013) corroborate what Castilho and Fialho affirm, remembering the transformation of the information flow:

The Internet provides a new paradigm, capillarization of the emission and reception of news through [...] technologies used by private or public people or entities, to disseminate content, provoking the sharing of opinions, ideas, experiences and different perspectives (BARBEIRO e LIMA, 2013, p. 35).

There are several terms to define this reader that consumes and also creates content: prosumer, interactor, cyber-readers, user, communicator, interactive reader, among others. Based on Rost (2014), the concept that the most consensus seems to have is that of "users". Rost explains the proposal of Martínez Rodríguez (2005, apud ROST, 2014), which distinguishes "readers users" and "producing users", which makes it clear that not all those who access the network contribute with content.

It is considered important to clarify that this multifunctional reader is "appropriate" today for three primary reasons:

a) The growth of Cyberspace

The growth of cyberspace is guided by three fundamental principles: interconnection, the creation of virtual communities and collective intelligence. The interconnection, worldwide or local, is a basic principle of cyberspace, since its dynamics is dialogical. Virtual communities "are built on affinities of interests, knowledge, projects, in a mutual process of cooperation and exchange" (LÉVY, 1999, p. 127). Collective intelligence can be considered the ultimate goal of cyberspace, since it describes a type of shared intelligence that comes from the collaboration of many individuals in their diversity. "It is an intelligence distributed everywhere, in which all knowledge is in humanity, since

nobody knows everything, but everyone knows something" (LÉVY, 2007, p. 212).

b) Breaking the hegemony of the paradigm of the knowledge fragmentation

Edgar Morin's theory of complex thinking reinforces the need to break with the hegemony of a simplifying paradigm formulated by Descartes, of the fragmentation of knowledge. Morin (2015) defines three principles that can help to think complexity: the dialogic ("allows us to maintain duality within unity" - page 74), organizational recursion ("idea breaking with the linear idea of cause/effect, of product/producer, of structure/superstructure, since everything that is produced turns on what produces it in a self-constitutive, self-organizing and self-producing cycle", and the hologramatic ("one can enrich the knowledge of the parts by the whole and the whole by the parts, in the same knowledge-producing movement" - page 75).

b) People live the Liquid Modernity

The concept of liquid modernity by the sociologist Zygmunt Bauman refers to the set of relations and dynamics that present themselves in our contemporary environment and which differ from those established in what Bauman calls "solid modernity" because of its fluidity and volatility. For Bauman, relationships become, become volatile as the concrete parameters of "classification" dissolve. It is the individualization of the world, in which the subject is now "free" at certain points to be what he can be through his own forces.

In this scenario of cyberculture and breaking of "bins", of watertight positions, it becomes necessary to rethink the dynamics of journalistic production, as proposed by Deuze (2006) with the concept of net journalism:

We must embrace the uncertainty and complexity of emerging ecology of new media, and harness it for what it is: an endless resource for the generation of content and experiences by a growing number of people around the world. Part of what will happen will reproduce the existing power, relationships and inequalities, for sure. However, we are also witnessing an unparalleled degree of human agency and user control in our lived experience of mediated reality. A journalism that will embrace and engage this ecology, will have to become fluid: a fluid journalism (DEUZE, 2006, p. 7).

As the author himself explains, these are forms of collaborative peer-oriented ownership of newsmaking; rich forms of transmedia narrative.

This rethinking encompasses all areas of the journalistic area, including management, and not only the production, distribution and consumption of news, but it is necessary to reflect on a new business and management model for journalistic organizations.

IV. DISRUPTION IN THE NEWS INDUSTRY AND THE NEW ECONOMY

In the last decades, the availability of the personal computer, the popularization of the Internet and the emergence and intensive use of social networks have been decisive disruptive axes for transforming life into society as a whole, for the business world, especially for the journalistic industry.

This same process had already occurred in the past, when the industrial revolution brought with it innovations that completely transformed the business world, such as the use of steel, the invention of the steam locomotive, the use of electric energy and petroleum-derived fuels, invention from engine to explosion, replacement of the intensive use of human labor, development of chemicals, etc.

These disruptive events did not come to optimize the journalistic production activity, but they altered and continue to alter the essence of what to do, transforming this industry completely. Increasingly, it is possible to perceive an acceleration of the occurrence of disruptive events for the journalistic industry, as it can be seen in Figure 1, below:

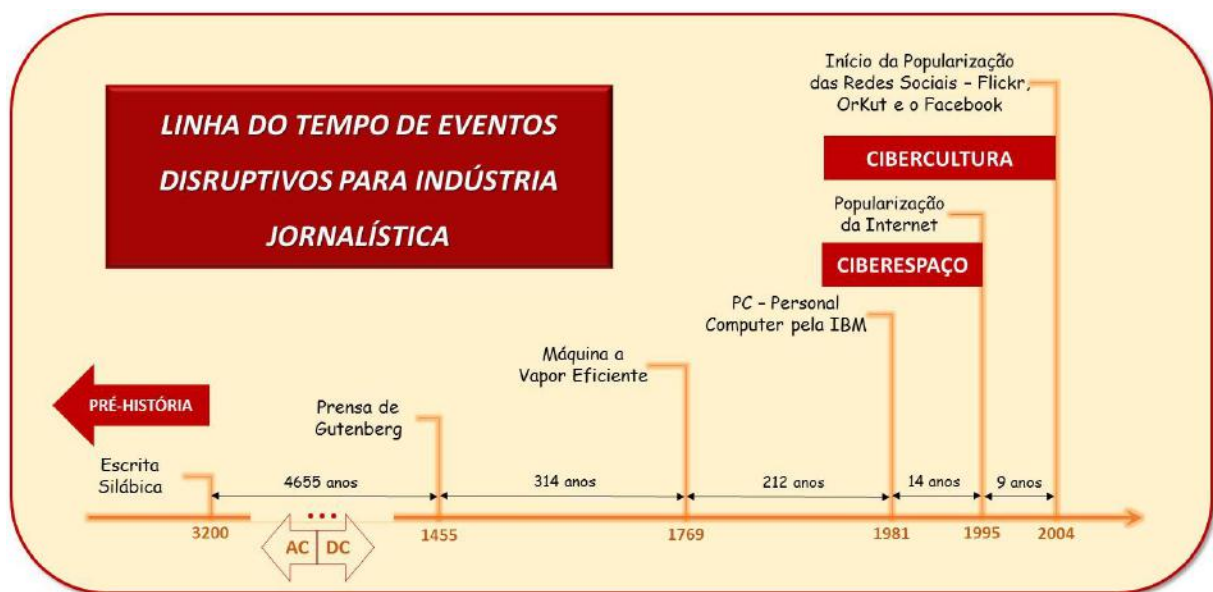


Fig.1: Timeline of disruptive events for the journalistic industry.
Source: Rodrigues (2017).

The newspaper industry took much longer to understand the disruptive momentum it experienced than other industries, such as telecommunications, music or retail, for instance (COSTA, 2014).

The internet and cyberspace have influenced the entire dynamics of the newspaper industry, changing the whole process of printing and distribution of news. The expenses with printing, circulation and distribution of the news practically disappeared and this generated the necessity of a new design of business model in the journalistic industry, as Costa clarifies (2014):

The old way of producing information has changed, the monopolization of distribution, which belonged to an industry called journalistic, no longer belongs. Anyone can now produce and distribute this information. What is happening is a combination of media and communication,

thus giving birth to the overdistribution (COSTA, 2014, p. 11).

The journalist Caio Túlio Costa, in his postdoctoral research at the Columbia University Graduate School of Journalism, argues that journalistic organizations need to transform themselves into technology companies as well, as the new model breathes in with social networks. For him, the issue is not just being on Facebook or Google, it is knowing how to be in each of these networks, in each of the digital platforms, and for this there is technique, that is, it has to be modular for each network; this is over distribution.

Just as cyberspace represented a strong moment of disruption for the journalistic industry, and it was a strategic milestone in changing cost behavior, this new space also allowed for greater interaction between people, deepening social relations and enabling the formation of communities, to which Lévy (1999, p.17) called

cyberculture, that is, "a set of techniques (material and intellectual), practices, attitudes, modes of thought and values that develop along with the growth of cyberspace".

For Santaella (2013, p. 136), cyberspace is a space with its own existence, of a mobile, fluid and liquid nature, where "information circulates in the blink of an eye" and "everything moves in connection", which has given rise to a new form of culture, called cyberculture.

Based on the real-time concept of the internet, where distances do not exist and almost everything is at a click, *new economy* is the new concept of doing business in the digital age, whose value of exchange is information and the favored with the reward is the client.

Also called digital economy, internet economics, or web economics, the term "new economy" can mean "digital networks and communications infrastructures that provide a global platform from which individuals and organizations interact, communicate, collaborate and thrive information" (SIQUEIRA E CRISPIM, 2012, p. 11).

In this context, the phenomena caused by the insertion of the personal computer and the intensive use of the internet and social networks have altered the relations in the journalistic business, as well as the way of measuring the wealth of the organizations of this industry. Iudícibus et al. (2005) point out that constant changes have generated a dynamic and competitive environment, where wealth is no longer focused on physical benefits, but on intellectual capital and intangible assets fb.

Previously, wealth in the journalistic industry was based on the large tangible assets of its industrial park (rotating). However, with the changes brought about by technology, especially digital, these companies have been and are being forced to adapt. Following the proposal of the new economy, journalistic organizations adhered to the use of low-value tangible assets (computers in networks), creating a new way of distributing and circulating information through cyberspace and cyberculture. This change has an intangible asset of extreme potential for generating future benefits, called wealth.

Intangible wealth means the value of a company because of the specific knowledge that it has in relation to a product or process. This recognition of the intangible wealth of a company as a representation of its greater patrimony is a new conception of business, as a result of the advent of the digital era (KAYO, 2002).

In this new digital world, there are many examples of companies with this profile to be cited: Instagram, which was acquired by Facebook for a billion dollars in 2012 with only 13 employees (FERNÁNDEZ, 2017); Snapchat, which declined to offer \$3 billion; and Facebook, which bought Whatsapp for \$19 billion (COSTA, 2014).

Authors such as Kayo (2002), Lev (2001), Stewart (1998) have argued that wealth generation in organizations would be directly related to intangible assets, as these assets would be responsible for higher economic performance and shareholder value generation. In addition, a greater presence of unaccounted intangible assets could explain the gaps between the market value and the equity value of the companies.

Journalistic organizations need to look for new ways to try to survive in the digital environment, because, as Costa (2014) explains: "the old form has been squeezed and the solution begins with the understanding of a new value chain".

For Costa (2014), something was even trying to be done, but based on the old value chain of the news industry:

Its executors only transposed to the digital media the old Gutenbergian form, the same model of the business. First, they published on their websites the very production of journalistic content. Second, they filled this production with advertising (or what was left of it) and, thirdly, the distribution of the product began to be made through the commercialization of digital signatures (COSTA, 2014, p. 54).

Thus, Costa (2014) points out that "the value chain of the news industry in the new era brought by the Internet is radically different from the value chain of the traditional newspaper business." The truth is that the democratization of creation and access to journalistic content is causing the journalistic business to reinvent itself and thus create new business models.

V. CONCEPTUAL BASIS OF A BUSINESS AND MANAGEMENT MODEL FOR A COLLABORATIVE VIRTUAL NEWS ENVIRONMENT

The way companies seek to generate value, also called business model, has undergone numerous transformations, due to the technological disruptions that have occurred in the last decades. For Osterwalder and Pigneur (2011, p.15), the business model shows "the logic of creation, delivery and capture of value by an organization", that is, how to create value for all its stakeholders, be they stakeholders or shareholders. The authors further explain that the business model "is a scheme for the strategy to be implemented through the organizational structures of processes and systems" (OSTERWALDER, 2011, p. 15).

The management model, on the other hand, defines the logical and rational form of the process of transforming the objective into result, by setting priorities

and setting goals, going beyond the numbers, valuing agents and people and providing convergence to business objectives (KUGELMEIER, 2014).

The management model establishes the strategy to be implemented, defined by the top management and based on the attributes of scenarios and markets. For the implementation of this strategy and the scope of competitive advantage, the model uses the organizational structure, mediated by the actions of planning and control of the controllership, which in their measurement models, defines decision support variables, whose objective is to guide the convergence of the business objective and its transformation into competitive advantage.

To be effective, a management model and its control system, focused on achieving economic results, needs much more to motivate people to achieve organizational goals than simply to ensure what is currently occurring. A control system seeks to promote an identity between the objectives of the members of the organization (individuals and groups) and the objectives of the organization as a whole. Complete congruence is hardly attained; thus, the goal of the control system is to increase the degree of Goal Congruence (FLAMHOLTZ, 1979).

Thus, a business and management model for journalistic organizations in the new economy needs to

use Logical Intelligence of Goal Congruence in defining the roles of all agents involved in the business. Through Flamholtz's (1979) approach to the issue of system influence on stakeholder behavior, the main purpose of Goal Congruence is to maximize the likelihood that people are motivated to achieve organizational goals.

It is also considered important that this business and management model use a method of solving problems, which will be adopted here the PDCA cycle, a management tool that promotes the maintenance and continuous improvement of the processes, through a circuit of four actions: **Plan**, **Do**, **Check**, and **Act** (CAMPOS, 1992a).

The PDCA Cycle can be used to maintain and improve the "control guidelines" of a process, from two perspectives: maintenance (viable and sustainable goals) and improvement (the goals are challenging). Through the PDCA cycle it is possible to control whether efforts are actually delivering the expected results.

It is possible to visualize in Figure 2 the main concepts of the business area considered most suitable for the creation of a business and management model that assists in the management of a virtual collaborative news environment.



Fig.2: Concepts used in the business model and management for theAVNC.

Source: Rodrigues (2017).

After enumerating the most appropriate concepts to control this new way of generating value in journalistic organizations of the new economy, in order to make its existence and continuity viable, it is considered important to outline six premises that will be the basis of the business model and management for a virtual collaborative news environment: (a) Logic of creation, delivery and capture of value by the organizational

agents; (b) Increase in tangible and intangible wealth as value; (c) Integration and convergence of agent objectives through Goal Congruence; (d) Management control system through the PDCA cycle; (e) Establishment of a virtuous cycle and (f) Growth through a range improvement cycle.

From the first premise, the agents that form this new journalistic business (reader, publisher, advertiser

and portal) will be defined, as well as the role played by each of them and their relationships, establishing a process of creating, delivering and capture value.

With the second premise, measures will be proposed to measure the performance of all the agents involved, regarding tangible and intangible wealth. Having established the measures of value creation, both tangible and intangible, it is important to dedicate to the respective acknowledgments that will be given to each agent, as a way to provide the movement of convergence of the objectives of all involved, as proposed by the third premise.

The fourth premise provides for a management control system that, through the use of the reasoning method of the PDCA cycle, will establish the necessary adjustments, both through the Maintenance PDCA - maintenance of the operation in the short and medium term - and of the PDCA Improvement - comprehensive growth establishment, perpetuating long-term operation.

In the fifth premise, the central idea is the controlled evolution of the organization, through a virtuous cycle in which, through the efforts of all the agents involved, governed by the logical intelligence of Goal Congruence, we have the intensification of the intangible wealth.

The virtuous cycle would happen as follows: investment in intellectual capital (those intangible benefits that generate value for the company), through an efficient management control system that allows the recognition of agents responsible for this increase in intangible wealth, increased attractiveness of the organization (of the virtual environment of news), bringing in the present not only a greater number of advertisers and clients and growth of scope, but also a greater added value of the offered services, which will materialize in tangible revenue growth that, new investments in intellectual capital, would bring the perpetuity of the cycle.

Finally, through the various cyclical movements of the PDCA in the management of all the activities of the organization, new areas of coverage are being achieved, establishing, therefore, the Cycle of Improvement of scope, with consequent evolution of the organization, being configured the sixth premise.

It is considered important that the model has as its initial focus a locality view for the availability of advertising and ancillary services, serving a specific and qualified target audience. With the valuation of agents that increase the attractiveness of the business, revenues will be increased and this will expand its coverage area.

VI THE VIRTUAL COLLABORATIVE NEWS ENVIRONMENT

Starting from Costa's (2014) thought - that "newspapers need to shake up their way of relating to people and respect the new ways they consume related information and services" (COSTA, 2014, 55). This article proposes the total interaction of the reader-user of the internet, through a Virtual Collaborative News Environment.

In an interdisciplinary way, the implantation of this environment involves three fronts of research: rethinking the production of news in cyberspace (NUNES, 2018, in press); developing a platform based on the 3C collaboration model (OLIVEIRA, 2018, in press); proposing a business model and management that helps in the management of a virtual collaborative news environment (RODRIGUES, 2017).

The core of the collaborative virtual news environment system follows the Wiki software model, which can be analyzed and framed as a collaborative software (PRIMO, 2004, p. 14). Created by Ward Cunningham in 1995, the first Wiki was made available on the web under the name Portland Pattern Repository. Cunningham's proposal was to develop a site that made it possible for users to generate content. Another peculiarity that determined the success of this social software is its type of free use license, which freely allows its copy, redistribution and adaptation to the needs of users' demands.

This type of participatory journalism, also called citizen journalism, collaborative journalism, democratic journalism or even open source journalism, is defined by Bowman and Willis (2003) as "the act of a citizen, or group of citizens, to play an active role in the process of collecting, reporting, analyzing and disseminating news and information" (p. 9).

It is considered important for this proposal to include the Collaboration Model 3C (Communication, Coordination and Cooperation), which has shown to be an advance in the paradigms of development of collaborative environments. According to Ellis, Gibbs and Rein (1991), 3C Model establishes the need for a joint work of experts, which includes social scientists and computer scientists, in order to promote greater integration of individuals with technologies, establishing three dimensions that guide collaboration, which are consolidated in communication, coordination and cooperation.

Thus, "communication is related to the exchange of messages and information between people; coordination is related to the management of people, their activities and resources; and cooperation is the production that takes place in a shared space" (MICHALSKY, MAMANI, GEROSA, 2010, p.1).

Empirically, the 3C model is presented as a in Figure 3:
means to classify collaborative systems, as it can be seen



Fig.3: The diagram of the 3C collaboration model.
Source: Michalsky, Mamani, Gerosa (2010, p. 1).

In contemplating the socio-technical components inherent in cyberculture, the basis for sustaining this environment is revealed in technologies that support the production of static and dynamic content on the Internet, commonly observed in websites, portals, blogs, digital social networks, etc.

The fact that people seek these environments as a source of information presents a change in the media dissemination paradigm, initially monopolized in physical media, which was gradually migrating to the digital medium, being updated according to the infrastructure conditions of hardware and software, constantly evolving technology, merging new electronic devices, their usability, and especially the concept of mobility, affecting behaviors in the producers and consumers of news.

According to Oliveira (2018, in press), the model created to account for a virtual collaborative news environment is based on the essential components of the 3C collaboration model, extending its functionality to two more conceptual elements that segment collaborative work, present in the original model, and converging to a good practice of producing digital content of the news type.

For Oliveira (2018, in press), the model that extends the 3C model and fully meets this proposal is:

[..] the model 3C2I, starting from the communication, where the collaborator-reader begins the collaborative construction of the news. Then, in the coordination phase, the algorithm defines the ordering actions together within the environment, considering: individuals, resources and permissions. The

next step leads to cooperation the demands of sharing the environment, which can start the production cycle again, notifying the collaborating reader who initiated the demand, or advancing to the component that extends the original model, enhancing the interaction between reader-collaborators, with statistical records of his or her ability to produce news (likes, shares, views), his level of participation and blind peer internal evaluation report of submitted news. Concomitantly, this phase guarantees access to the integration of functionalities arranged in the environment, allowing the highest level of readers, assisted by information agents, members of the environment and artificial intelligence, to list the best classified news, being arranged in order of higher precedence, defining whether the object (submitted news) follows for publication or returns to the workflow with a message (communication), detailing each evaluators' opinion, the statistics, the data generated in the artificial intelligence, as well as the deployments of the agents information, which made the final publication of the news impossible (OLIVEIRA, 2018, page 43 [in press]).

The graphical representation of this new model that extends the 3C model, adapting the workflow that contemplates the particularities present in a Virtual Environment of Collaborative News, can be observed in Figure 4 below:

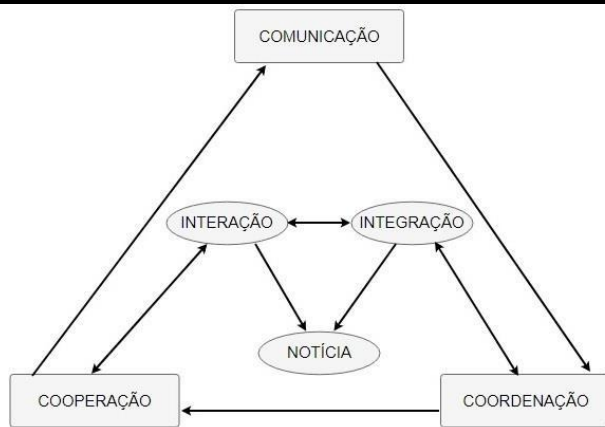


Fig.4: Model 3C2I

Source: Oliveira (2018 [in press]).

The model 3C2I, described above, presents this design to meet the demands of this type of journalistic production. In the proposal of Oliveira (2018, in press):

[...] in the flowchart of the AVNC editorial process, the collaborator-reader submits a news story about the environment and feeds the indexing metadata. Soon after, the AVNC algorithm places the news in the queue of submissions and appoints two evaluators, who assume their curatorship. During the curatorial process, the submission is verified, the evaluation is carried out following the dimensions recommended in the news evaluation form (FAN), it signals the AVNC neural network to

execute a learning algorithm based on probabilistic methods, of type SVM (Support Vector Regression), which performs a linear regression and suggests to the evaluators the most relevant news for future publication. The FAN and the data from the neural network processing are important instances that inform the evaluators in the collaborative curation of news production, interacting with each other and with the author, through the exchange of messages through the environment, and through the panel of control that, according to the permission and level of the individuals, are stimulated to collaborate, for diverse motivations, or only by prestige and reach of relevance between the readers / consumers of the environment. Once the evaluation opinion is favorable to the publication, the news changes from status, "evaluation" to "marked to timeline", enabling it to join the "news timeline" instead of less relevant news, a measure taken instead, a submission undergoes a change in its status, favorable to publication (OLIVEIRA, 2018, p.44 [in press]).

Thus, the 3C2I model materializes in the definition of the operation of the process that begins the production of the news until its publication, and can be better understood in the flowchart shown in Figure 5 below:

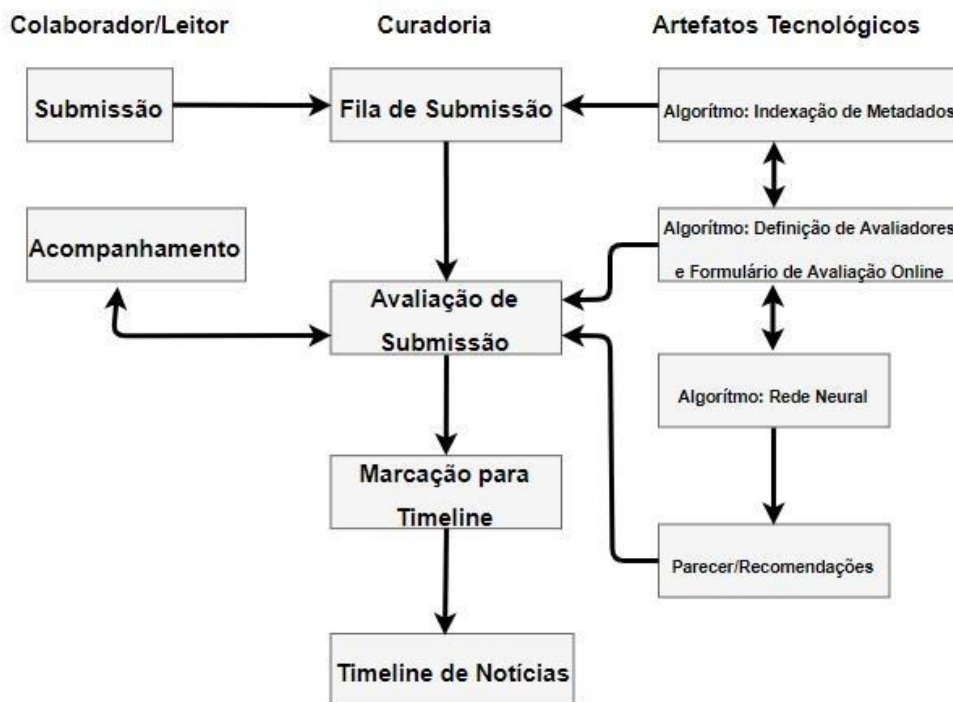


Fig.5: AVNC publishing flowchart.

Source: Oliveira (2018 [in press]).

The graphic representation, through a flowchart, explains in a comprehensive and detailed way the operation of the environment, which aims to be collaborative.

The AVNC will initially cover the academic communities of UENF, UFF and IFF, institutions based in Campos dos Goytacazes, Rio de Janeiro. It should be emphasized that, although initially composed of academic communities, the AVNC will not be limited to academic-scientific news, "for the community", as would be characteristic of community journalism. The restriction will be exclusively for an experimental group in which it is assumed that it already has an openness to innovation and collaboration, since the chosen institutions dedicate themselves to science and research, as well as already have a technical-scientific cooperation relationship between them.

VII. FINAL CONSIDERATIONS

From a brief overview on the production and consumption of news in Brazil, modified in the last years by the internet and the technologies of information and communication, it was verified that people have been informed more and more by the internet and the cultural transformations brought with information and communication technologies allow, in addition to information, readers to contribute with production of content.

In the literature review, concepts that define new social practices, with the advent of technology, were approached, such as the new roles occupied by readers that are no longer mere spectators to become active producers of news and information, which changes the whole dynamics of journalistic production.

Through a timeline of disruptive events for the newspaper industry, it was possible to better understand that technological disruptions have been occurring in an increasingly shorter time span, completely transforming journalistic organizations, which shows the dynamism of this becoming increasingly digital.

Since there is no way to "brake" the dynamics of the production and dissemination of news from the internet and the reader/producer that acts in this environment, it was necessary to think of a business and management model that could help in the management of a virtual environment of collaborative news (AVNC), as the one that intends to create in the State University of the North Fluminense from the researches conducted in the Postgraduation Program of Cognition and Language.

From the selection of concepts of the area of management and business that enabled the control of this new way of generating value in journalistic organizations of the new economy, the business and management model was thought.

At the end, as a possible application of the theories and ideas discussed throughout the article, an idea was presented of the AVNC platform, which will be based on the 3C model of collaboration with the necessary complements necessary to sustain a virtual collaborative news environment in times of cyberspace.

It is believed that because it is a collaborative form of journalistic production in its essence and totality, it tends to have fewer errors; to be more up-to-date and critical, with the monitoring and supervision of the public; and fully interactive. Being able to explore new forms of collaboration, new analysis tools and data sources, and new ways of communicating what is interesting for the public is the most exciting and transformative aspect of the current journalistic scenario (ANDERSON, BELL and SHIRKY, 2013).

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Cold Wire Addition in MAG Welding

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Abstract—This work aims to present a variation of the conventional MAG (Metal Active Gas) welding process, with the addition of a cold wire fed by a slave torch in the molten pool promoted by the electric arc originated from the main wire. Comparisons were made between traditional MAG processes with only one energized wire and the MAG-CW (MAG with addition of a cold wire). The welding parameters used allowed the spray mode of metallic transfer and the stability of the electric arc. As a result, a comparison was made to analyze the deposition rate, profile, width and depth of the bead between the two processes.

Keywords— Welding, MIG / MAG; MAG-CW; Double Wire; Cold wire; Metallic transfer, Slave torch.

I. INTRODUCTION

The MIG / MAG welding process was introduced in 1948. This process of joining materials is one of the most widely used in industrialized countries (Bohme et al, 1996)^[1]. It is a process of fusion welding, which begins with the opening of an electric arc shielded by a gas (GMAW -Gas Metal Arc Welding). (Marques, Modenesi and Bacarense, 2011)^[2]

In order to increase the productivity of welding processes as a whole, the double wire was first applied in 1948 in submerged arc welding. Later, in 1955, this idea expanded to the area of welding with shielding gas. (Michie et al, 1999)^[3]. The variation of the traditional process was known as MAG-CW.

This study has as main point analyzing the increase of the rate of weld deposition maintaining the quality of the bead and improving the penetration profile in the MAG welding with the addition of a cold wire.

II. OBJECTIVE OF THE INVESTIGATION

The main aim of this investigation is to compare the difference in deposition rate between the traditional process and the process with cold wire. Analyze the penetration profile in the two situations and associate it with the convection movement of the liquid metal in the melting pool. Understand and analyze the phenomena of

the electric arc that act in the melting pool when adding a cold non-energized wire. It is possible to increase the welding speed in single bead pass welds or to decrease the number of passes by increasing the volume of the bead.

III. EXPERIMENTAL PROCEDURE

For the tests, it was used a power source, model AristoPower 460 Esab and an OrigoFeed 304N P4™ Feeding Head that was used to feed the non-energized wire.

The bead on plate welding was carried out on a bench designed to provide support and movement of the torch system (energized and non-energized), seeking to move them at controlled and precise speed, as well as fixing the test specimen. The electrical parameters used (current, voltage and welding speed) were determined based on previous experiments and pre-tests with the MAG and MAG-CW welding processes.

The consumables used were the two wires (electrode and cold) and the shielding gas. The AWS 70S-6 electrode consists of a thin wire, with a diameter of 1.6 mm, which is wound on feeder heads and driven to the electrical contact point. (Quites, 2002)^[4]. The negative (-) pole of the power source is connected to the test specimen and the other positive pole to the electrode wire, the arc is established between the consumable wire and the base metal. The electrode, therefore, is both electric arc support and addition metal. The arc heat melts the end of the wire and the surface of the base metal to form the welding pool in the welded joint. The non-energized electrode wire is attached and melts in the heat of the arc and the liquid metal is transferred by spray, towards the base metal, forming the welding pool that is fully protected by the active shielding gas composed of a mixture of CO₂ and Ar. In the spray transfer, the arc is quite stable; there is few spatter (Marques, 2012)^[5]. The gas is externally fed and flows through a concentric nozzle of the welding torch. (Quites, 2002^[4]; Gohr, 2002^[6]). The test specimen is an ASTM-A36 plate with dimensions of 19x140x540 mm.

IV. FIGURES AND TABLES

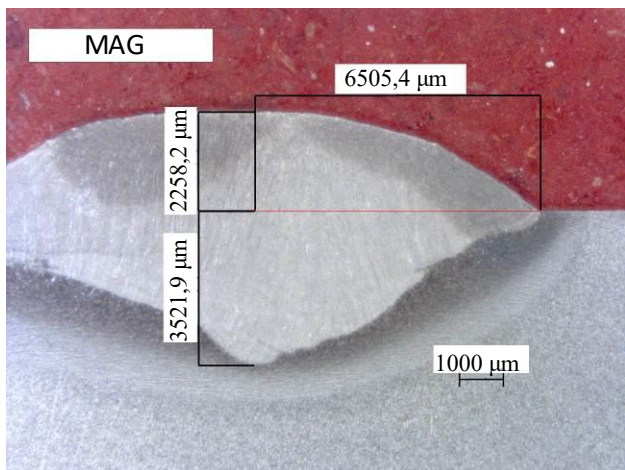


Fig. 1: Weld cord without addition of cold wire in the melt pool

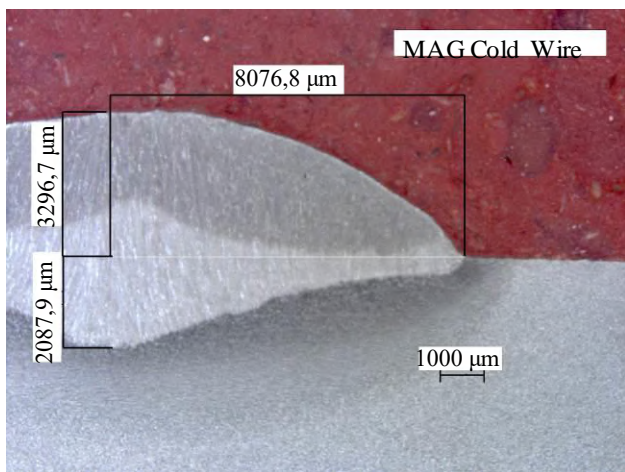


Fig. 2: Weld bead with addition of cold wire in the melting puddle

Tables of results

Process Dimensions	MAG	MAG-CW	Increase rate (%)
Width (μm)	6505,4	8076,8	24,15
Height (μm)	2258,2	3296,7	45,99
Penetration (μm)	3521,9	2087,9	-40,72

V. CONCLUSION

The addition of cold wire to the welding pool in MAG process is possible. As a result, it was found a great increase in the deposition rate by weld bead. Its width and height increased, respectively, 24,15% and 45,99%. The MAG-CW process allows to decrease the power consumption, compared to the process with two energized wires. The penetration decreased 40,72%, due the heat needed to melt the cold wire . The penetration profile of the weld can be change decreasing the welding speed. The stability of the electric arc of the MAG-CW is as

good as the process with double wire.

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Synthesis of Silicon Nitride Ceramic Material using Direct Nitridation Process

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Abstract— Silicon nitride has been widely employed as one of the most important engineering ceramics for many practical applications due to their excellent properties such as high temperature resistance, low density, high corrosion resistance and other mechanical properties. In this study, silicon nitride (Si_3N_4) ceramic materials was synthesized by a direct nitridation method of amorphous silicon powder under a flow mixture of argon and nitrogen or ammonia. The amorphous silicon powder was placed in a tube furnace at the temperature of from 1300°C to 1600°C for 30-800 min under a flow of gases mixture. The phase compositions and morphology of the obtained Si_3N_4 powder were characterized by using X-ray diffractometry (XRD) and SEM techniques, respectively. The $\alpha\text{-Si}_3\text{N}_4$ formed at temperature of 1500°C under a mixed gases flow of 3 L/min for 400 composed of straight rod-like fibers with a length in the range of 5 to 100 μm and diameters of about 0.3-4 μm . The effects of gas flow rate, conversion temperature, reduction time and gas composition on the effectiveness of $\alpha\text{-Si}_3\text{N}_4$ formation were investigated in detail. Effect of the auxiliary gases and synthesizing conditions for direct nitridation of Si_3N_4 on α phase content and phase transformation of $\alpha\text{-Si}_3\text{N}_4$ to $\beta\text{-Si}_3\text{N}_4$ were also evaluated.

Keywords— Silicon nitride, direct nitridation, $\beta\text{-Si}_3\text{N}_4$, $\alpha\text{-Si}_3\text{N}_4$.

I. INTRODUCTION

Silicon nitride have been widely used in many fields of application such as automobile and aerospace industries, high speed air turbine bearing and biotechnology industry, catalyst supports. This ceramic materials could be employed as riser tubes, thermocouple sheaths, crucibles, filters for molten metals, high temperature gas filters, cutting tools, ball bearings and heat engine parts (turbine blades, gas turbines, turbocharger rotors, cam roller, rotor blades, nozzle), etc [1-4].

To date two well-known hexagonal crystal structures of silicon nitride, which are $\alpha\text{-Si}_3\text{N}_4$ and $\beta\text{-Si}_3\text{N}_4$ phases, have been extensively studied. $\alpha\text{-Si}_3\text{N}_4$ with stacking sequence in structure is commonly harder than $\beta\text{-Si}_3\text{N}_4$,

however β -phase is considered to be more stable at high temperature than that of $\alpha\text{-Si}_3\text{N}_4$ [5].

Silicon nitride are commonly fabricated by five main methods such as carbothermal reduction and nitridation (CRN), silicon diimide process, vapor phase reaction process and plasma synthesis or direct nitridation of Si powder. In the carbothermal reaction approach, Si_3N_4 starts forming at 1400°C and phases are transformed from $\alpha\text{-Si}_3\text{N}_4$ to $\beta\text{-Si}_3\text{N}_4$ at temperature of higher than 1600°C [6,7].

Figure 1 shows the crystal structure of silicon nitride, where silicon atoms (black) and nitrogen (green) form hexagonal crystal structures [8].

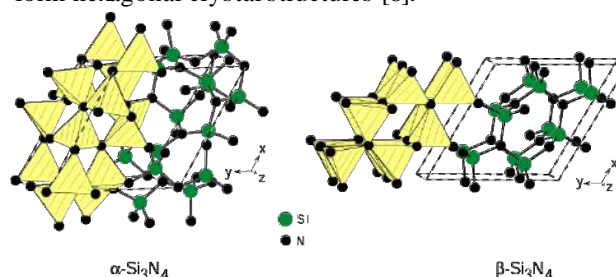


Fig.1: (a) AB layers of Si and N atoms in $\beta\text{-Si}_3\text{N}_4$ (b) CD layers of Si and N atoms in $\alpha\text{-Si}_3\text{N}_4$.

In this study, silicon direct nitridation method was employed to fabricate Si_3N_4 ceramic material by placing Si powder under the gasses mixture of argon and nitrogen or ammonia [9-20]. The effect of the reaction conditions are assessed and optimized.

II. MATERIALS AND METHODS

2.1 Materials

For this study, the starting material is amorphous silicon powder which was received from Sigma-Aldrich, Inc (USA), with ammonia, nitrogen as a nitrogen gas precursor (China Abrasive Import & Export Corp., China, 99%)

2.2 Produce the silicon nitride powder

Si_3N_4 ceramic material was fabricated by using the silicon direct nitridation method. Typically, the amorphous silicon powder was placed into a graphite crucible coated with boro nitride BN with internal diameter of $\phi 100$ mm ,

The nitridation reaction were carried out in a horizontal tube furnace (Gas pressure sintering GPS, FPW 100/150-2200-100-LA, Elatec Inc., USA) under the gases flow rate of 1 to 3 L/min of nitrogen gas (99.99%, China) and ammonia gas with the mixtures gas pressure is raised from 0.2 to 1 MPa.at temperatures ranging from 1300°C to 1600°C for 30 to 800 min The obtained powder were then sintered using a Self-propagating high temperature synthesis SHS system (model 1050, Sumitomo Coal Mining Co., Ltd). Before heating, the furnace was purged with nitrogen or ammonia-argon mixtures to remove the remaining air in the tube. The furnace was then heated at a ramp rate of 10°C/min to 1000°C, and then heating continued at 5°C/min to the final temperature. After reaching temperature, samples were held from 30 to 800 min before cooling. After the sintering process was completed, the furnace was cooled to room temperature with the cooling rate of 20°C/min.

After cooling to room temperature, the substrates were removed from the reactor to determine the amount of Si_3N_4 deposited, and for further characterizations

2.3 Survey on properties of silicon nitride powder

The phase compositions of the silicon nitride powder were determined by X-ray diffraction (XRD; Siemens D500, Germany), using $\text{CuK}\alpha$ radiation ($\lambda=1.5406 \text{ \AA}$) with a step of 0.02° (2θ) and a scanning

rate of 2° min^{-1} . The pattern was collected in the range from 10° to 90° .

The morphology of ceramic materials were investigated by scanning electron microscopy (SEM, FEI-Inspect F, JEOL, Japan). The operating parameters were 20kV for accelerating voltage, beam current 0.5 nA, 50 s life time and beam diameter of 1-2 μm .

The conversion of Si is determined by the formula:

$$C = \frac{Si_o - Si_c}{Si_o} \times 100\%$$

Where, C is the conversion percentage of Si, Si_o is initial amount of Si, Si_c is amount of Si after the reaction.

III. RESULTS AND DISCUSSION

Illustrated in Figure 2 are SEM images of Si_3N_4 ceramic materials prepared with various flow rates. It can be seen from the figure that with the gasses flow rate of 1 L/min, Si_3N_4 (mainly α -phase) is composed of dendritic fibers, while at 2 L/min is mostly composed of curvulate fibers with some anomalous particles. With the flow rate of 3 L/min the Si_3N_4 crystal is composed of straight rod-like fibers with a length in the range of 5 to 100 μm and diameters of about 0.3-4 μm . It is obvious that the completeness of Si_3N_4 crystals increases along with gas flow rates.

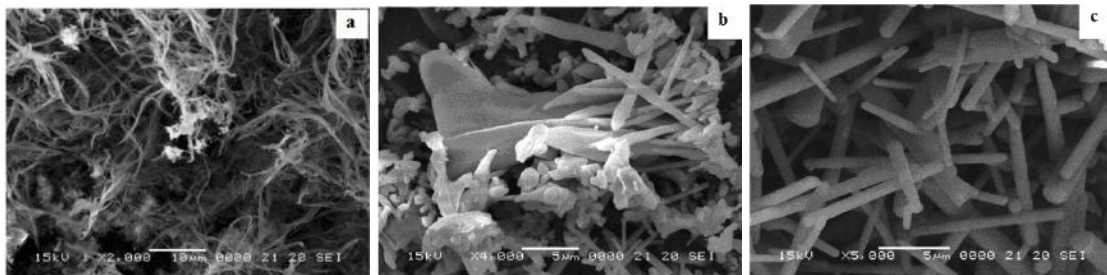


Fig.2: SEM images of Si_3N_4 formed under different flow rates: (a) 1 L/min, (b) 2 L/min, (c) 3 L/min.

The crystalline phase of Si_3N_4 at different reaction temperatures was investigated. The XRD patterns of the samples sintered at different temperatures are shown in Figure 3.

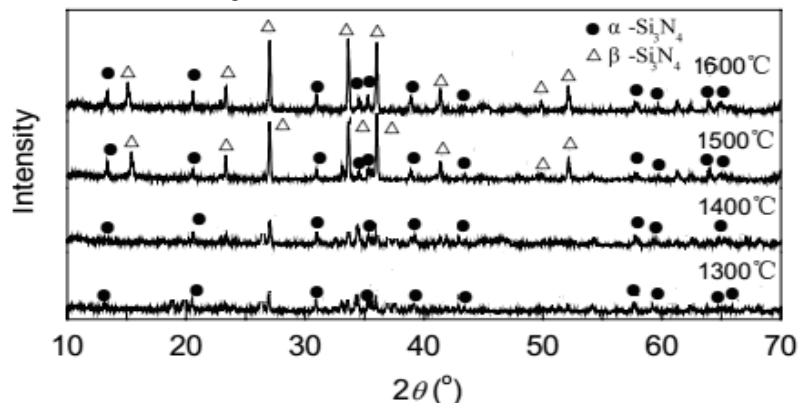


Fig.3: XRD patterns of Si_3N_4 ceramic materials prepared at different temperatures in 75 vol% N_2 -25 vol% Ar mixtures with gas flow rate of 3 L/min and 0.2 MPa

It is obviously that α - Si_3N_4 was evidently detected at 1300°C, however the intensity was relatively weak. The intensity of α - Si_3N_4 peaks increased with increasing temperature. The XRD analysis showed that β - Si_3N_4 appeared at temperature of 1500°C. When the temperature increased to 1600°C, the amount of β - Si_3N_4 increased. Besides, β - Si_3N_4 appeared in the products and became the predominant crystalline phase when the synthesis temperature was above 1500°C. At 1600°C, the peak intensity of β - Si_3N_4 was higher than that obtained at 1500°C, which indicate the highly crystallinity of β - Si_3N_4 at high temperature.

Effect of reaction temperature and time on phase composition and micromorphology of silicon nitride

The effect of temperature and time on nitridation of silicon was investigated at different temperatures (1300°C, 1400°C, 1500°C and 1600°C) for 600 min in the nitrogen-argon mixtures (75 vol% N_2) with gas flow rate 3 L/min at 0.2 MPa. Figure 4 presents the effect of conversion efficiency of Si powder into Si_3N_4 on reaction temperature. It is obvious that the rate of Si nitridation increased when the temperature increase. The conversion of Si was 81 % in efficiency at the temperature of 1300°C. This increased to 85 % at 1400°C, 88 % at 1600°C, and reached the maximum 92 % at 1500°C after 400 min.

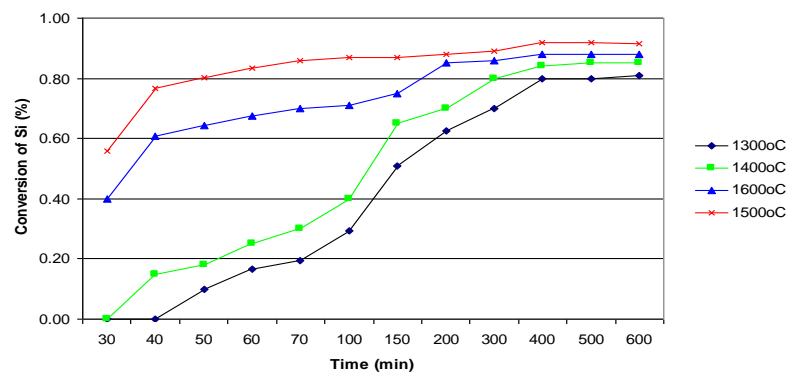


Fig.4: Effect of temperature on conversion of Si in 75 vol% N_2 -25 vol% Ar mixtures at gas flow rate was 3 L/min and 0.2 MPa

We found that the conversion of Si decreased when the temperature increased to 1600°C. This can be explained that at 1600°C, Si can be melted, so the Si surface is covered which decrease contact between Si and N_2 particles.

Effect of operating gas flow rates on nitridation of silicon

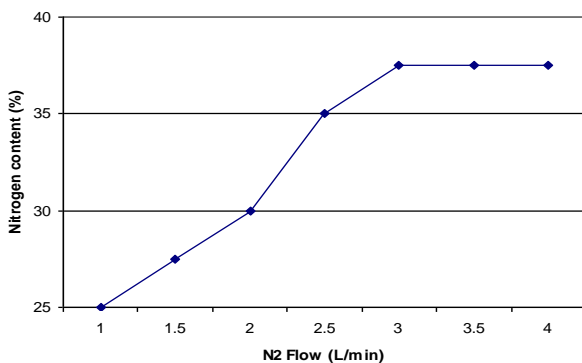


Fig.5: Effect of N_2 flow on nitrogen content of Si_3N_4 powders in 75 vol% N_2 -25 vol% Ar mixtures at 1300°C and 400 min.

The effect of operating gas flow rates was investigated at flow rates from 1 L/min to 4 L/min for 400 min in the nitrogen-argon mixtures (75 vol% N_2) at 1300°C. Figure 5 shows the effect of N_2 flow on nitrogen content of prepared Si_3N_4 materials. The nitrogen content of Si_3N_4 powder increased along with the increase of N_2 flow and reach a maximal of 37.5% at the flow rate of 3 L/min. When the flow rate was further increase, the content of nitrogen was almost unchanged.

Effect of ammonia and nitrogen on nitridation of silicon

The effect of ammonia and nitrogen on nitridation of silicon was investigated at different nitrogen or ammonia concentration in the mixtures with argon at temperature of 1400°C, gas flow rate 3 L/min and reaction time of 400 min (Figure 6). The figure indicates that the rate of Si nitridation increased with increasing nitrogen or ammonia concentration from 35 vol% to 95 vol%. Fig. 6a shows the rate of Si conversion under the flow of N_2 – Ar gasses mixture. The rate of Si nitridation reached the maximum of 92 % with the mixture ratio of 95 vol% N_2 – 5 vol% Ar after 400 min of reaction time. The maximum Si conversion of 92% also is reached after reaction time of

450 min, 500 min and 600 min for the mixture ratio of in 75 vol% N₂ – 25 vol% Ar, 55 vol% N₂ – 45 vol% Ar, 35 vol% N₂ – 65 vol% Ar, respectively. After the rate of Si nitridation was unchanged when time further increased. The rate of Si conversion under the flow of NH₃ – Ar mixture are shown in Figure 6b. After 350 min

reaction, Si conversion was increased from 36% in 35 vol% NH₃ – 65 vol% Ar to 47% in 55 vol% NH₃ – 45 vol% Ar, 86% in 75 vol% NH₃ – 25 vol% Ar and reached the maximum of 92 % in 95 vol% NH₃ – 5 vol% Ar mixture.

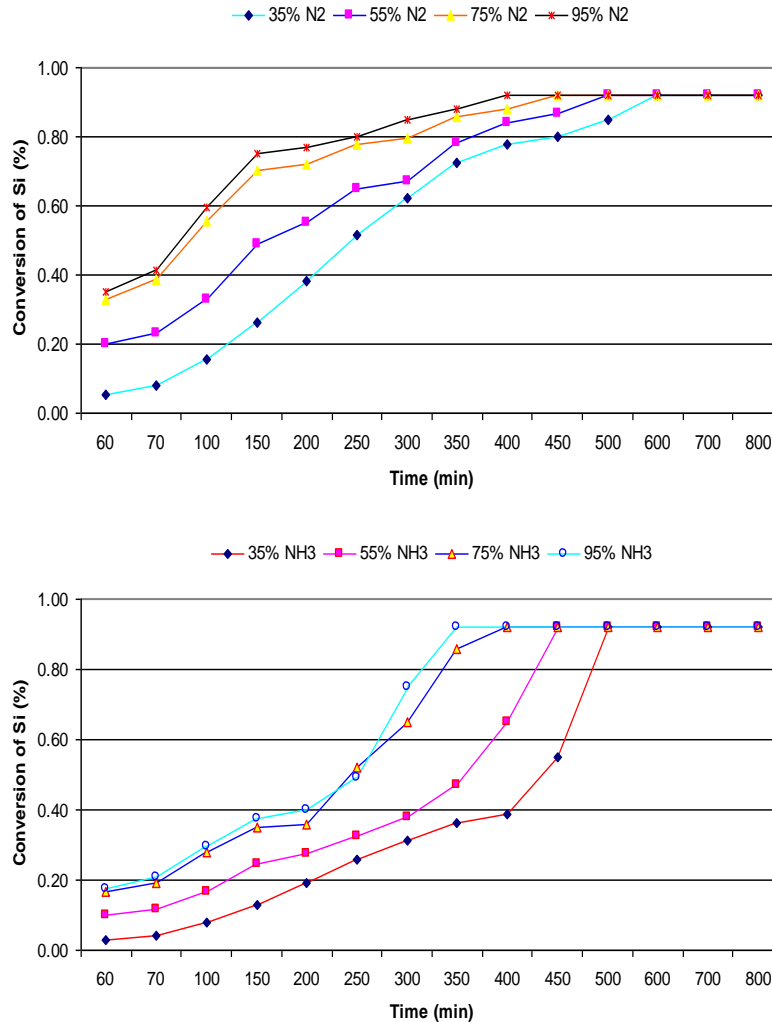


Fig.6: Effect of ammonia and nitrogen on nitridation of silicon at gas flow rate 3 L/min, 400 min and 1400°C: (a) N₂ - Ar; (b) NH₃ - Ar.

It can be found that the effectiveness of Si nitridation in 75 vol% N₂ – 25 vol% Ar is similar to the rate of Si nitridation in 95 vol% N₂ – 5 vol% Ar. Therefore, the Si nitridation in 75 vol% N₂ – 25 vol% Ar mixture instead of the Si nitridation in 95 vol% N₂ – 5 vol% Ar mixture is selected as optimized N₂ - A mixture ratio. Furthermore, the rate of Si nitridation in 75 vol% NH₃ – 25 vol% Ar is same as the rate of Si nitridation in 95 vol% NH₃ – 5 vol% Ar. As a result, for NH₃ - Ar mixture the optimized ratio is 75 vol% NH₃ – 25 vol% Ar mixture

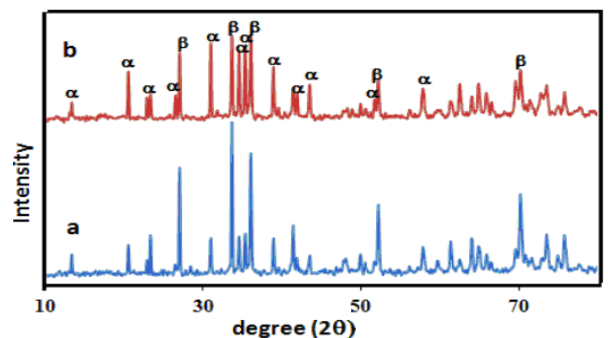


Fig.7: XRD patterns of samples after nitridation at (a) N₂-Ar; (b) NH₃-Ar.

In the first stage, the conversion of Si in the NH₃-Ar mixture is lower than the conversion of Si in the N₂-Ar mixture. This can be explained that the molar of N₂ is double in comparison with NH₃. However, the reaction between Si and NH₃ may be easier than the reaction between Si and N₂.

Figure 7 illustrates the XRD pattern of the samples after nitridation by using N₂-Ar and NH₃-Ar mixtures. It is obvious that with N₂-Ar mixture, the obtained ceramic was mainly β-Si₃N₄ some traces of α-Si₃N₄. While with NH₃-Ar mixture α-Si₃N₄ is dominant phase in the ceramic materials.

IV. CONCLUSIONS

In short, silicon nitride (Si₃N₄) ceramic materials was successfully fabricated by a direct nitridation method. In the resultant ceramic materials, although β-Si₃N₄ was detected, but α-Si₃N₄ was the main phase of silicon nitride. Si₃N₄ ceramic materials can be obtained from amorphous silicon powder annealed at 1500°C under 75 vol% N₂ – 25 vol% Ar or 75 vol% NH₃ – 25 vol% Ar mixture at gas flow rate was 3 L/min for 400 min. The conversion of Si was 81 % in nitridation at 1300°C. It increased to 85 % at 1400°C, 88 % at 1600°C, and reached the maximum 92 % at 1500°C after 400 min. Percentages of α-Si₃N₄ content obtained with ammonia and argon is higher than those with nitrogen and argon. α-Si₃N₄ was detected at temperature of 1300°C, but the intensity was very weak. β-Si₃N₄ became apparent at the temperature of 1500°C. When the temperature increased to 1600°C, the amount of β-Si₃N₄ increased. Besides, β-Si₃N₄ appeared in the products and became the predominant crystalline phase when the synthesis temperature was above 1500°C. The nitrogen content of Si₃N₄ powder increased with the increase of N₂ flow and reached the maximum when the N₂ flow was 3L/ min.

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Use, Prescription and Dispensing of Drugs to Elderly Patients with Systemic Arterial Hypertension (SAH) and Diabetes *Mellitus* (DM) in the City of Amazônia, Brazil

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Abstract— Objective: To analyze the therapeutic process of hypertensive and diabetic elderly assisted in Hiperdia program UBS city of Ariquemes, Rondônia, Brazil. **Method:** The research model was a quantitative study, cross, which was used pre-structured form. The sample consisted of 196 patients with hypertension and / or diabetes between 60 and 92 years. **Results:** Predominantly female 66.9%, a consumption of 5.40 per

individual medications, and frequent self-medication few physiological parameters described in the charts. Overweight and obesity prevalence in the elderly 78.9%, 67.5% with systolic blood pressure above 140 mmHg and 79.3% with greater than 125 mg glucose / dL. Statistical tests observing pool was applied between the amount of medication and self-medication ($p = 0.001$) correlation with significance between age and systolic

blood pressure ($p = 0.003$) and body mass and age index ($p = 0.018$) was observed association between income and acquisition of medication or correlation between age and glucose values. Of the research subjects, 44% reported problems with the drug that can lead to lack of adherence to treatment, and future complications. **Conclusions:** 1059 drugs were used. 76% of patients acquire medication in at least 02 different sites may favor the therapeutic duplication. Among the most cited DRPs are stomach problems and discomfort, 17.4% have difficulty in recognizing, 15.1% are not taking the drug due to adverse accustomed and 69.4% use at least one self-medication. In the classification of physiological parameters was observed lack of data in the records, and 79.3% had blood glucose levels > 125 mg / dL and 67.5% with SBP > 140 mmHg, it was also observed association between the amount of medication and self-medication and correlation between age and SBP and BMI and age.

Keywords— *Drugs. Arterial Hypertension. Diabetes. Dispensation. Elderly Patients.*

I. INTRODUCTION

The current medicine seeks innovative and humane proposals in the healing process in the field of health education, assistance and policies aimed at promoting health. The importance of observation and individuality of human treatment is becoming more popular, since health involves biological, psychological, social and environmental, as well as habits and lifestyles, promotion and prevention suggest actions aimed at enhancing the patient as the primary contributor of healing itself. (Teixeira, 2007).

Improving the quality of life, technological advances, drugs and people's access to health systems in recent years have provided a significant increase in life expectancy. Population aging is a global phenomenon and in Brazil it is believed that by 2025 the elderly population will reach 34 million, causing an increase in demand and use of health services and medicines. (ZAMPARETTI; LUCIANO; GALLATE, 2008).

This group of patients is constantly the target of acute or chronic diseases, which leads to the use of several medications at the same time, causing the emergence of Drug Related Problems (DRPs) can cause non-adherence to treatment or inefficiency of the same. The very old body can favor the appearance of unwanted effects, or the failure to obtain therapeutic results, due to the reduction of several physiological mechanisms, including highlight the impaired renal and hepatic function. (CARVALHO, 2010).

Pharmaceutical care is considered worldwide as one of the basic elements of primary health care in getting the maximum benefits with minimal risk to the patient. Thus, we value the well-being of the same, generating

information on the correct use of medicines, implementing a pharmaceutical care service, where the pharmacist how knowledgeable drugs plays a fundamental role, since currently, the medication is being treated as a simple commodity where the irrational use may bring serious consequences to the individual or collective health. (Araujo *et al.*, 2008).

The elderly users of medicines to pharmaceutical care, being a practice developed in the context of pharmaceutical care, aims to provide individual or collective action in order to obtain a better quality of life. However, not intended to intervene in the diagnosis or prescription, which is doctor's competence, but rather to ensure that the patient has an efficient and safe pharmacotherapy avoiding future complications and lower the cost of treatment. (Meneses, SA, 2010).

Given that the DRP can lead to non-adherence to treatment and consequently to serious complications for the patient (resulting from chronic diseases that affect this age group) is a pharmacotherapeutic monitoring can identify early cases where the pharmacological treatment is not efficient, and thus facilitate the use of the medication by the patient, ensuring proper dispensing and patient care that makes use of polipharmacies.

II. THEORETICAL FOUNDATION

2.1 Primary care directed care of the elderly

The Basic Health Units (BHU) are the gateway to all the local health system, where primary needs must be met by approximately 80%.

For this to happen healthcare professionals should be able to care and provide services where access and the host are suitable for the population served. The increase in the elderly population has been a major challenge for public health. (PICCINI *et al.*, 2006).

The new care model that proposes the Unified Health System (SUS) considers the principle of completeness, where the user is the system of the protagonist. It requires reformulation of care with practices aimed at closer relations between attendant and user, creating bond with the patient, which is not enough to have access to the service, but should allow the achievement of better results. It emphasizes the importance of qualifying this access in order to ensure that these people can be met by the health service, decentralizing the doctor to a multidisciplinary team, enhancing the quality of assistance aimed not only to meet, more listening and dialogue, be able to make decisions and guide or even intervene in accordance with the reality of the region or the patient. (Souza *et al.* 2008).

A major problem for the SUS implementation is related to the qualification of human resources, this area we must turn to a quality service with more humane techniques related to technological advances. Best results are

achieved in places where the service organization and the skills of professionals reflect on solving health problems, contemplating the universality guidelines, integrity and fairness, where the host can be used as the health system strategy, able to enlarge positive results, favoring the user, relieving the public system for a better result in the curing process. (Carvalho *et al.*, 2008).

2.2 Elderly patient and the aging process

In order that aging is a dynamic and progressive process, according to the World Health Organization (WHO), by 2025 Brazil will have the sixth largest elderly population in the world, meaning 13% of the population. This increase exponentially elderly reflects an increased demand for health services that alert you need to better understand the physiology of aging and understand the psychological, social and metabolic elderly as a resource for the prevention of diseases affecting this group of the population. (RIBEIRO; ALVES; MEIRA, 2009).

The aging process involves morphological, physiological, biochemical and psychological changes that favor the development of many pathologies. It is known that in a pharmacological treatment and compromise its effectiveness can result in unwanted reactions, hindering the healing process, the quality of life of the elderly. Public policies in the health field have been developing actions aiming to better care for this population, but the demand for health services impossible better attention, even a certain carelessness or negligence, due to misinformation or lack of preparation of health professionals for not knowing the natural aging changes. (SILVA; Fossatti; PORTELLA, 2007).

Among the changes that occur with the elderly, we can highlight the skin changes, musculoskeletal disorders that cause pain hampering their mobility, loss of bone density that deserves preventive care health teams, which when combined with limited mobility can lead to fractures falls; cognitive impairment even in mild cases, which can hinder basic functions of everyday life and social of the elderly, as well as sensory changes such as vision, hearing and smell that compromise the integration and interaction of the elderly with the environment. (RIBEIRO; ALVES; MEIRA, 2009).

From the pharmacological point the concern is for pharmacokinetic and pharmacodynamic changes that interfere with the action of drugs causing danger to the elderly patient, either by the action of the drug increased as not to obtain desired results, leaving unprotected elderly. Modifications those that occur due to the decline in muscle mass and the amount of body fluids causing a decrease in the volume delivered, the first passage of drug metabolism caused by hepatic impairment, as well as the decrease in filtration capacity and renal excretion, hindering elimination of metabolites, leading

to accumulation of toxic substances to the human body. (Rocha *et al.*, 2008).

2.3. Pharmaceutical care as an educational service in the therapeutic process

Pharmaceutical care was considered by the National Congress of Pharmaceutical Care and Drug Policy, occurred in Brazil in 1988 as a very broad set of procedures which should ensure access and proper use of medications, encompassing from research, production, storage, dispensing and orientation, and the pharmacist as technical and scientific knowledgeable of the areas focused on medication.

This condition, seen as fundamental both to ensure the population access to medicines that have proven efficacy and safety, developing clinical protocols and standardization of drugs and in monitoring treatment, promoting a pharmaceutical care service, and rational use of medication. (Araujo *et al.*, 2008).

The pharmaceutical care includes educational services in the therapeutic process, standardizing a rational and safe drug therapy, individual levels and collective, with pharmaceutical orientation, promoting the implementation of a follow-up therapeutic drug (SFT), followed by evaluation of the results, being able to identify PRM. This proposal is an enabling strategy, especially for the elderly patient, which in most cases is chronic use of several medications and is more conducive to adverse reactions and drug interactions. (Meneses, SA, 2010).

The pharmacist's role is to make the evaluation of the prescription, even for the elderly involves a number of experts, and in some cases occur duplication of medications due to the variety of different brand names with the same active ingredient, when the patient feels good with medication it becomes more adept at handling. By promoting patient adherence to pharmacotherapy, it passes in need of a dwindling number of medication, using fewer health services, improving services and quality of life of patients. (Meneses, SA, 2010).

2.4 Tracking Pharmacotherapeutic / Method Dader - Pharmacist Professional practice

The SFT is a practice that requires a lot of dedication and responsibility of the pharmacist in obtaining Pharmacotherapeutic history of the patient, with the purpose to evaluate the health status of the patient, as well as the clinical pharmacology results and identify, prevent and resolve DRPs that are considered adverse clinical outcomes, drug related, interfere with obtaining the expected therapeutic response, or causing undesirable adverse effects. (Santos *et al.*, 2004).

The FTS Dader method was developed by researchers at the University of Granada (Spain) in 1999 and is currently being used by pharmacists from various

countries to assist in pharmaceutical care and obtaining satisfactory therapeutic results, based on filed concrete procedures, governed by rules acting to describe the status of each patient, where the clinical pharmacist and the doctor in consensus with the patient decide what to do on the data obtained in the interviews conducted by the pharmacist. This is a working tool that allows health care professionals improve the clinical treatment of the patient, solving or preventing the negative results of drug treatment. (CARVALHO, 2010).

2.5 Interaction drugs in elderly

Drug interaction (IM) is the process by which modifies the effect of a drug or the appearance of new effects as a result of interactions that may be caused by concomitant use of another drug with food, beverages or environmental chemical agent. These interactions may be classified as pharmacokinetics, affecting the process of absorption, distribution, metabolism or excretion, and as pharmacodynamics, and the change of the drug at its site of action, may cancel or enhance the effect of the drug. (Rossignoli, Guarido; CESTARI, 2006).

Pharmacists can help identify drug interactions and guide other health professionals through the dissemination of information on medicinal products. As age advances, the onset may occur in various conditions, contributing to the emergence of such interactions due to constant use of more than one drug. (Rossignoli, Guarido; CESTARI, 2006).

Drug interactions can be classified as desirable or undesirable, the first of which can reduce the therapeutic effect or to increase it, causing the appearance of adverse effects, no treatment compliance and jeopardize pharmacotherapy. Now, desirable effects are beneficial to the patient, and associations that can prolong the therapeutic effect, reduce the occurrence of adverse effects, increase patient compliance and treatment efficacy. Thus, a drug can bring benefits or problems to the patient, and the health risk possibility can cause the patient to more complex treatments or prolong hospital stay the same. (Matos *et al.*, 2009).

The risk of occurrence of drug interactions increases with age and the number of drugs used, up to 85% in patients who use more than six medications. In elderly 19% of them receive combinations likely to these events, enhancing the problem of pharmacological elderly treatment, and the main drugs involved are often used in the treatment of common chronic diseases the oldest patient as digoxin, diuretics, antidiabetic agents, antiarrhythmics, warfarin, Nonsteroidal Anti steroidal drugs (NSAIDs), phenytoin, centrally acting analgesics, and antipsychotics. Some of these drugs have a narrow therapeutic window, depending on the interaction, expose the patient to toxic risk compromising patient safety. (LOCATELLI, 2007).

III. METHODS

In order to meet the therapeutic process of hypertensive and diabetic elderly assisted in Basic Health Unit carried out a quantitative research, the patients treated in Hiperdia program neighborhood UBS Sector 06, the city of Ariquemes, Rondonia, Brazil. This unit carried out the service 08 close quarters, assisted by two teams of the Family Health Strategy (ESF) which in addition to other functions to assist people with arterial hypertension (HBP) and Diabetes *Mellitus* (DM).

Of the 08 districts were selected 03 for the research. It is inferred that the population of the districts involved have some similar characteristics, such as socioeconomic conditions, in addition to these neighborhoods are those who hold the largest number of patients assisted by Hiperdia Program at UBS said the context of care. The availability of staff to work with the provision of data for the accomplishment of this study was also major item for the election of the target population.

The study population of elderly accompanied by Community Health Workers (CHWs) who attend the monthly group Hiperdia assisted by UBS, neighborhoods Sector were selected 06, Sector 08 and Sector 11, totaling 410 patients of which 315 are hypertensive and 95 diabetic, of these 196 patients were analyzed, using as age inclusion criteria less than 60 years, assisted by CHWs, who attend the group, be found in the residence within two attempts and agreed to participate, as exclusion criteria, patient They did not meet the inclusion criteria.

Data collection started after the project was approved by the Research Ethics Committee (CEP) of the Faculty of Education and Environment (FAEMA) on the opinion substantiated 704.163. Todos patients were informed about the study and signed the Term consent Form (ICF). Data collection lasted 78 days. The interviews were conducted during the group meetings and through home visits to patients registered who did not attend the meetings, which are the majority.

It is clarified that the data collection process occurred through the application of a form that was divided into three parts: demographic data relating to the identification, gender, income, education, marital stay; user perception about medication which quantified the drugs presented by patients through label, box, *blister* or revenues, as well as those mentioned by patients used without prescription, order acquisition and difficulties; It was obtained in the third step records data such as weight, height, body mass index (BMI) values of BP and blood glucose. Also in this instrument we have been addressed DRP involving the acquisition, use orientation, amount of drugs for the same condition and quantity of drugs with self-medication.

How important addition was applied statistical test to establish an association between the user's income and the acquisition of medication, amount of medicine with self-medication and acquisition. Were also established correlation between age, systolic blood pressure (SBP), diastolic blood pressure (DBP) blood glucose and BMI. Finally the SBP, glucose and BMI were classified in order to observe the degree of risk of patients.

IV. RESULTS AND DISCUSSIONS

4.1 Socio-demographic characteristics

We analyzed 196 patients aged 60 to 92 years with an age range longer present between 60 and 69 years (65.8%), represented by 65 males and 131 females, it was found that 42.3% of patients are illiterate and only 4.6% have secondary education, 38 elderly do not have any income and women with higher prevalence (32), 58.7% are married and 66.8% receive some kind of benefit, as shown in Table 1.

Verification of female dominance is common to other studies, may suggest a greater awareness and care in relation to health, as well as increased demand for health services by women compared to men. (ROMERO *et al.*, 2010;. PLACIDO; FERNANDES; Guarido, 2009; Santos *et al.*, 2005; FLOWERS; Benvegnù, 2008).

The fact that patients or not literate can significantly contribute to the adherence to treatment, patients with

higher levels of education may better understand the prescription, find it easier to understand the pathology and medicines used, literacy contributes to a reduced risk offered by inadequate drug treatment and prevent late complications caused by chronic diseases. (SANTOS, OLIVEIRA; COLET, 2010).

Second Kings and Ventura (2013) low levels of education reflects directly on the patient's quality of life to be related to a low financial income, as well as the above study, it was observed that levels of education are influences of early work primarily in crops by need of assistance in family income.

According to Bos and Bos (2004), the impact of income mainly the elderly patient with chronic disease, is a very significant influence on the choice of health used being public or private system, seniors with lower incomes are more dependent on the public system. They found that individuals with higher levels of education tend to use more private system due to greater awareness of the public system and demand for more sophisticated alternatives, which corroborates with our research.

Regarding marital status a study in Montes Claros in Minas Gerais noted that married seniors showed no difficulties in medication due to the assistance of the spouse when one partner has some difficulty. (Silva *et al.*, 2010).

Table.1: Distribution of sociodemographic variables according to gender, absolute and relative numbers of elderly Hiperdia group.

Variables	N total	% Total	Men's		Women	
			N	%	N	%
Age (Years)						
60 – 69	129	65,8	34	17,3	95	48,5
70 – 79	46	23,5	18	9,2	28	14,3
80 – 89	20	10,2	12	6,1	08	4,1
>90	01	0,5	01	0,5	00	00
Totals	196	100	65	33,1	131	66,9
Schooling (years of study)						
Illiterate	83	42,3	27	13,8	56	28,6
Literate	05	2,5	04	2,0	01	0,5
1 -4 year Elementary School	83	42,3	31	15,8	52	26,5
5 -8 years Elementary School	16	8,3	02	1,0	14	7,2
High school	09	4,6	01	0,5	08	4,1
Totals	196	100	65	33,1	131	66,9
Income for the elderly (minimum wage)						
No income	38	19,4	06	3,1	32	16,3
Up to 01 salary	122	62,3	45	22,9	77	39,4
Up to 02 salary	33	16,8	13	6,6	20	10,2
> 02 wages	03	1,5	01	0,5	02	1,0
Totals	196	100	65	33,1	131	66,9
Marital Status						
Singles	09	4,5	04	2,0	05	2,5

Married	115	58,7	46	23,5	69	35,2
Widowed	47	24	05	2,5	42	21,5
Separated	25	12,8	10	5,1	15	7,7
Totals	196	100	65	33,1	131	66,9
Receive benefit						
Yes	131	66,8	46	23,5	85	43,4
No	65	33,2	19	9,6	46	23,5
Totals	196	100	65	33,1	131	66,9

4.2 Main conditions presented by patients and medications used

From the analysis of the data cited patients take medicines to 32 different pathologies, among which the most frequent were hypertension (92.9%), hypercholesterolemia (34.2%) and DM (30.1%). The higher prevalence of cardiovascular diseases and metabolism is related to the fact that patients are part of

the group of elderly hypertensive and / or diabetic the results are similar to other national studies. (Pereira *et al.*, 2012). There was a higher incidence among women of hypercholesterolemia, gastric disorders and depression compared to men have also been observed that use of these five treatments for prostatic hyperplasia. Table 2 shows the main morbidities according to gender.

Table.2: Description of the major pathologies cited by the elderly Hiperdia group.

Pathologies	Patients	% Total	Men's	% (M)	Women	% (F)
Systemic Arterial Hypertension	182	92,9	57	87,7	125	95,4
Hypercholesterolemia	67	34,2	17	26,2	50	38,2
Diabetes Mellitus	59	30,1	21	32,3	38	29,0
Cardiac diseases	24	12,2	08	12,3	16	12,2
Gastric problems	16	08,2	01	1,5	15	11,5
Depression	12	6,1	01	1,5	11	8,4

It found that patients using 01-13 medications comprises a total 1059 medicines for the entire group studied (Table 3), an average of 5.4 medications per patient, ranked 177 in pharmaceutical specialties, and 845 are of continuous use and 214 of occasional use, were classified in the occasional group all drugs that were not administered daily even being frequently used.

In 2008 a study of elderly entered into a support group in Porto Alegre / RS found a total of 5.34 medications per patient data similar to those presented in this study. (COLET; MAYORGA; AMADOR, 2008).

Among the drugs observed a higher intake of antihypertensive (241) since 92.9% of patients are hypertensive and many of them use more than one drug of this class, analgesics (136) due to reports of frequent headaches and muscle aches diuretics (125) to aid in reducing hypertension, antidiabetics (96) greater incidence of type 2 diabetes drugs most frequently used are shown in Table 3, and losartan, hydrochlorothiazide and dipyron the most widely used drugs.

Regarding the use of polidrugs there was a finding that 53% of patients using 05 to 10% drugs and 4 make use of more than 10 drugs (Figure 1). These findings are commonly found in Brazilian literature and other countries, as the elderly are constantly affected by

concurrent disorders in different organs or systems, making them easy targets for the use of several drugs at the same time. (Aguiar *et al.*, 2008).

It also noted the occurrence of major polimediations among women a proportion of 63.6% of women use 05 or more medications, and among patients of male 44.6% of them use more than 05 drugs. A study by Pereira *et al.* (2012) with hypertensive and diabetic patients in Minas Gerais observed increased use of drugs among women due to increased demand for health services for them.

It is inferred that the concomitant use of several medications may favor the emergence of DRPs, especially in elderly patients, hindering adherence to treatment due to several daily doses, use of drugs with low rates therapeutic and other factors can also lead to events of rise undesirable adverse including hospitalizations for drug interactions. In a study conducted in Tubarão, Santa Catarina, it was observed that cardiovascular problems such as hypertension, endocrine as diabetes, central nervous system and depression are the main contributors to the polimediations. (GALLATE; SILVA; TIBURCIO, 2010).

On the acquisition of medication of 196 patients 18 (9.2%) to buy all medication because they cannot get any by the public, 16 (8.2%) acquire exclusively by the Popular Pharmacy Program (PFP), 13 (6.6%) patients can take all medications at UBS, and most (149), ie 76% for all drugs used takes the medication in two or more locations, namely UBS through the public system, the PFP or buy in private pharmacies at least one of the drugs, among all patients 25 (12.8%) reported getting at some point without taking the medication when not found

in public, for lack of financial condition or do not have the prescription with which can acquire the People's Pharmacy. In Table 4 one can see the profile of acquisition of the patients' medication Hiperdia group.

When comparing the acquisition of the drug with the income was not observed in the statistical analyzes significant differences in acquisition among even groups because it is a population where the majority receive up to minimum wage and attends the same group of health care.

Table.3: Description of the amount of drugs most frequently used and their therapeutic classes.

Total Drugs	%	Class of medications	Most used drugs	Total	%
241	22,8	Antihypertensives	Losartan	76	7,2
			Enalapril	44	4,1
			Captopril	37	3,5
			Others	84	8,0
136	12,8	Analgesics and antipyretics	Dipyron	80	7,5
			Paracetamol	54	5,1
			Others	02	0,2
125	11,8	Diuretics	Hydrochlorothiazide	110	10,4
			Others	15	1,4
96	9,1	Hypoglycemic agents	Metformin	47	4,4
			Glibeclamide	39	3,7
			NPH Insulin	09	0,9
			Other	01	0,1
73	6,9	Antilipemics	Simvastatin	56	5,3
			Ciprofibrate	09	0,9
			Others	08	0,7
85	8,0	AINES	Diclofenac sodium	39	3,7
			Ibuprofen	21	2,0
			Others	25	2,3
59	5,6	Antiplatelet	AAs 100mg	59	5,6
52	4,9	Anti-acid and Antacids	Omeprazole	16	1,5
			Others	36	3,4
23	2,2	Cardiac Protectors and Antiarrhythmics			2,2
18	1,7	Vitamins			1,7
23	2,2	Anticoagulants and blood circulation			2,2
13	1,2	Prevention of Osteoporosis			1,2
11	1,0	Antimicrobials and antifungals			1,0
104	9,8	Others			9,8
1059	100	Total			100

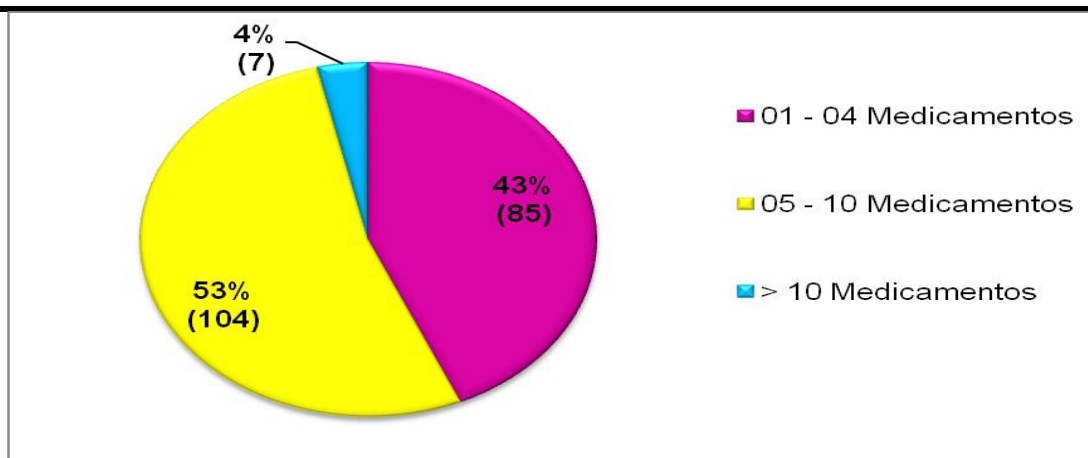


Fig.1: Number of drugs by patients.

Table.4: Relationship patients about medication acquiring form according to income

	Total Patients	Purchase all Medication	PFP	UBS	More of 02 places
No income	38	03	03	02	30
Up to 01 salary	122	08	11	07	96
Up to 02 wages	33	07	02	04	20
> 02 wages	03	00	00	00	03
Totals	196	18	16	13	149

Given that 42.3% of the population is illiterate as shown in Table 1, the purchase of medicines in various locations can contribute to therapeutic duplication due to the wide variety of medicinal and pharmacological associations existing in the market. It was found that among respondents 30.60% of patients acquire neither medication use without medical

variety of medicinal and pharmacological associations existing in the market.

4.3 Elderly patients and self-medication supervision since 136 (68.4%) reported the use of at least one self-medication, as shown in Figure 2.

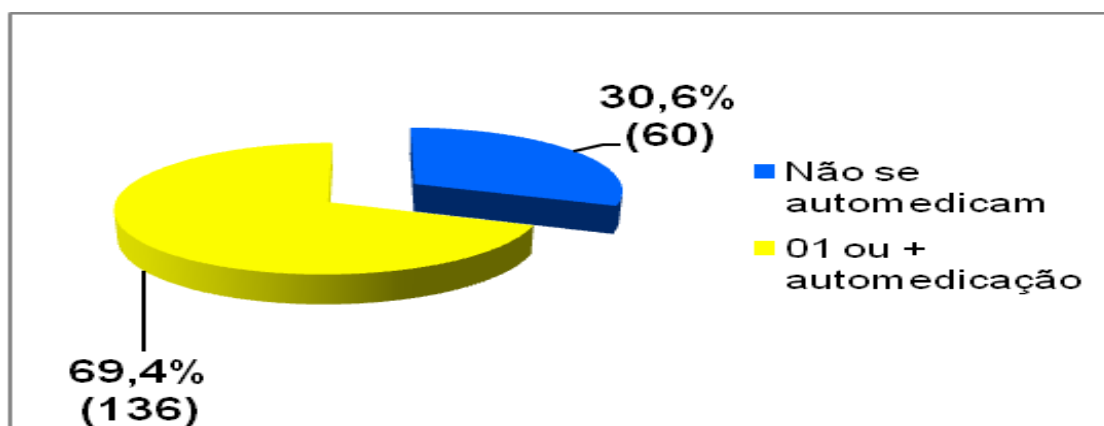


Fig.2: Number of patients for self-medication

Figure 3 shows the administration profile of the medications used without a prescription, 52 are used daily, 05 drugs on a frequency of 02 or more times per

week, 30 weekly and 125 used only when necessary, totaling 212 self-medication.

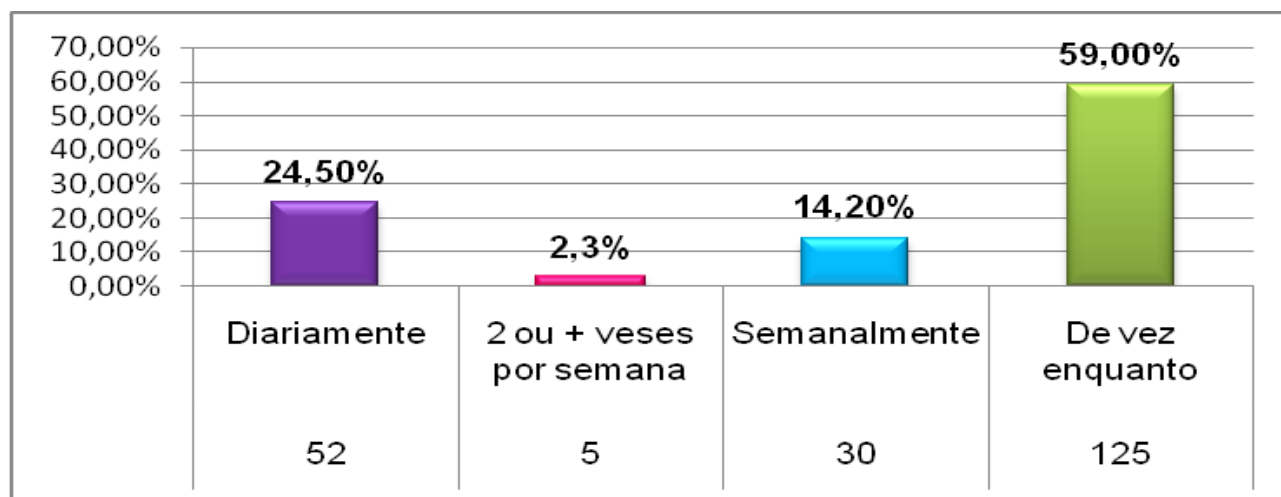


Fig.3: Quantity of self-medication according to the utilization profile

It was verified the practice of self-medication mainly of analgesics, anti-inflammatory and medications for the gastrointestinal tract, being 54 (25.5%) for headaches and 81 (38.20%) for pain in general mainly muscular pains,

20 (9.4%) for gastric discomfort, 10 (4.7%) vitamins and 47 (22.2%) for other health problems. Figure 4 shows the use of self-medication.

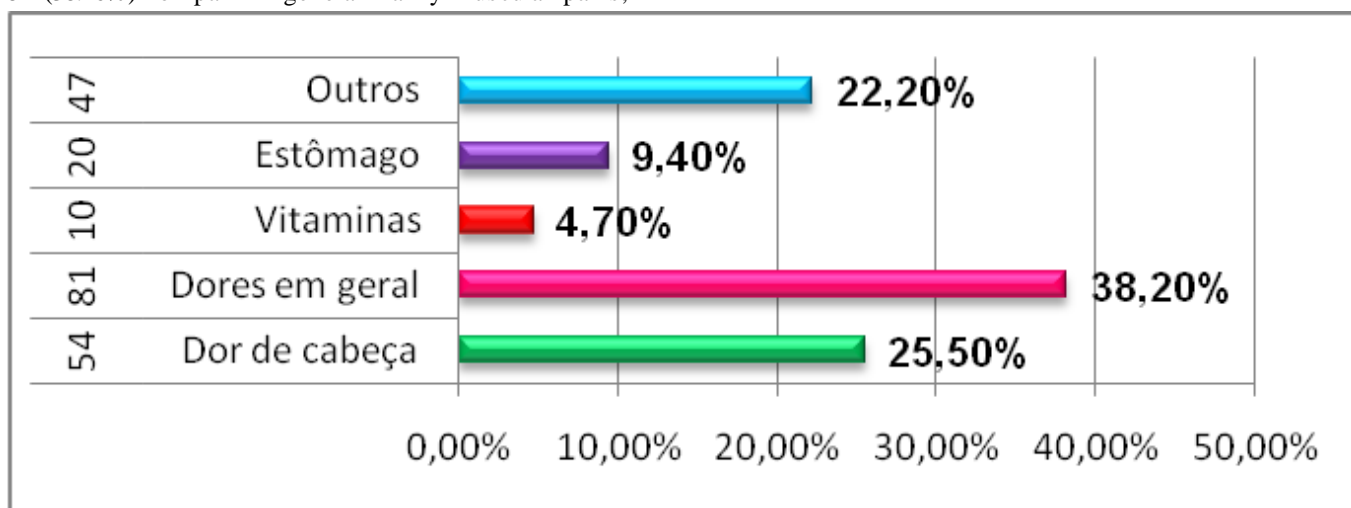


Fig.4: Demonstration of the use of non-prescription medicines

In a study carried out with elderly people in the south of Brazil, 80.5% of the patients were self-medicated, and analgesics were the most used therapeutic class, considering simple health problems and because they are over-the-counter, according to the authors, self-medication can cause problems for the elderly, since the choice is not always appropriate to the symptomatology, and by the use of polipharmacies, which may cause adverse reactions or undesirable drug interactions. (CASCAES; FALCHETTI; GALATO, 2008).

It was found association between the amount of medication used and self-medication, according to the analysis of Figure 5, it was noted that there is association () between the variable amounts of medications and self-medication. The most significant values are between 03 to 08 drugs with a higher proportion of self-medication, among patients with more than 10 medications it is possible to note that patients use more than 03 self-medication.

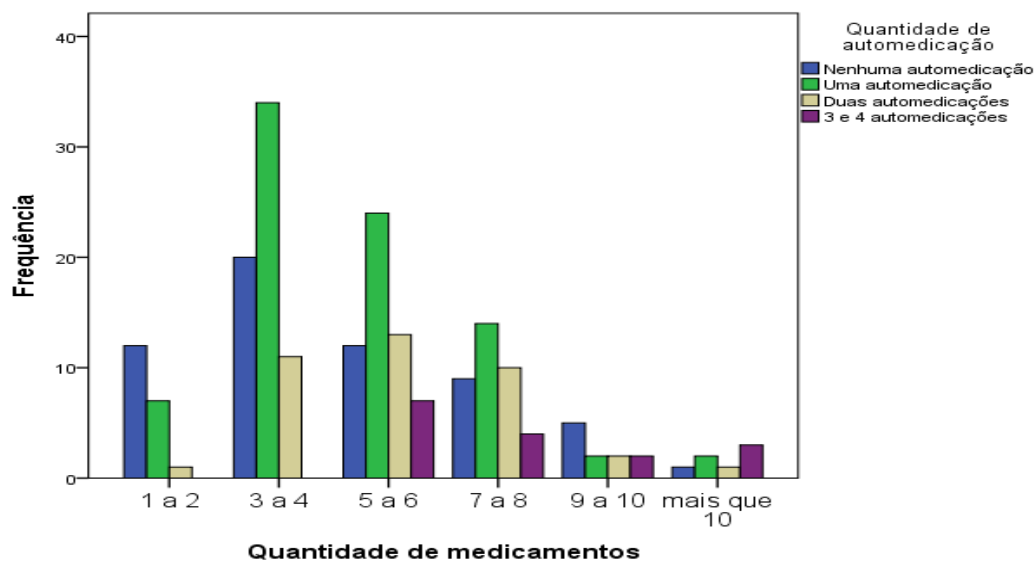


Figure 5 - Association between the amount of drugs with the amount of self-medication

4.4 Assessment of physical appearance and physiological parameters

With aging, care is taken to minimize the risks of Cardiovascular Diseases (CVD), among the predisposing factors are smoking, hypertension, dyslipidemia, DM, total and central obesity. (FERREIRA et al., 2010). In the analysis of the charts it was possible to verify that 38.73% of the patients were classified as overweight, 28,17 with degree I obesity, 7,04 degree II obesity and 4.93% degree

III obesity, totaling 78.9% of overweight patients, according to BMI values shown in Figure 6. According to Ferreira et al (2010), a study carried out in Goiânia observed the prevalence of obesity in 76.2% of elderly patients, again being women with a higher incidence (83.3%), the prevalence of type 2 DM was associated with high mortality rates, since most diabetics were overweight or obese.

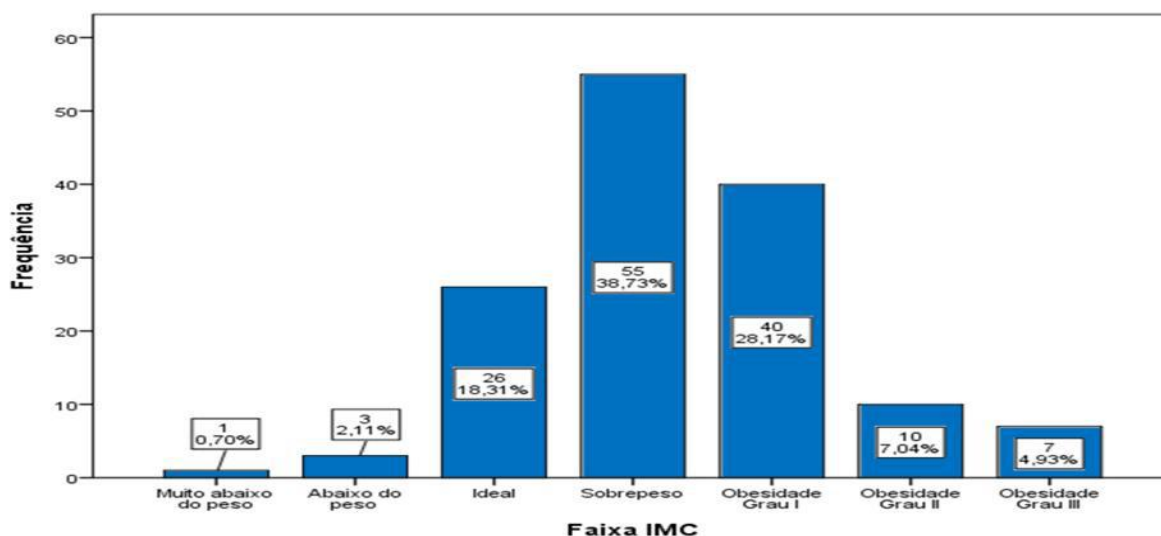


Fig.6: Classification in relation to the value of BMI

Costa (2004), in a survey conducted in Belo Horizonte / MG, about the harmful factors to health of the elderly, reports that income, education and other aggravating factors of health, but healthy eating is related to cultural habits, but poverty defines the access to vegetables and fruit due to low purchasing power, in addition, much of

the old income is spent on drugs. Also it was observed that elderly people with less education were more sedentary lifestyle and had less healthy eating habits.

4.5 Problems related to drugs cited by users

With respect to DRP 56% (110) of the elderly respondents reported do not have any, and 44% (86)

reported at least one problem with the drug (Figure 7), the most common are shown in Figure 08 were hardly be cited by 31.4% of patients, 40.7% reported stomach problems observed in this case the use of hypoglycemic drugs and NSAIDs, 17.4% reported having difficulties in recognizing the medication which makes the pharmacological treatment a health risk patients can be

serious consequences for short and long term depending on the type of medication and therapeutic index, 15.1% due to discomfort come to be without taking medication noting non-adherence to treatment, 3.5% difficulty swallowing also 3.5% They reported a lack of satisfactory results as control of BP and blood glucose and 4.6% reported dry cough.

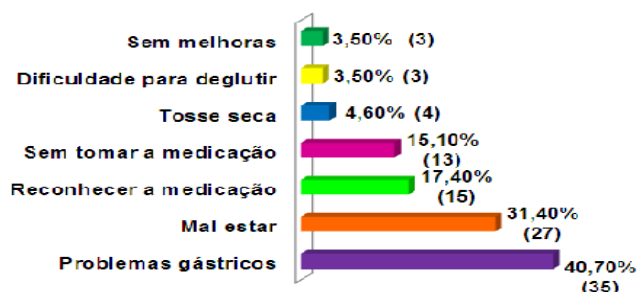
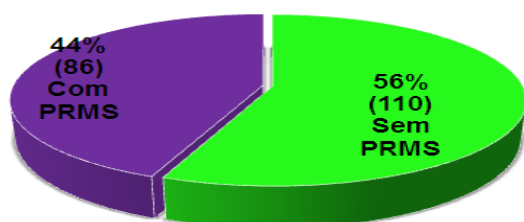


Fig.7: (a) Number of seniors with DRP (b) Main DRP cited by Seniors

The DRP and bring discomfort to the patient may impair the pharmacological treatment leading to non-compliance with treatment or undesirable consequences such as hospitalizations, studies have reported that the risk of drug interactions increases with the amount of medication 06 drugs leads to a risk 85%, 08 drug interaction potential of up to 100% on these facts the monitoring of prescriptions and monitoring of elderly patients is indispensable. (LOCATELLI, 2007).

Regarding the direction of the medication the elderly reported that the doctor is the main advisor, when do not

understand how to take their medication mainly seek help with children or family house that pushes through private pharmacies get some medicine.

Permanent education and adoption of collaborative strategies among physicians, pharmacists, nurses and CHWs can contribute to a more humane and promising service, adopting measures and updated programs or lists of the main interactions and side effects can assist in the identification of drug interactions to reduce risks to health of the elderly and possible hospitalization patients. (Matos *et al.*, 2009).

Table.5: Demonstration of the number of patients according glucose levels during the period of nine (9) months

Blood glucose values (mg/dL)	Frequency	% Total	% Valid	% Cumulative
70 a 99,99	04	2,0	7,5	7,5
100 a 124,99	07	3,6	13,2	20,7
125 a 269,99	30	15,3	56,6	77,3
>270	12	6,1	22,7	100,0
Total	53	27	100,0	
No history	143	73		
Total	196	100,0		

Table 5 shows the amount and percentage of patients according to the glyceimic levels found in the medical records. It was possible to locate 53 (27%) patients with at least one glyceimic measurement during the period of 9 (nine) months, the other patients totaling 143 (73%) were classified as without history due to lack of follow up in the present period. Only 7.5% of the glyceimic values were <100 mg / dL, 13.2% between 100 and 125 mg / dL and the remaining 79.3% of the values found were greater than 125 mg / dL

Table 6 shows the frequencies of PAS values, parameters collected from medical records, and 169 (86.2%) had at least one annotation in the same period mentioned above, and 27 (13.8%) were not found no result in this period which leads one to believe that they were not followed up by health professionals. Among the patients with a history of 13.6%, SBP <120 mmHg, 18.9% between 120-130 mmHg, most of them totaling 67.5%, SBP values between 140 and 240 mmHg were observed.

Table.6: Frequency of patients according to pressure levels in the period of 9 (nine) months.

Pressure Levels (mmHg)	Frequency	% Total	% Valid	% Cumulative
Ideal (< 120)	23	11,7	13,6	13,6
Normal(120 a 130)	32	16,3	18,9	32,5
Stage I (140 a 159,99)	58	29,6	34,4	66,9
Stage II (160 a 179,99)	34	17,4	20,1	87,0
Stage III (\geq 180)	22	11,2	13,0	100,0
Total	169	86,2	100,0	
No history	27	13,8		
Total	196	100,0		

Pink and Franken (2007) highlight the importance in monitoring hypertensive patients, especially elderly people who have higher levels than younger patients due to high prevalence of coronary, cerebral and heart disease, the BP control helps reduce the risk of pathological events that may compromise the health and welfare of the elderly.

When applied Pearson correlation statistical test to verify the correlation between age, PAS and blood glucose observed that age and systolic blood pressure is statistically correlated positively ($p = 0.003$), showing that the larger the higher age are the values of SBP, not correlation between SBP and glucose ($p = 0.393$) or between glucose and age ($p = 0.174$), noting that were not correlated patients with two logs or more glucose and PA, observed 40 patients with more than two glycemic and 152 history with more than two PA history, which may compromise the results, it is suggested a more detailed follow-up of these physiological parameters in order to obtain more satisfactory results.

BMI at pressure levels and the age of patients, there was a significant positive correlation was also correlated with age ($p = 0.018$) and no association with blood pressure levels ($p = 0.334$) for this analysis was analyzed history 142 elderly.

5. FINAL CONSIDERATIONS

After analysis of the results was observed using 1059 medicaments, 76% acquire medication in at least 02 different places may promote therapeutic duplication, the physician is the main guiding medication use, among the cited MICs are stomach problems and malaise, 17.4% have difficulty in recognizing, 15.1% are not taking the drug due to adverse accustomed and 69.4% use at least one self-medication.

Regarding income observed similarity in the mode of acquisition, the classification of physiological parameters was observed lack of data in the records, and 79.3% had blood glucose levels > 125 mg / dL and 67.5% with SBP > 140 mmHg, also noted it is association between the

amount of medicines and self-medication and correlation between age and SBP and BMI and age.

The application of the SFT can assist in achieving safer and more effective drug therapies, deployment strategies that can promote greater patient adherence to medication and monitoring of physiological parameters. Therefore, it is inferred that this study may support public policies of attention and promoting the health of the elderly facing the aging not as a disease but a natural process of life.

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RFID System Applicability Model for Traceability of Luggage at Airports

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Abstract - One of the critical points in the framework of air transport, is the management of luggage at airports. Every year, a large number of people feel the need to travel for various reasons and that efficient management is a difficult task that needs to keep up with the growth demand in a satisfactorily. One of the problems that has not been solved is exactly the loss, misplacement or mishandling of baggage at airports, given the difficulty of the current management systems to monitor the baggage, which causes unwanted situations to life. Radiofrequency Identification Technology (RFID), integrated with an information system, presents itself as a solution to numerous daily setbacks in various segments, because its main feature is basically to capture information at a distance about some element in movement. By implementing a smart tag (tag) in each baggage, it becomes possible to trace it along the path. In order to solve this problem, the present work aims to develop a prototype software, integrated with RFID, to simulate the control of luggage at airports by means of three scenarios where luggage misplacement may occur.

Keywords - Information Technology, RFID, Traceability.

I. INTRODUCTION

Traveling is something that is part of the daily lives of people, whether it's for business or simply leisure and choice of an aircraft as a means of transportation for this purpose, has been common. Hence arises a problem quite often, it's the luggage misplacement. One of the biggest fears of travelers is that something goes wrong. Proper planning already prevents more than half of the problems, but it's good to be prepared for unforeseen events, mainly in relation to the belongings.

According to the report from the Ministry of Labor and Employment (MLE), the total passenger movement in

Brazilian airports, as graph of the illustration 1, increased 2.56% in August 2017, compared to the same period in 2016, with a rate of monthly medium growth of 2.59% from March of the same year [2].

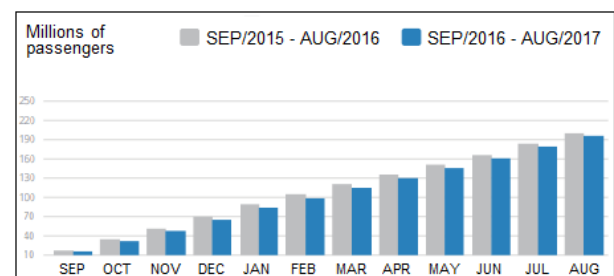


Fig. 1 – Movement of passengers in Brazilian airports in 2017 [2].

Every year, over 3 billion luggages are checked at airports all over the world, an impressive number that will continue to increase drastically in the next two decades [8].

The movement of loads also had a relevant increment, in the comparison between August 2017 and August 2016, being registered a growth of 12.56%, with 96 thousand tons in the month. Year to date through August 2016, the air cargo market obtained a growth of 8.23% in the load tonnage transported in relation to the same period of the previous year, having the domestic and international market grown in similar magnitudes, 7.42% and 8.59%, respectively [6].

Given these expressive numbers and the current demand for this type of transport, the airport infrastructure needs to follow the demands of users, who are often harmed. In Brazil, not especially, there is much to be done in relation to improving the management of baggage and passengers. For now the solution consists in indemnity, that is, compensation for the damage caused by the loss of the

luggage after the fact accomplished. That depends on each airline.

A new International Air Transport Association (IATA) resolution came into force in June 2018, forcing airports to ensure that their baggage handling systems come into compliance. The resolution is mandatory for IATA members, who represent 85% of global air traffic. Airlines must set up four baggage tracking points (check-in, loading, transfer, arrival) and share these data with everyone involved in the process. With the implementation and fulfillment of Resolution 753, IATA intends to increase customer satisfaction, reduce overheads and curb fraud and robbery [7].

A technology that has been expanding worldwide is the Radio-Frequency Identification (RFID). According to reports from International Air Transport Association (IATA), RFID holds the potential to save industrial aviation, generating savings of 3 billion dollars, over seven years, improving the management and operation of the baggage, as shown in figure 3. The technology has high reading performance and low maintenance cost. Initial implementations show that the bags are tracked at a rate of over 99%, allowing reduction of manual operations and can be deployed for only US\$ 0,1 per passenger [8].

a luggage label for the destination. This label (tag) also has a RFID UHF chip, EPC standard (Electronic Product Code) Gen 2, with a unique identification number that relates the luggage to your flight and destination, through the Vanderlande's software known as VIBES. The airport also has installed 130 self check-in kiosks, so that the passengers could print their own RFID tags. The cost in this period was 5 million dollars a year with passive tags, but through a mass adoption, the price of the chips, which cost more than 1 dollar each, could be reduced [5].

Hong Kong International Airport, which began its RFID program in 2004 and answered about 48 million passengers a year, has updated its bar code system by radio frequency identification at a cost of HK \$ 50 million \$ 6.5 million). The overall reading accuracy of the airport baggage handling system increased from an average of 80% with the bar code to 97% with the RFID tags. Due to this constant technological evolution it remains one of the best airports in the world [10].

With the help of this technology it is possible to control all objects that have electronic tags deployed, from the information contained in each object. Such data can be provided for viewing through an interface with the user, being possible to extract some information in real time and accurately. Currently, there are few companies that use this technology worldwide, mainly due to its deployment cost. However, the trend is that this technology be spread more with the reduction of costs.

In order to solve this problem, this article aims to develop a prototype software, integrated with RFID, to simulate the luggage control at airports by means of three scenarios where there may occur misplacement.

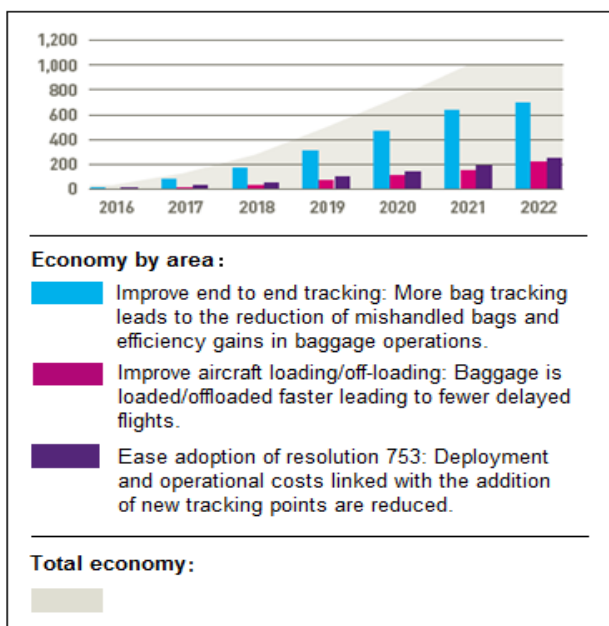


Fig. 2 – Economy, in millions of dollars linked to the adoption of RFID [8].

Some airports around the world already use this technology, such as the international airports McCarran, in Las Vegas, USA, and Hong Kong, in China. The McCarran, in 2005, was the first from the United States to install a system based in RFID for the control of luggage. At check-in, an employee of the airline McCarran inserts

II. THEORETICAL REFERENCE

2.1 SURVEY ON LOST LUGGAGE

In 2015, all over the world, about 10.4 million luggage were lost [8]. The scene is increasingly common in Brazilian airports: boarding an airplane and, upon arrival at the final destination, not get the bag back, or find it violated.

A survey conducted in 2016 by SITA, as shown in picture 3, displays the amount of bustling luggage over 10 years:

2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
35.5	46.9	36.9	28.2	32.3	25.3	26.3	21.8	24.3	23.1

Fig. 3 - Movement of luggages, in billion, per year [8].

Another survey conducted by the website Reclame Aqui, through the intelligence tool Knowit, showed an increase of 96% of the number of complaints involving luggage, against airlines, between June and October 2017 [6].

According to SITA, according to a report carried out in 2015, of all the problems related to luggage, 79% are about misplacements, 15% concerning to thefts and damages and 6% to robberies and losses. And related to misplacements, which represent the most of the problems related to luggages, of 10.4 million misplaced luggage in 2015, the most common causes are represented in the graph of figure 4:

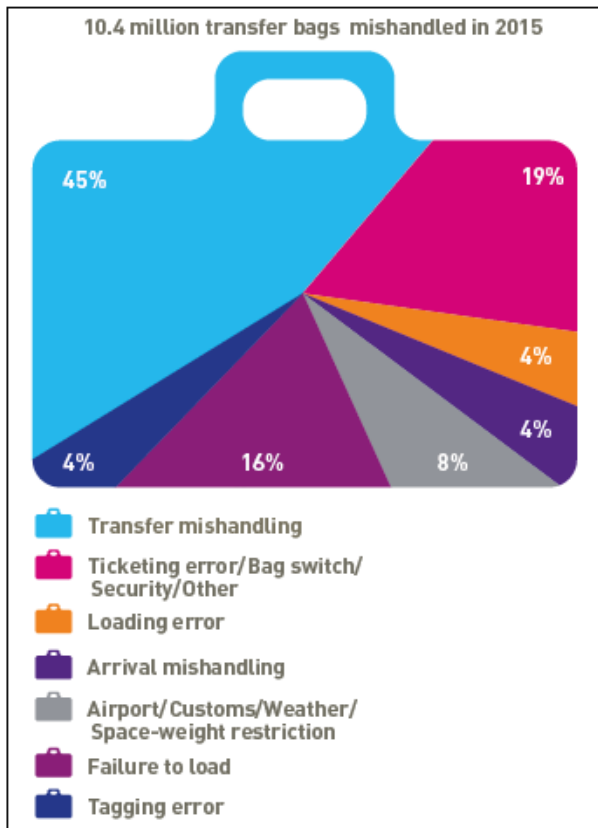


Fig. 4 - Main causes for misplacement of baggage [8].

According to specialists, apart from the lack of policing to prevent thefts, the strong growth of the sector, without infrastructure improvements at airports, has contributed to the increase of luggage misplacements [1].

2.2 PROCEDURE AFTER LOSING A LUGGAGE

When the luggage does not appear it is necessary to seek and airline employee and fill out the Registration of Baggage Irregularity (RIB) or a similar form, such as the Property Irregularity Report. It works as an occurrence bulletin, in which you fill out the necessary data to start searching for your belongings.

When a suitcase does not arrive at its destination, the airline makes a search in the holds of the airplane, in the passenger's terminal and cargo sheds and also send the information about the luggage to computerized networks of tracking. In general, the airlines begin the search for the external characteristics of the suitcase. After some days, it starts a second search phase, for the content of the

luggage. In Brazil, the misplacement of a suitcase is characterized if it is not found within a period of thirty days. But this may vary from company to company, mainly among the international ones. After this period, it begins the compensation process to the passenger for the lost luggage.

2.3 RFID SYSTEM

This identification technology uses radio frequency signs to do the communication between a reader and a tag with RFID chip to capture the data that will identify the object that carries the label (tag).

Characteristics	RFID	Bar Code
Mechanical resistance	High	Low
Formats	Several	Tags
Requires eye contact	No	Yes
Lifespan	High	Low
Possibility of Writing	Yes	No
Social Reading	Yes	No
Data Stored	High	Low
Additional Functions	Yes	No
Safety	High	Low
Initial Cost	High	Low
Maintenance Cost	Low	High
Reuse	Yes	No

Fig. 5 - Comparison between RFID and barcode [3].

As it can be seen in the table of figure 5, the advantages of RFID on the bar code are countless. This way, RFID can be seen as the technology substitute of bar code, this technology was developed in the 60's and currently essential for identification of any marketed product. With the expansion of RFID it is necessary to understand how this technology works which is so present in the current technological debates.

As it can be seen in figure 6, the RFID system is composed basically of three components: the antennas, the tags and the reader. Briefly the operation of this system happens in the following way:

1. The reader is connected to the antenna, generating the radio frequency signal;
2. When a tag enters the coverage area of the signal generated by the reader, it happens the reception of energy and activation of the circuits;
3. Tag circuits are energized by the reader, engaging reading tag data of the tag that you/they are sent to the reader;
4. The reader processes the information and stores the identifier of the tag, sending it to a server that will be processed by a computer system.

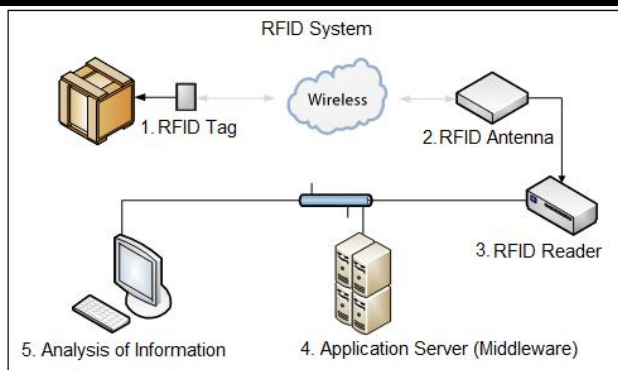


Fig. 6 – RFID System.

2.3.1 ANTENNAS

The antenna is the RFID system element responsible for radio frequency signal propagation. They are radio waves that correspond to electromagnetic oscillations, generated by the reader. It is the simplest component and it has the lowest cost of the entire system.

There is a wide variety of commercially available antennas and since they are passive elements, which only depend on the frequency of operation, several models can be used in a RFID system.

2.3.2 TAG

The tag, also known as smart tag or transponder, the element of identification of the RFID system, being composed of three basic components: antenna, integrated circuit and encapsulation. The composition between the antenna and the Integrated Circuit (IC) or RFID system, receives the name of inlay and after being encapsulated becomes a RFID tag. The construction and use of the tag is also tied to the definition of the system as a whole. The tags can be passive, in which they obtain energy through magnetic field generated by readers or they can be active, when they have a battery that supplies the energy to perform processing and signal modulation. The active ones have battery, a component that increases its cost, while passive tags have no battery which reduces.

2.3.3 READERS

Readers are interface elements between the tags and the systems. Technically, they are responsible for converting radio waves reflected from the RFID tag in digital information to be processed by computers. As all the other system components, readers have several characteristics that, according to the desired application, should be evaluated so that the chosen equipments add the features that more assist the needs of the project. A RFID reader can be sorted according to its mobility by the following types: fixed and mobiles. Mobile readers are those which are connected to a Personal Digital Assistant (PDA), a pocket computer, data collectors or notebooks and they are used for applications where it is necessary to

go until the identified item and perform the reading of the tag. Fixed readers are those which have direct interface to computers or even network interfaces and connect directly with local computer network. These readers have optimized performance and provide the greatest reading distances [4].

2.4 EPC

The EPC (electronic product code) consists of a sequence of numbers and letters, encompassed in a header and three sets of data partitions. By separating the data into partitions, readers can search for items with code of a particular manufacturer or product. This becomes it possible, for instance, to find more quickly products which might be approaching its expiration date or that need to be collected. That way the RFID, with the use of this standardized system of codes, helps to reduce human mistakes, due to its ability to record all objects at once [5].

III. MATERIALS AND METHODS

It was accomplished a simulation, through a software emulator, to solve problems related to misplaced luggages at airports. The proposed scenarios were mapped according to potential situations for occurrence of misplacement, having the necessary equipments: readers, antennas and tags.

The software used as development environment was Delphi 7. The emulator used for simulation of the scenarios was RIFIDI. The database management system was *Firebird 2.5*. The integration between the development environment and the emulator occurred through *sockets*, using the TELNET protocol. The communication between the integrated system and the RFID reader, as shown in figure 7, was accomplished through USB, serial and Ethernet.

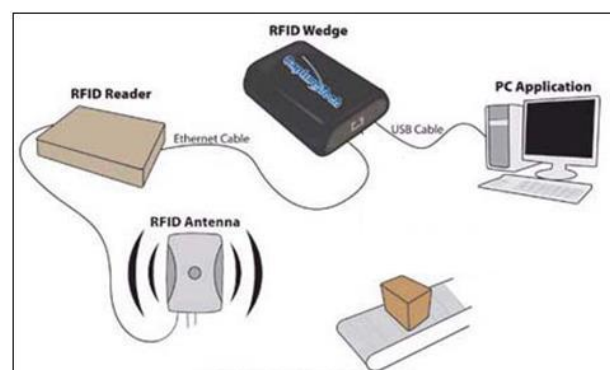


Fig. 7- Communication equipment

3.1 RIFIDI EMULATOR

Rifidi emulator was used to create a test environment in order to simulate real-world events required for the study. With the aid of the emulator we created the *tags*,

simulated the reader performance and established the necessary connections. It was not possible to simulate all possible physical interference problems. The basic operation of the emulator, as shown in figure 8, offers multiple readers and antennas disabled by default. This way, to simulate a specific tag in the field of the view of the antenna, you must select one of the tags created and drag it to the main module of the emulator. Once this is done, the antenna sensor, green and red field, begin to oscillate showing that a tag has entered the view field of the antenna. Thus, the information can be handled by the virtual reader and transferred to the software [9].

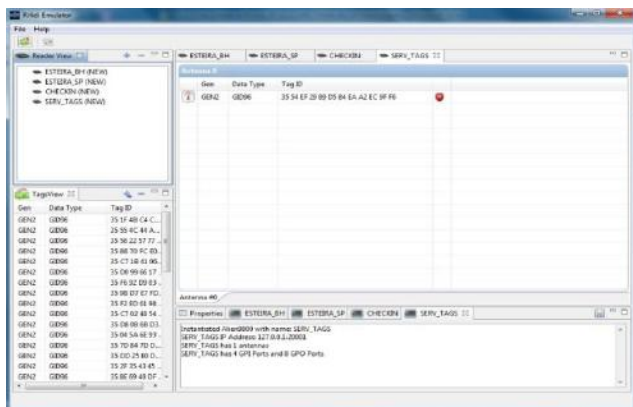


Fig. 8 - RIFIDI Emulator

IV. RESULTS AND DISCUSSIONS

The scenarios refer to typical situations in which may happen intentional or unintentional misplacement of luggage. The developed software will simulate the baggage control in three scenarios: dispatched baggage to the airplane (in the luggage compartment); the airplane exit (exit of the luggage compartment); exit of the airport (arrivals). The equipments used for the scenarios are: RFID antenna panel, fixed RFID reader, passive tag and monitor with sound.

We will use antennas of type panel, which are more suitable for projects that require greater coverage area for identification. The polarization used will be linear, by the fact of having more quality in the propagation of the signal and information capture.

4.1 SCENARIO 1

The front door of the baggage from the airplane, an antenna and a RFID reader are installed to read the placed tag in the luggage, as shown in figure 9. So, the operator has only to verify if the luggage is in the correct destination through the system panel. If the luggage is in the incorrect destination, the system will emit an error beep, so the luggage will return to the airport, as the flow of figure 10. All checks will be performed based on the flight information stored in the database.

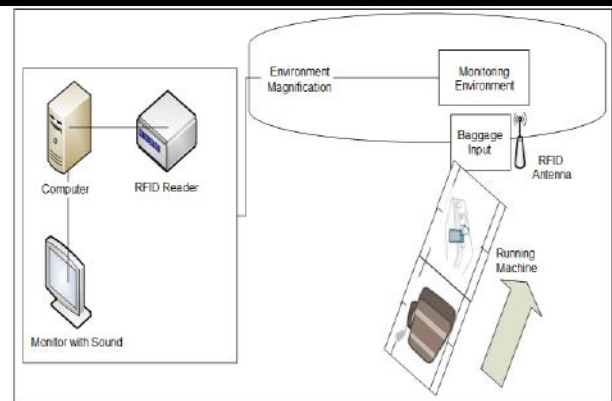


Fig. 9- Architecture of equipment in the airplane compartment.

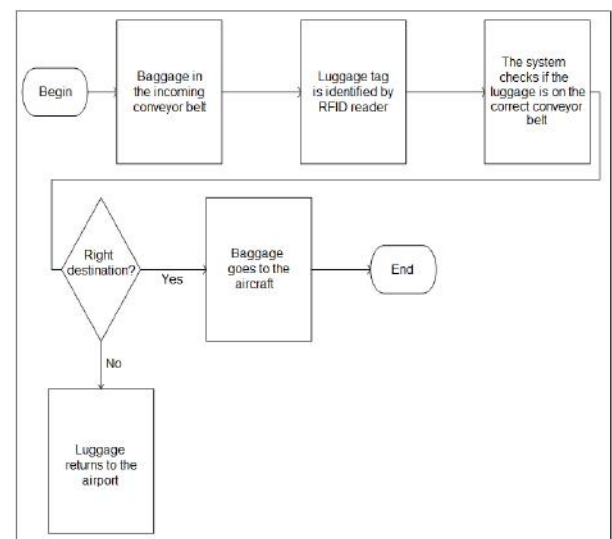


Figure 10 - Flow scenario 01

4.2 SCENARIO 2

In the exit door of the airplane's luggages, and antenna and a RFID reader will be installed to read the tag placed in the luggage, as shown in figure 11.

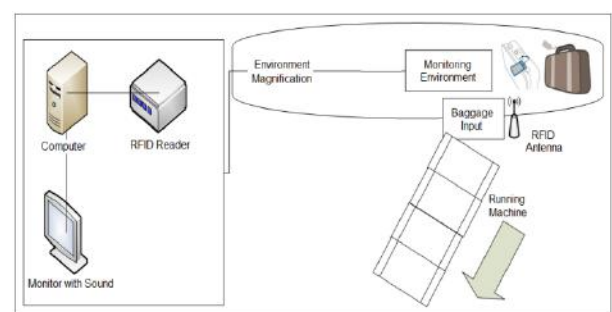


Fig. 11 – Architecture of the equipment of the airplane exit.

The operator should check in the system if the luggage came from the correct destination. If the luggage is in the wrong destination, just like in the first scenario, the system will emit an error beep, preventing the luggage off the airplane as the flow of figure 12.

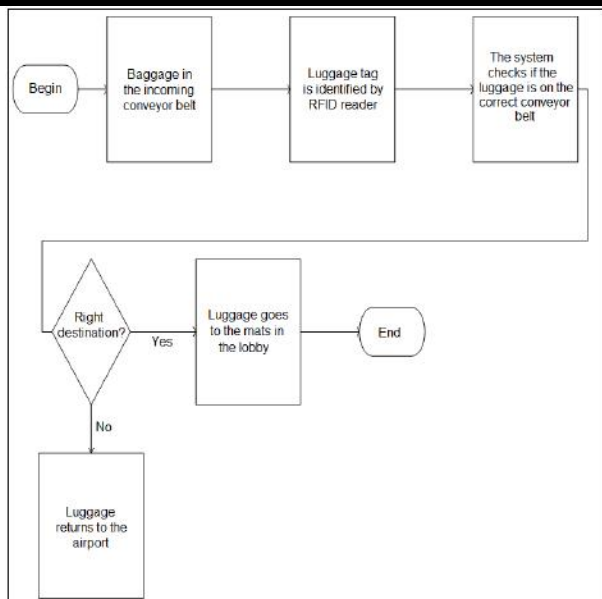


Fig. 12 - Flow Scenario 2

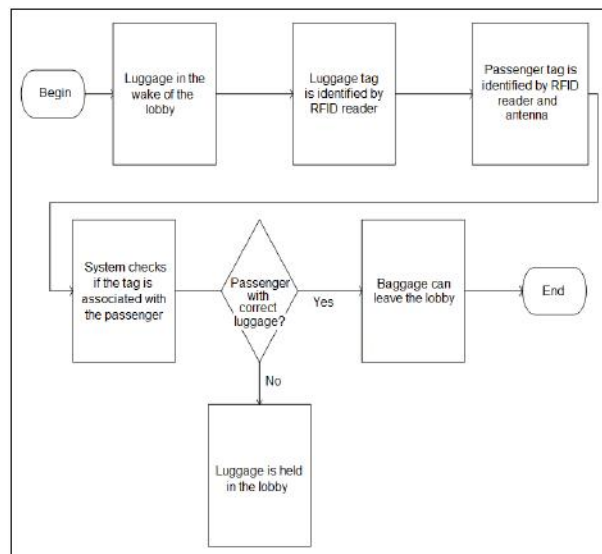


Fig. 14 - Flow scenario 3

4.3 CENÁRIO 3

In the airport lounge there will be also an antenna and a RFID reader, as shown in figure 13. The passenger who disembark, will pass through the gate where will be held the tag reading of the luggage and tickets. If both tags are attached, the resonant monitor will not accuse, as the flow of figure 14. However, if there's no relationship between the two tags, the system will emit a resonant alert in beep form, preventing the passenger take the luggage and alerting the responsible for monitoring, who should take the proper measures.

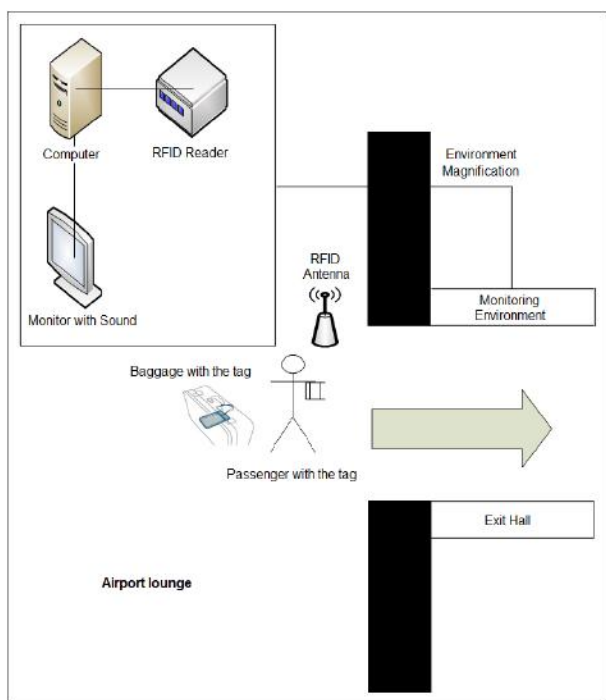


Fig. 13 – Architecture of equipment in the lobby

4.4 PROTÓTIPO DO SISTEMA

The conceptual model of the prototype of the system is simple. The luggage is associated with a tag, which is associated with its flight and ticket, forming a ternary relationship, as shown in figure 15:

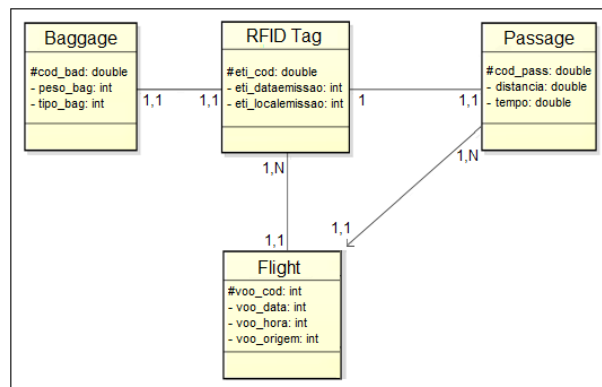


Fig. 15- System Class Diagram

In the presentation screen of the application, that corresponds to the check-in, the operator inserts the individual passenger data, such as name, ID number, flight number, phone number, as shown in figure 16. If the passenger has luggage to be dispatched, it will be generated a random and unique tag loaded from database, for identification of the luggage. After check-in confirmation, the association between the luggage tag, the passenger and the flight are associated. In case of error, the process can be repeated.

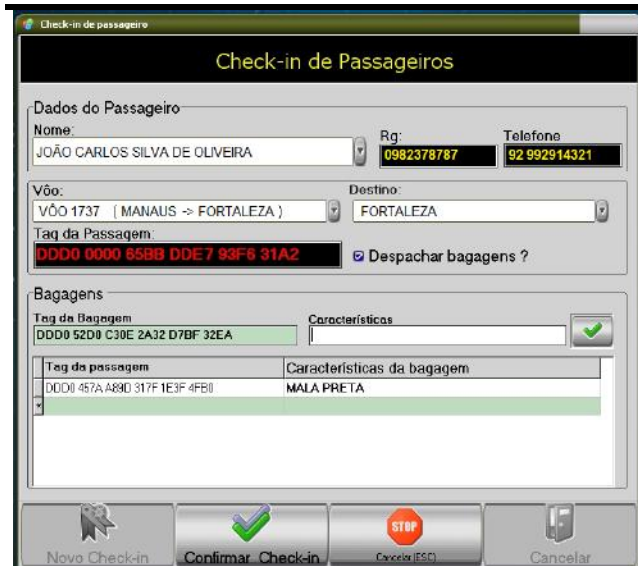


Fig. 16 – Check-in Screen

After check-in, the operator will be directed to a second screen, which represents the simulation of the luggage going to the airplane. The control and the correct entry of baggage occur at this stage, as shown in figure 17. In the system, simply select the flight and click the start button, so the tags will be processed and associated with the desired flight.

Inside the airplane will be carried out a comparison between the selected flight at check-in with the selected flight at this stage of the process. Having information, the luggage is released. Otherwise, the system will accuse error in the process with emission of audible alarm, preventing the luggage of passing.



Fig. 17 – Airplane's Input Screen

In the second scenario, as shown in figure 18, the luggage inside the airplane will be taken on arrival at the destination. At this time, they go through the reader,

which identify whether or not to continue to the airport lounge. Not being the final destination of the baggage, the system informs the operator that the case should remain in the airplane and move on to final destination.

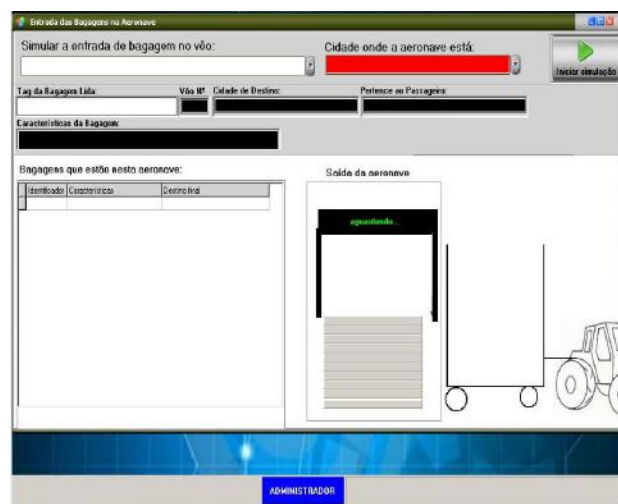


Fig. 18 – Airplane's Output Screen

In the last scenario, as shown in figure 19 and illustrated by the airport lobby, will be held the last check. At this stage, there is the comparison between the passage tag and the passenger's luggage tag. The baggage, being removed from the airplane, is directed to the airport. Then, the passenger with luggage in hand will still pass through a portal containing an antenna and a RFID reader. This last check is carried out to avoid the passenger get out with a different luggage of his/hers.



Fig. 19 – Airport's lobby screen

RFID technology is a premise for the control and management of luggage in the airport sector and, no doubt, has the potential to save the aviation industry. The technology used today in air transport is obsolete, mainly because of the lack of investment in transport of bags.

With the support of the emulator, we evidenced the behavior of the system in the proposed scenarios, enabling the development of a viable situation, integrating

to existing systems. The implementation of this system will help to control the spread of frauds attempts and thefts, besides reducing the costs generated by too much misplacement of luggages, such as reimbursements and indemnities. It becomes a solution for companies that need to come into compliance with the resolution 753 of the International Air Transport Association (IATA).

In the simulation environment, the identification tests of tags were carried out successfully. On these aspects, the application becomes a useful tool able to be deployed.

V. CONCLUSION

RFID technology is a premise for the control and management of luggage in the airport sector and, no doubt, has the potential to save the aviation industry. The technology used today in air transport is obsolete, mainly because of the lack of investment in transport of bags.

With the support of the emulator, we evidenced the behavior of the system in the proposed scenarios, enabling the development of a viable situation, integrating to existing systems. The implementation of this system will help to control the spread of frauds attempts and thefts, besides reducing the costs generated by too much misplacement of luggages, such as reimbursements and indemnities. It becomes a solution for companies that need to come into compliance with the resolution 753 of the International Air Transport Association (IATA). In the simulation environment, the identification tests of tags were carried out successfully. On these aspects, the application becomes a useful tool able to be deployed.

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Characteristics comparison of Biodiesel-Diesel Blend (B20) Fuel with Alcohol Additives

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Abstract— The effect of properties like density, viscosity and flashpoint with alcohol additives in biodiesel blend fuel has been studied. Biodiesel blend fuel (B20) is used for characterization to compare with 5% and 10% of ethanol and methanol. The results indicated that flash point of B20 decrease drastically at 5% alcohols and increases at higher percentages. Increase in flash point as blend concentration increase may be considered better with respect to safety in fuel handling. In case of viscosity and density, cetane number and acid values decrease as the percentage of alcohol increases. Alcohols lower the flash point slightly and reduces the viscosity and density of blend fuel marginally, with this fuel ignition can start at lower temperature and able to burn completely. The combustion rate of fuel is increased due to more oxygen availability in alcohol that results in reducing the levels of pollutants in exhaust gases.

Keywords— Biodiesel, Properties, Ethanol, Methanol, Blend fuel, Viscosity, Density.

I. INTRODUCTION

Depletion in fossil fuel sources, increasing dependence on imported crude oil and increasing the environmental pollution have led to the use of bioenergy from biofuels as an ideal alternative to diesel fuel. Considerable attention has been paid in the development of alternative fuel sources in India on biofuels which possess an added advantage of being a renewable fuel [1]. Biodiesel is an alkyl monoester available from vegetable oils, animal fats or waste cooking oils. It will be produced by transesterification process in presence of methanol as a catalyst to remove fats from oil. Renewability of bioenergy and its carbon-neutral structure, the bioenergy utilization can contribute to reduce carbon dioxide emissions. When ethanol was added to palm oil methyl esters-diesel blends B50 has shown significant difference in low temperature performance, with a maximum decrease in pour point temperature [2]. Recently biodiesel has received a great deal of attention because of

the advantages associated with its biodegradability, environment friendly and big resource of energy availability in nature [3].

The availability and sustainability of biodiesel feed stocks will be the crucial determinants in the popularization of biodiesel. Triacetin additive can be used as an antiknock agent to reduce engine knocking, to improve cold flow and viscosity properties of biodiesel. From the experiments it was concluded that 10% of Triacetin with biodiesel gives encouraging results [4]. Ethanol-biodiesels have lower cloud points for all blends compared to cloud points obtained for diesel fuel alone [5]. Bio-fuel consumption decreases by 3.5% at moderate loading conditions as compared to diesel [6]. In particular, biodiesel has received wide attention as a replacement for diesel fuel because it is biodegradable, nontoxic and emit less pollutant gases. Alcohols used as additives with biodiesel to dilute, achieve similar properties and performance characteristics as conventional diesel fuel [7, 8]. Increase in the quantity of alcohol additive in B50 improves in density, viscosity, pour point and cloud point and with slight decrease in energy content. The test fuel viscosity and density were decreasing by 41%, 2.73%, respectively with 20% ethanol in blend fuel. The flash and fire points were 51°C and 54°C slightly lower than the flash and fire points of the conventional diesel and 18.3% of energy content decreases as compared to the blend fuel.

The results of diesel-biodiesel mixture with methanol as an additive could reduce the exhaust gas temperature due to the higher oxygen content and increase heat of evaporation of the blended fuel, hence reduces the HC, NO_x emission and soot compared to diesel fuel [9]. Lower density of fuel is required to control fuel flow in the injection pump and minimize the smoke formation when operates with maximum power at higher loads [10]. The objective of this study is to determine the fuel properties of biodiesel B100, B20, B20-alcohol blend fuels at 5% & 10% and compare with mineral diesel as a baseline fuel.

These properties provide important data to further investigate the engine operation in terms of performance, combustion and emission characteristics with these fuels.

II. MAKING OF BIODIESEL

Straight Vegetable Oils (SVO) can be used directly as a fossil diesel fuel substitute, but using this fuel can lead to serious engine problems. Due to high viscosity of SVO, atomization of fuel in the cylinder is poor which leads to incomplete combustion and choking of the fuel injectors [11]. To overcome these problems transesterification process is used to produce biodiesel from SVO. Filtered karanja oil is heated at 105°C to remove water from the oil after that acid treated with methanol and sulfuric acid to remove part of glycerol from the karanja oil.

In base treatment sodium methoxide (mixture of NaOH and methanol) is added and the mixture is stirred while heating at a temperature below 65°C and cooled for settlement. After separating glycerol, the formed methyl ester is bubble washed with water and orthophosphoric acid to remove soap contents. The production process of biodiesel and reaction are shown in figures 1 and 6. The Karanja Oil Methyl Ester (KOME) is heated to remove water content in order to use in diesel engine [12, 13].

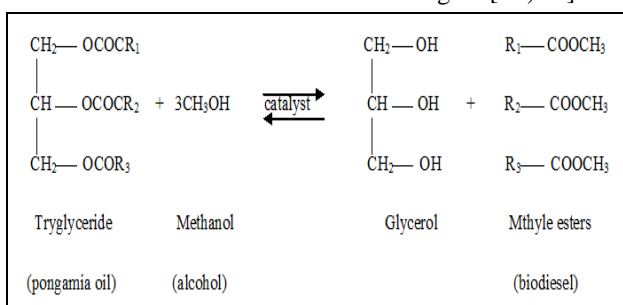


Fig. 1 Chemical reaction of biodiesel formation

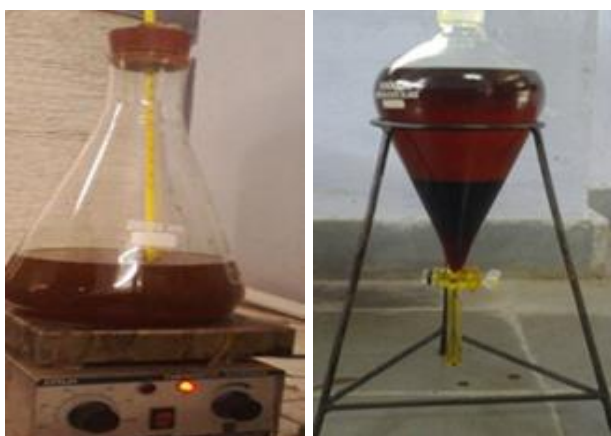


Fig.2 Acid treatment Fig. 3 Glycerin separation



Fig. 4 Soaps separation Fig. 5 Clean water in washing



Fig. 6 Biodiesel (PPME)

III. METHODOLOGY USED

The required biodiesel was produced from karanja oil by transesterification process to prepare the blend fuel. The B20 (20% biodiesel and 80% diesel by volume) blend fuels with ethanol and methanol were prepared to study the properties. Ethanol and B20 blend fuel is inherently immiscible and needs an effective emulsifier to produce homogenous mixture of fuel. The mixtures was stirred continuously for 20 minutes and left for 30 minutes to reach equilibrium at room temperature before testing. The emulsifier would reduce interfacial tension force leading to emulsion stability. Biodiesel is known to act as an emulsifier due to its low polarity and long fatty acid carbon chain has potential to improve miscibility of ethanol and diesel over limited range. The fuels shown in table 1 with their percentages Diesel (D100), Biodiesel (B100), B20, B20E5, B20E10, B20M5 and B20M10 were tested to compare their properties.

The properties like flash point, viscosity, density, acid value and cetane number were measured and compared the results with normal diesel fuel as per standard ASTM procedures recommended by manufacturers. These tests were conducted in a controlled room temperature, pressure and relative humidity to ensure that the result will not be influenced with change in environment.

Table.1: Tested Fuels (B20+Alcohol)

S. No	Type of Fuel	Percentages in Blend Fuel
1	Diesel	100% Diesel
2	B100	100% Biodiesel
3	B20	20% Biodiesel+ 80% Diesel
4	B20E5	B20 with 5% Ethanol
5	B20E10	B20 with 10% Ethanol
6	B20M5	B20 with 5% Methanol
7	B20M10	B20 with 10% Methanol

3.1 Flash point: Flash point is the lowest temperature of fuel measured at which the test causes flash flame on the surface of fuel inside the cup due to formation of vapours. The temperature at which the test flame causes burning for a period of about five seconds continuously is called fire point. Samples of 75ml fuel were poured into a flash point cup which was connected to the regulator bath and increases the temperature from 20°C to a maximum of 200°C.

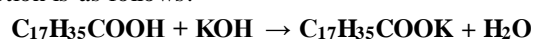
3.2 Viscosity: Viscosity can be defined as the resistance of oil to flow by overcoming the internal friction. Vegetable oils have very high viscosity to use as fuel in diesel engine. This can be significantly reduced to form as biodiesel by using transesterification process. Biodiesel viscosity is also higher as compared to diesel fuel, but it can be used as a substitute to diesel fuel at lower viscosity with minimum environmental pollution. Under low temperatures viscosity has a greater impact on fuel to flow smoothly from the storage tank into the engine. Higher viscosity causes poor atomization of the fuel spray and inaccurate fuel injectors operation causes improper combustion in the engine cylinder.

Redwood Viscometer was used to measure viscosity of fuel. The apparatus oil cup was cleaned with a suitable solvent and dried. Orifice was closed with the ball then filled fuel in the cup up to the mark. For all blend fuels time for collection of 50cc was recorded with the help of stop watch at room temperature. The values of kinematic viscosity were determined with the help of recorded time.

3.3 Acid value: The amount of potassium hydroxide (KOH) in milligrams that is necessary to neutralize free fatty acids (FFAs) contained in 1 gram of oil is called as acid value number. The maximum value of this number is 0.5mg KOH/g and it is an important factor to monitor the oil degradation during storage period.

Acid value of diesel, biodiesel and biodiesel blend with ethanol/methanol were measured by ASTM method (ASTM – D7467). According to this 0.2 to 0.5gm of fuel under test was taken into a 250ml conical flask and 50ml of neutral alcohol added to it. The flask is heated for some time, after that cooled it to room temperature, then few drops of phenolphthalein solution were added. The formed solution was titrated with N/10 KOH solution

until it turns into permanent pink color. The chemical reaction is as follows.



The acid value of diesel, biodiesel and biodiesel blends with ethanol/methanol can be determined by using the following formulae.

$$\text{Acid value} = 100X \frac{N}{10} \frac{\text{KOH solution used (ml)}}{\text{Weight of test fuel (gms)}}$$

For example: In case diesel fuel, Where 5.6 represents the amount of KOH in mg present per each ml of N/10 KOH solution (1000 ml of 1N KOH= 56 gm of KOH).

3.4 Density: The density of biodiesel is higher than diesel fuel. Biodiesels density can be decreased with the addition of additives for better performance of the engine. The density is measured by using Portable Density/Gravity Meter. High viscosity of fuel leads to problem in pumping and spray characteristics such as atomization, penetration and combustion etc. The improper mixing of fuel with air contributes to incomplete combustion that leads to low power output and exhaust with pollutants.

3.5 Cetane number: Ignition quality of fuel is identified by Cetane number. This number defines that whether the fuel has longer or shorter ignition delay during the combustion period. Higher the Cetane number means that fuel is with longer carbon chain. Normally diesel engines accept the Cetane number between 40 and 55 while below 38, ignition delay occurs more rapidly. In general, compared to diesel and biodiesel alcohol has lower Cetane number. When the engine is operated with lower Cetane number fuel produces noise and increase in ignition delay period. Alcohols are very poor CI engine fuels in performance as their cetane number is very low. Furthermore, the cetane number of B20 blend fuel with alcohol is dependent on the diesel ignition quality and the percentage of alcohol in the blend fuel along with the addition of cetane improver additives. The objective of the study is to determine the fuel properties B100, B20 and B20 with alcohols at 5% and 10% in volume.

IV. RESULTS AND DISCUSSION

The general observation is that the addition of ethanol and methanol improves the properties of biodiesel - diesel blend fuel. Hence alcohols can be used as an additive to decrease the density/viscosity of biodiesel-diesel blend fuel for better performance than diesel fuel.

i) Flash points of different fuels shown graphically in figure 7. The observation is that flash point of biodiesel is much higher, followed by B20 and alcohol blend fuels. The flash point of biodiesel and B20 are 143% and 43% more than diesel fuel. Biodiesel can be stored easily with higher flash point, but initially high temperature is required to burn in the combustion chamber. As the flash

and fire points of ethanol are very less when compared to diesel and biodiesel, the flash and fire points of the blends decreases with increase in percentage of ethanol. The blend fuels with 5% and 10% of ethanol additive decreases the flash point by 32.8% and 25% similarly with methanol additive 29.8% and 20.3% when compared with diesel fuel.

ii) From the figure 8 it is observed that the viscosity of biodiesel is 33.5% more than diesel fuel because of free fatty acid (FFA) concentration. Due to higher viscosity of biodiesel the blend fuel B20 is also at 7% more than diesel fuel. On other hand, small amount of alcohol addition in the blend fuel reduces the viscosity by 25.4%, 26.6% and 22%, 23.4% for 5% and 10% of ethanol and methanol respectively in comparison with diesel fuel.

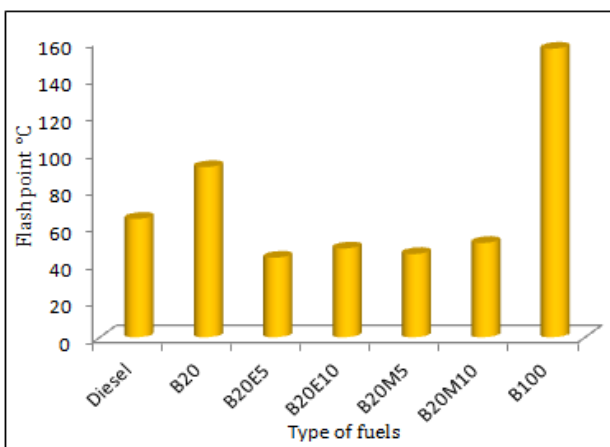


Fig.7 Flash point values of B20 with alcohols

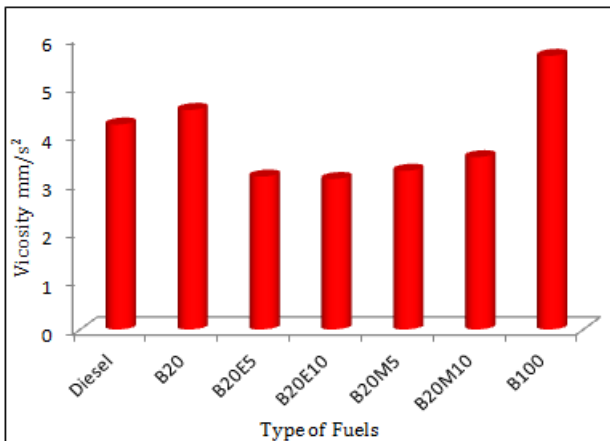


Fig.8 Viscosity values of B20 with alcohols

iii) Figure 9 shows the density of diesel, biodiesel; B20 and B20 with ethanol/methanol blend fuels. It is observed that the density of biodiesel is the higher at 0.878 kg/m³ and density of diesel is the lowest at 0.837 kg/m³. The removal of the glycerol from vegetable oil has significantly reduced the density biodiesel fuel and it is 4.92% higher than diesel fuel. Increase in biodiesel percentage in diesel fuel increases the density of blend

fuel and mostly conventional diesel fuel and biodiesel have very similar density values.

iv) Figure 10 represents the acid values of fuels tested. It is observed from the figure that the acid value for biodiesel is at 0.3 and for diesel is lower at 0.24mg KOH/g. The acid values of B20 blend with ethanol/methanol increases and are much higher than biodiesel. B20 blend with ethanol increase in acid value and decreases where as with methanol increases. The acid values of B20 blend with ethanol/methanol at 5% and 10% obtained are 0.54, 0.52 and 0.69, 0.75mg KOH/g respectively.

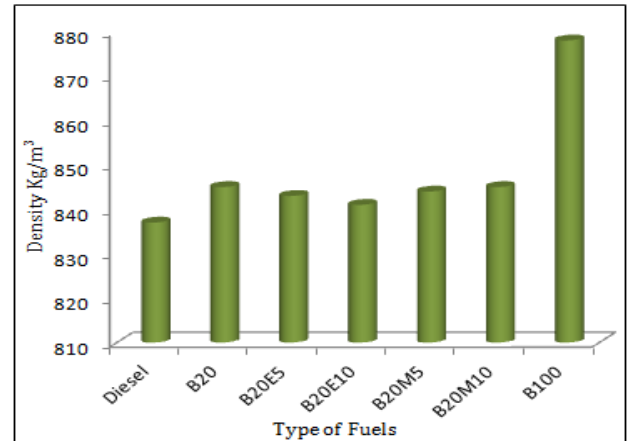


Fig.9 Density values of B20 with alcohols

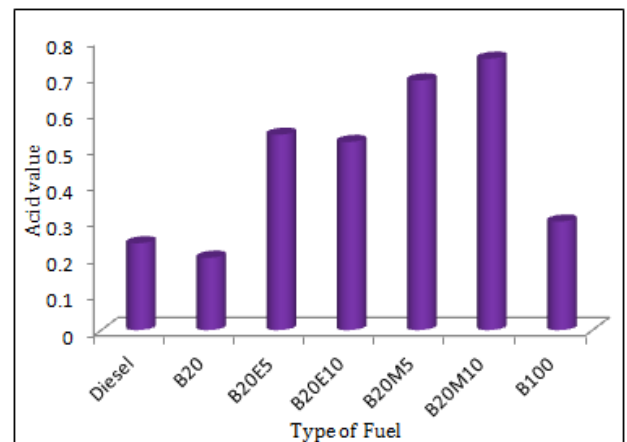


Fig.10 Acid values of B20 with alcohols

v) The Cetane number of biodiesel is significantly very high when compared to mineral diesel. Figure 11 shows that the Cetane number of different fuels tested. The observation from the figure is that the mineral diesel has the lowest Cetane number of 71.6 while the biodiesel (B100) has the highest value at 98. The Cetane number is found to be increased when the percentage of biodiesel in the blend is increasing. This is because of the fatty acids distribution or fat in the original oil. The longer the fatty acid, carbon dioxide (CO₂) chains and the more saturated the molecules, the higher the Cetane number value.

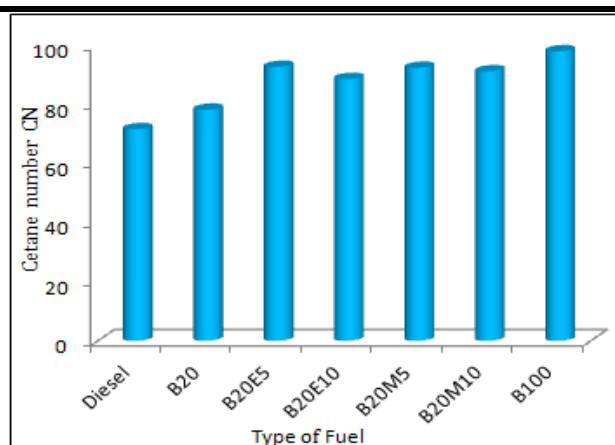


Fig.11 Cetane number values of B20 with alcohols

V. CONCLUSION

The following conclusions are drawn after studying the properties of biodiesel and its blends with ethanol and methanol as compared with diesel fuel.

- Blend fuels of biodiesel (B20) with ethanol or methanol has decreased density and viscosity than diesel fuel.
- Small quantity addition of ethanol or methanol in 5% and 10% by volume diluted the blend fuel significantly hence the viscosity and density were reduced at the cost of increase in flash point and Cetane number.
- The reduction in properties improves the engine operation in terms of performance, combustion and emission characteristics with these blend fuels.
- Blend fuel can be stored easily with higher flash point, but initially high temperature is required to burn in the combustion chamber.
- The blend fuel Cetane number is higher with low viscosity, which enhances the burning rate to improve power output of the engine.

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Evaluation of the planning of pedagogical actions in the fundamental school

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Abstract — Currently, the construction of knowledge forces a new posture of the teacher in Elementary Schools, requiring a broader view and interaction in the various areas, where knowledge management becomes mandatory. This article aims to evaluate the pedagogical management applied in a fundamental school with about 250 students, located in Rio de Janeiro, Brazil, using interviews and questionnaires with teachers. With this research it was possible to conclude that teachers perceive the existence of several conditions that favour the creation, dissemination and socialization of knowledge, considering the good professional relations existing between the teachers who work in the classroom and the pedagogical team.

Keywords — pedagogical management, pedagogical actions, fundamental education, structured interview, questionnaire.

I. INTRODUCTION

The current globalized world is dominated by organizations in their most varied fields. In every organization there is a management, whose role is to organize the institution according to its predetermined objectives, its values and its mission.

Chiavenato [1] defines the organization as social units, thus composed of people who work together, and who exist to achieve certain objectives. These objectives may be related to profit, commercial transactions, education, public services, charity, leisure, etc. He points out that, at present, the life of human beings is intrinsically linked to organizations, because all human activities are carried out within them.

Still in the Chiavenato [2] vision, the concept of management has evolved considerably throughout the twentieth century. In terms of common sense, a person defines management as administration. Thus, the role of management in an organization is to manage business, people and resources to achieve the desired goals. It is the process of planning, organizing, directing, and controlling people to achieve organizational goals.

Libâneo [3], with his educational vision, emphasizes that for some authors the centre of organization and the

administrative process is decision-making, since it is the function of all the other functions of the organization, such as planning, the organizational structure, the direction, the evaluation. He defines management as action that involves the intentional and systematic processes of reaching a decision and making it work. In other words, it is the activity through which means and procedures are mobilized to achieve the objectives of the organization, basically involving the managerial and technical-administrative aspects, being, in this sense, synonymous with management.

This article aims at the analysis of pedagogical management in an Elementary School based on interviews and questionnaires to evaluate the work of teachers regarding the planning and application of innovative pedagogical actions. This school has about 250 students; it is located in Rio de Janeiro, Brazil, and its management is tied to the Federal Government.

II. CONTEXTUALIZATION

2.1-School management

Ikeshoji et al. [4] emphasize that, unlike a business organization, the social unit in which people are treated as human resources, a school organization is a social unit geared, essentially, towards human promotion and training. Since its main objective is education, the interaction between people assumes a prominent position. The development of the integral being occurs through the teaching-learning process.

The manager must understand this process very well in order to intervene. The manager's job is to deal with the knowledge and information that each of the stakeholders brings with them, such as their values, beliefs, competencies aimed at achieving the primary goal of the school, which is education. Thus, it should value the relationships among all involved in the school context, since it is in diversity that actions will be articulated seeking the greater goal.

In the view of Santos [5] and Bussmann [6], school management objectively, essentially plans, organizes, directs and controls – with the due comprehensiveness of an organization of a social nature – the services necessary

for education, including in its scope of action the school organization.

2.2-The function of the educational coordinator at school

According to Vasconcellos [7], the pedagogical coordinator should act as a supervisor and not as a supervisor or controller of teachers. He or she should act as an element of school management, that is, an articulator of the pedagogical work in the school, who works with the general directorate of the school and the teachers, discussing with them the problems and possible solutions for the improvement of teaching-learning. The pedagogical coordinator must be questioning, valuing the collective, the cooperation and the interaction between the teachers, encouraging them and subsidizing them with elements that contribute to the growth of the team and the development of a quality and innovative work. The pedagogical coordinator has the knowledge management tool, conditions that will favour the creation, socialization and dissemination of knowledge, dialogue and social interaction among the professionals involved that can lead them to plan and implement pedagogical actions innovative factor, a competitive advantage factor for this institution compared to other schools in the region.

2.3-Pedagogical innovations

Education, in this context of constant changes, faces numerous challenges and cannot remain static in traditionalism or concentrated on outdated values. Figueiredo [8] emphasizes that it is precisely in this context that school systems are insufficient both in their ability to renew themselves and in the preparation of future generations for a world in which creativity and innovation have become primary differentiation factors. Often the actors involved in the educational process themselves are afraid of constant changes and tend to keep the various segments fixed and balanced. However, it is imperative that these challenges be overcome. It is necessary, then, to provide opportunities for innovations to be implemented. The practices of reflection and stimulation between teachers and pedagogical managers must be permanently encouraged and applied.

According to Carbonell [9], innovation is understood as a series of interventions, decisions and processes, with some degree of intentionality and systematization, which attempt to modify attitudes, ideas, cultures, contents, models and pedagogical practices.

For Alencar [10], some factors converge to establish an innovative process: in addition to the creative potential and the knowledge domain on the part of the individuals involved, a motivating environment so that the ideas can be realized and the material resources that enable its implementation are fundamental.

Ferreti [11] describes what he calls pedagogical 'innovations': the pedagogical experiences and research that emerge as alternatives to the problems and needs faced by a teaching system. Such as:

- Pedagogical innovations related to the curricular structure corresponding to the proposals of curricular organizations that promote the integration of contents or objectives;
- Innovations in teaching methods and techniques, which concentrate the attempts to produce educational change, probably because they are those that the teacher has more control over and, therefore, provide more opportunities to act. Such modifications refer to those structured teaching methods that aim to encourage students to use their intellectual abilities, to exercise reflective thinking in problem-solving and decision-making;
- Under the didactics vision, innovations are related to the creation of teaching methods or techniques that favour the integration of content and the social integration of students, as well as stimulating the participation of students at levels other than the intellectual;
- Innovation in instructional materials and educational technology for individualized teaching, in addition to the development of audio-visual resources for educational purposes and the use of educational technology in order to make content learning and the development of intellectual skills more meaningful;
- Innovations in the teacher-student relationship are related to the intentional willingness of the teachers to maintain contact with the students based on cooperation, the stimulation of their capacities and the challenge to participate, in which the teacher is considered a facilitator of learning;
- Innovations in educational evaluation refer to the continuous nature of data collection, to the diversification of the dimensions to be evaluated, to the instruments and techniques employed, and to enable the verification of the mastery of the skills necessary to carry out complex activities.

III. METHODOLOGY

The research was carried out in a Fundamental School, located in Rio de Janeiro, Brazil, with 250 students and 48 teachers. The approach chosen to conduct this research was a mixed (qualitative-quantitative) approach, given that there was analysis of non-measurable data and others measures that can be analysed by the use of statistical instruments.

Thus, a structured questionnaire was developed with clear and objective questions, to guarantee the uniformity of understanding of the interviewees. However, not everyone was able to participate as respondents. The

sample, then, corresponds to the 33 questionnaires returned (68.75% of the questionnaires applied). In addition, 16 semi-structured interviews were carried out, covering teachers from the different disciplines offered to students, including class teachers who work in pedagogical coordination and orientation. Planning opportunities were analysed in the weekly meetings of teachers with the pedagogical team, and the subsequent implementation on campus of innovative pedagogical actions.

This technique was also used because during the interviews, doubts that could exist on the part of the respondents could be clarified, guaranteeing a greater veracity to the data collected. In addition, the respondents were able to express their vision in a more complete way, explaining it in more detail.

IV. RESULTS AND DISCUSSION

Regarding the pedagogical team, 54.5% of the teachers already worked in pedagogical teams of other institutions, 36.4% of the teachers worked only in the observed campus team and 9.1% did not declare this information. From the qualitative data obtained, a content analysis was performed. Quantitative data were analysed statistically with percentage frequency. In the replies of the questionnaires and interviews, one can see recurrent words: ‘discussion’, ‘exchange’, ‘sharing’, ‘collective’, ‘participation’, ‘dialogue’.

Figure 1 shows the respondents’ perception regarding the quality of the relations between the teachers working in classroom:

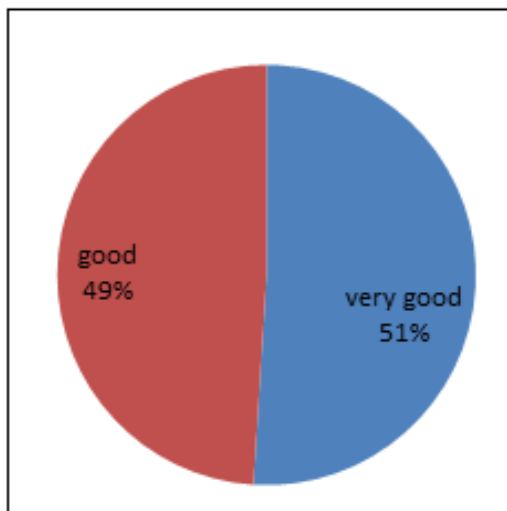


Fig. 1: Perceptions of respondents on the relationship between teachers. Source: Elaborated by the authors based on the questionnaire answers.

Figure 2 shows the respondents’ perception of the quality of the relationship between teachers and pedagogical staff.

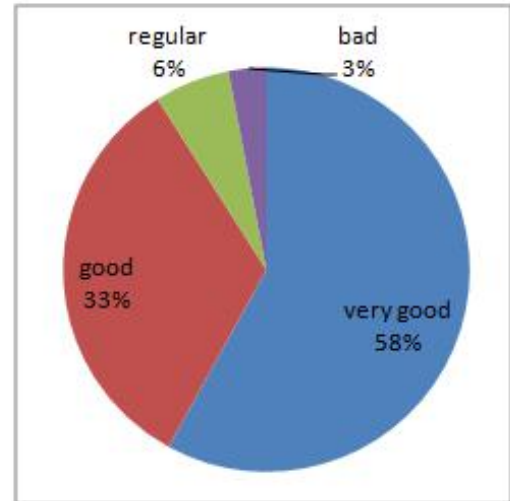


Fig. 2: Perception of the respondents regarding the relationship between teachers and pedagogical staff. Source: Elaborated by the authors based on the questionnaire answers.

Teachers working on the campus were questioned whether, in their view, in the planning meetings there are moments when innovative pedagogical actions are planned. The result of the survey is shown in Figure 3.

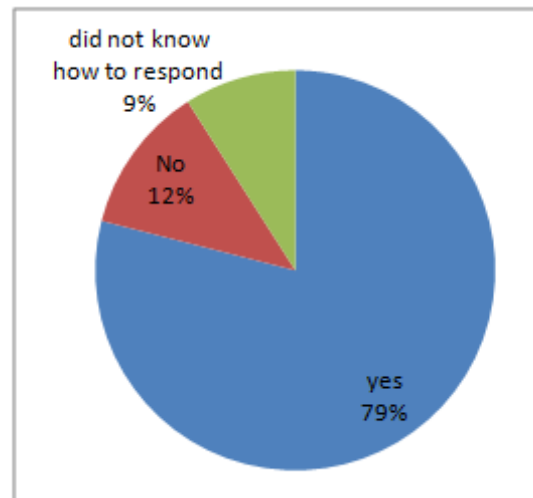


Fig. 3: Perception of respondents about the planning of innovative pedagogical actions in the meetings. Source: Elaborated by the authors based on the questionnaire answers.

Teixeira [12] points out that, in the conceptualizations of innovation in education that he researched, he perceived a constant relationship between this and pedagogical mediation, understood as the teacher’s performance between the student and his / her learning. In this line, innovation is related, then, to the introduction of new materials, resources, activities and new techniques related to pedagogical action / practice, in order to achieve new objectives / results.

Most of the teachers who answered the questionnaires and all those who were interviewed (79% of the respondents) understood that the pedagogical actions collectively planned by the teachers who act in the classrooms with the pedagogical team and were then implemented in the school are innovative pedagogical actions. This is because they are planned with the involvement of all the teachers who work with the classes, seeking the organization of the pedagogical work by projects, in order to guarantee an interdisciplinary approach, i.e. that the contents and objectives are integrated. In the view of Chimendes et al. [13] with pedagogical practices based on the practice of inter-, multi- and trans-disciplinarity, it is possible to contribute to an autonomous society, transforming tacit knowledge into explicit knowledge to serve as a basic tool for social development, sharing and incorporating new technologies.

The student body is actively involved in the process of their learning because the work developed aims at the social integration of students since the faculty understands that the students' active participation in this process implies more meaningful learning.

It is also important to highlight the social inclusion at school of the Nucleus of Attention to People with Special Needs (NAPSIN). The core coordinator guides teachers on strategies for working with students with specific needs, both the regent teachers and those who interact with these students in the classroom, as well as those who perform specialized educational assistance [14].

The teachers have several audio-visual resources, in addition to two computer labs, in which computers are used by the students weekly. In the classes of Educational Informatics, there is the presence of a teacher of the discipline, as well as the teacher who taught the class. The work done in these classes is also the result of integrated planning among these professionals. Research is encouraged by the teachers to be carried out by the students, often in the school itself, as a way to increase their knowledge. Educational technology is used by teachers to make content learning and the development of intellectual skills more meaningful to students.

In the research conducted by the questionnaire and semi-structured interviews, the following pedagogical actions were planned and implemented on the campus of the school:

- The semi-annual General Plans are meetings held with all teachers who work with a given year of schooling and the pedagogical team. In these meetings there is the sharing of suggestions on the part of all the teachers of different disciplines, aiming at the construction and accomplishment of a more integrated and interdisciplinary work;

- The Language Workshops project developed by the teachers of the campus, which provided the opportunity for more 'playful' work, exploring the different languages, but addressing as a priority the contents of Portuguese language and mathematics;
- Music education project that implements the practice of musical instruments using the songs known by students;
- Various institutional projects involving family members and integration with students;
- Development of specific competitions with the themes of Brazilian literature, music, geography, history and the environment;
- Development of the Science subjects using Environmental Education as a starting point, connecting the contents to the theme, which favours an interdisciplinary approach and also allows students to engage with a current theme and totally according to their interests. The work seeks to bring them to the awareness of the care that the environment requires for the maintenance of life on Earth, in addition to leading them to a change of attitude towards this environment that is reflected in their daily lives: avoiding waste of water and electricity; reusing the materials considered as rubbish and using parts of food that would be thrown away in order to reduce the production of rubbish; and developing conscious consumption among children, among other actions;
- The use of songs and poems in the science laboratory as a form of motivation to consolidate students' knowledge of science;
- Development of theatrical pieces involving everyday situations and the environment;
- Development of pedagogical excursions to the neighbourhood supermarket with the aim of developing of knowledge of measures of mass, volume and the monetary system;
- The video creation project, coordinated by teachers of visual arts, in which children create videos from a contemporary conception of how they see the world;
- Some mathematics activities made with games, videos and manipulative materials that facilitate the students' understanding of the contents.

V. CONCLUSIONS

Based on the research carried out, the following conclusions were reached:

- Teachers point to the existence of an environment favourable to the exchange of experiences in planning meetings culminating in the growth of all participants. A good dialogue-based work environment enhances interaction among teachers;

- Effective knowledge among groups favours the development of school work, serving as an extension of planning meetings;
- Most of the teachers who answered the questionnaires and all the teachers interviewed understood that the pedagogical actions planned collectively by the teachers with the pedagogical team and then implemented in the school, are innovative pedagogical actions. This is because they are planned with the involvement of all the teachers who work in the classroom, seeking the organization of the pedagogical work through projects, in order to guarantee an interdisciplinary approach and the integration of contents and objectives.

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The Effect of Time Budget Pressure and Task Complexity on the Performance of Government Internal Auditors with Emotional Intelligence as Moderation Variables

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Abstract— This study is intended to test contingency theory and the theory of self efficacy with the aim of analyzing the effect of budget time pressure and task complexity on auditor performance; emotional intelligence as the moderation variables. This research was carried out in the province of Gorontalo which included the Financial and Development Supervisory Agency, the Provincial Inspectorate, the Municipal Inspectorate of the Province of Gorontalo. The sampling technique with purposive sampling method with the number of samples as many as 120 respondents with the criteria of respondents who have functional position certificates for auditors and or respondents who have been assigned to conduct financial checks. The unit of analysis used in this study is individuals. Data analysis technique used is SEM with Smart PLS software.

The results showed that the budget time pressure had a negative and insignificant effect on auditor performance. task complexity has a positive and insignificant effect on auditor performance, emotional intelligence moderates the relationship of budget time pressure positively to auditor performance and emotional intelligence moderates the relationship of task complexity negatively to auditor performance. The performance of government internal auditors can be explained together with variables of budget time pressure, task complexity and emotional intelligence which is shown by the value of R^2 equal to 0,431 (good), while other variables are not explained in the model of 56.9%

Keyword — Complexity of task, time budget pressure, emotional intelligence, auditor performance.

I. INTRODUCTION

Mardiasmo (2005) suggests that there are three main aspects that support the creation of good governance, namely supervision, control and examination. The application of the State Financial Examination Standards (SPKN) must be carried out by the government internal auditors in every inspection carried out on government institutions. With the implementation of these standards, it is expected that it will guarantee the quality of the audit, the reliability, credibility and reliability of the information reported by the government's internal auditors.

Issue happens in government internal auditors showed that: the role of internal auditors of government as a supervisor, supervisors, examiners and review financial management system has not been effective and the maximum, as the previous assertion in Annex I Regulation of the Head of BPKP Number Per-1633 / K / Jf / 2011 Technical Guidelines for Increasing Capability The Government's Internal Supervision Apparatus shows that this condition illustrates the role of internal government auditors that have not been effective. Therefore, the effectiveness and maximization of government internal auditors in carrying out their functions or roles depends on the performance of the auditor, considering the auditor has an important role as an assessor of the adequacy of the internal control structure, assessing the effectiveness of internal control structures, and work quality assessors.

Larkin (1990), Trisnaningsih (2007) states that to measure the performance of auditors, there are four

personality dimensions, namely the ability (*ability*), professional commitment, motivation and job satisfaction. Kalbers and Forgarty (1995) suggested that auditor performance as an evaluation of work performed by superiors, co-workers, themselves, and direct subordinates with 3 (three) measures namely quality of work, quantity and timeliness. Fanani, *et. al* (2008) states that the achievement of better auditor performance must be in accordance with standards and a certain period of time, namely: quality of work, quantity of work and timeliness of completion of work De Angelo (1981) suggests that audit quality is the auditor's ability to detect errors in reports finance and report it to users of financial statements.

Supervision and inspection will be more effective and maximum if supported by the capabilities or expertise and attitudes of the auditor. The ability or expertise referred to by the author here is emotional intelligence. Emotional intelligence is the ability to recognize one's own feelings and feelings of others, motivate yourself, and manage emotions well in yourself and in relationships with others. With good emotional intelligence a person can act decisively able to make good decisions even though they are in a depressed state, besides that with emotional intelligence a person can show his integrity (Goleman, 2001).

In addition to the ability or expertise support the auditor has to improve his performance is the attitude of the auditor. Attitude is a vehicle for guiding auditor behavior. The auditor's attitude can be shown from his motivation to improve performance. Motivation is a desire that arises in the auditor that causes the auditor to act. The auditor's motivation is influenced by various factors whether it comes from the organization, individual or work environment, for example the budget time and task complexity

Budget time pressure task complexity audit activities can influence auditor attitudes, intentions and behavior. Time limitations may cause high levels of stress and affect auditor attitudes, intentions and behavior. Tekanan time budget is a constraint that arise because of time constraints or limitations of the resources allocated to carry out the assignment (DeZoort & Lord, 1997). Some results of empirical studies conducted by Coram *et al.* (2003), Donnelly *et al.* (2003), and Pierce & Sweeney (2004) found that auditors who experience time pressure tend to take actions that reduce audit quality so as to reduce the auditor's performance. Auditors working with budget pressure overload can degrade performance (Alderman and Deitrick 1982; Arnold *et al.*, (1997) and lead to various serious consequences for individuals and organizations (Cooper *et a l.*, (2001), McNamara and Liyanarachchi (2008) .

In addition to budget time pressures, auditors often face complex audit assignments that may affect their performance (Tan *et al.* , 2002). This is because auditors are often faced with many tasks, and are different, and are interrelated with each other. Task complexity is an unstructured, confusing, and difficult task (Sanusi and Iskandar, 2007). Jamilah *et al.*, (2007), complexity is the difficulty of a task that is caused by the limited capability, and memory and the ability to integrate problems that are owned by a decision maker.

II. FORMULATION OF THE PROBLEM

After looking at the background, the problem in this study is: the performance of government internal auditors. Effective and maximum functions and roles of government internal auditors are influenced by several factors including: individual factors and tasks. Individual factors include emotional intelligence, while the task factor is budget time pressure and task complexity. From the main problem, it can be identified the following research questions:

1. Does the time budget pressure affect the auditor's performance.
2. Does the complexity of the task affect the performance of the auditor.
3. Does emotional intelligence moderate the influence of budget time pressure on auditor performance
4. Does emotional kcerdasan moderate the influence of task complexity affecting auditor performance

III. LITERATURE REVIEW

Performance Auditor

Kalbers and Forgarty (1995) suggested that 3 (three) performance measures are work quality, quantity and timeliness. The Fanani, *et. al.* (2008) stated that the achievement of better auditor performance must be in accordance with certain standards and time periods, namely: 1) the quality of work is the quality of completion of work by working based on all abilities and skills, as well as knowledge possessed by the auditor; 2) the quantity of work is the amount of work that can be completed with targets that are the responsibility of the auditor's work, as well as the ability to utilize work supporting facilities and infrastructure; 3) timeliness is the accuracy of the completion of the work in accordance with the time available. De Angelo (1981) suggested that audit quality is the auditor's ability to detect errors in financial statements and report them to users of financial statements. The opportunity to detect errors depends on the competence or ability of the auditor, while the auditors' courage to report errors in the financial statements depends on the auditor's independence. Competency is measured from the auditor's

ability, for example the level of experience, auditor specialization, audit hours, and others.

Time Budget Pressure

Audit time budget is an estimate or estimated time allocated for the implementation of audit tasks in an assignment (Fleming, 1980). Budget time pressure is one factor that can affect auditor performance. The time pressure felt by the auditor in the implementation of the audit program can affect the auditor's behavior in the implementation of the audit program. Akers and Eton (2003) suggested that if auditors feel there is a budget time pressure in carrying out audit tasks, then the auditor might act (i) carry out audit procedures as they should, but manipulate time records by not reporting the actual audit time used for carrying out audit tasks. In this case the auditor overcomes the time budget constraints by conducting behavior *under reporting time*. (ii) do not conduct audit procedures as they should, but auditors claim that they have performed audit procedures as they should, in this case the auditor overcomes the perceived time budget constraints.

Task complexity

Task complexity can affect auditor performance. Jamilah *et al.* (2007), Fitriany *et al.* (2010), states that the complexity of the task is the difficulty of a task caused by the limited capability and memory and the ability to integrate problems that are owned by a decision maker. Bonner (1994) states that within the scope of audit work, it is very important to pay attention to the complexity of the task because it can have an impact on the performance of the audit judgment, and an understanding of the complexity of the audit task can help managers make task decisions to be better that is useful in decision making.

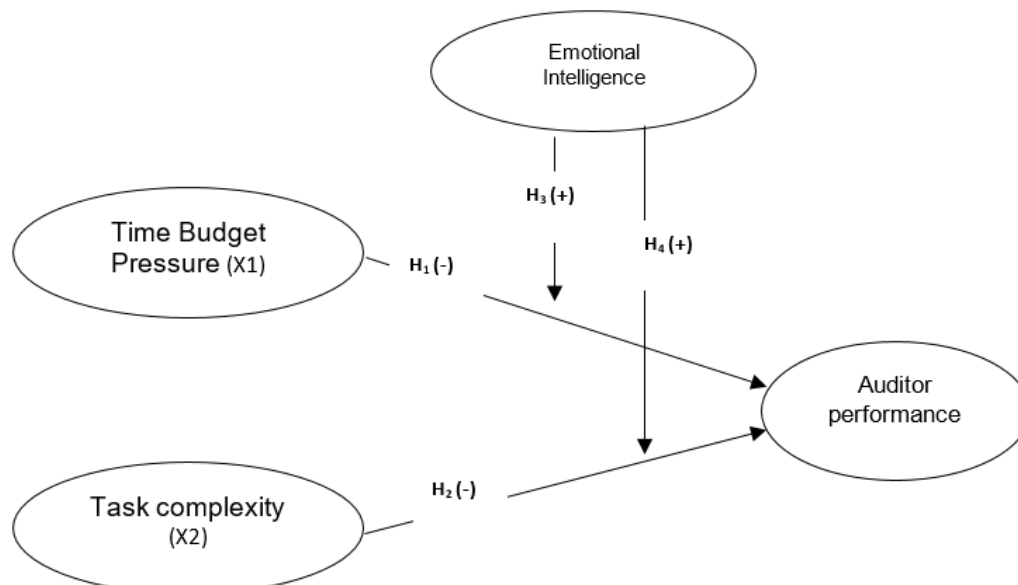
Emotional Intelligence

Emotional intelligence can affect auditor performance. Intelligence is the power of adjustment that is fast and precise, either physically or mentally to new experiences, making the experience and knowledge that is already available to be used when faced with new facts or conditions. Emotional intelligence (EI) is a person's ability to detect and manage emotional instructions and information. Huy (1999) states that *emotional intelligence* can help direct someone (employees) to change and adapt to their workplace. Likewise Cameron's study (1999) found that *emotional intelligence* can be a good predictor of the success of one's life both in the field of economics, life satisfaction, success in friends, and satisfaction in family life, including the achievement of work goals compared to *intelligence* quotient (IQ.)

Emotional Intelligence (EI) is an intelligence that refers to the ability to recognize one's own feelings and feelings of others, the ability to motivate yourself, and the ability to recognize emotions well in yourself and in dealing with others (Goleman, 2001). Salovey in Goleman (2007) classifies emotional intelligence into five main areas known as components of emotional intelligence, namely: Identifying self emotions, Managing emotion, Motivate yourself, recognize other people's emotions (*empathy*) and foster relationships with others.

IV. CONCEPTUAL FRAMEWORK

The performance of government internal auditors is influenced by variables of budget time pressure, task complexity and emotional intelligence as moderating variables. Therefore, in this study a conceptual framework can be made which shows the relationship between variables to be studied as in the following figure :



Picture.1: Conceptual Framework

V. RESEARCH HYPOTHESIS

5.1 Relationship The Time Budget Pressure to the performance auditor.

The audit time budget is useful as a basis for estimating audit costs, allocating personal audits on specific tasks and as a basis for evaluating the auditor's personal performance. The audit time budget is an estimate or estimated time allocated for carrying out audit tasks in an assignment (Fleming, 1980). The audit time budget is prepared by estimating the time required for the implementation of each stage of the audit program at various auditor levels.

Some previous studies related to the audit time budget with performance, among others: research by Broberg, Pemilla, *et al.*, (2016), Ettredge *et al.*, (2008), McNair (1991), Gundry & Liyanarachchi (2007), Otley & Pierce, (1996) shows that the relationship between budget time pressure and audit quality is negative, arguing that the time budget pressure (TBP) is the biggest cause of a decrease in audit quality.

Research Muslim Al Kautsar (2016) shows that budget time pressure has the potential to reduce auditor performance in carrying out audit tasks. In principle, dysfunctional audit behavior is influenced by several factors, one of which is the pressure of budget time. Budget time pressures can cause pressure on auditors to complete audit tasks and encourage auditors to perform dysfunctional audit behavior. This proves that compliance is still low for audit standards and weak implementation of audit procedures that are not performed optimally because the time budget provided in audit planning is very strict.

Kelly and Margheim (1990), Otley and Pierce (1996) and Pierce and Sweeney (2004) find that there is a linear relationship between budget time pressure and dysfunctional behavior. Likewise, Zohreh Hajih, and Elaheh Khodamoradi (2016), Svang & Ohan (2013), Peytcheva (2008), Gundry *et al.* (2007), Pierce & Sweeney (2006), Jang-Hua & Hui-Lin (2005), Lightner & Leisenring (1983), Arabsalehi *et al.* (2011), (Mahdavinia & Hosseyninia (2015), and Purheydari *et al.* (2015) which showed that there was a negative and significant relationship between *time budget pressure* and audit quality, and a positive and significant relationship between *time budget pressure* and URT.

Study Azad (1994) also shows that the budget inducing time of internal auditors reacts negatively to the audit through *premature sign-off*, *underreporting* time, and overriding the audit program, thereby reducing the effectiveness and efficiency of the internal audit function. From the description above, the hypothesis in this study is:

H₁: Pressure time terhadap budget adversely affect the performance of auditors

Relationship The complexity of the task to the performance auditor.

The complexity of the task is unstructured, confusing and difficult task (Sanusu and Iskandar, 2007). The complexity of audit assignment is one of the factors that can affect audit quality. According to Libby and Lipe (1992) and Kennedy (1993) stated that the complexity of audit assignment can be used as a tool to improve the quality of work. It may affect the auditor's efforts to achieve quality audit results by improving the quality of work.

Previous research has found that performance in general will reduce due to increased task complexity (Simnett, 1996; Tan *et al.*, 2002). Further Restuningtias and Indartono (2000) and Prasita and Adi (2007) concluded that increasing complexity in a task or system can decrease the level of task success. The Marganingsih and Martani (2010) study concluded that the complexity of the task does not affect the auditor's performance. Kasim Research (2014) states that the complexity task has a significant effect on auditor performance. The complexity of the task means much or no information to be processed and the success of the steps taken to process the information provided by the complexity of the auditor to deliver good performance. The higher the complexity of the task facing the stages that must be passed by the auditor in carrying out the examination. Tan and Kao (1999) also noted that the complexity of tasks associated with accountability can also improve employment outcomes. Based on the above description, the hypothesis in this study are:

H₂ : The negatively affects task complexity of the auditor's performance.

Emotional intelligence moderates the relationship of budget time pressure to auditor performance

Emotional intelligence is the ability to recognize the feelings of yourself and others to motivate yourself and manage emotions well in us and our relationships. This ability is complementary and different from pure academic abilities, namely pure cognitive abilities measured by Goleman (2001) *Intellectual Quotient (IQ)*.

An auditor who is faced with budget time pressure tends to reduce his performance, but if the auditor is able to use and utilize his emotional intelligence well then the goal can be achieved. Research related to emotional intelligence with performance is Yu-Chi Wu (2011), the results showed that the effects of emotional intelligence had a positive impact on performance and moderated this relationship. In this case, very emotionally intelligent employees are more likely than employees low emotional intelligence to be able to reduce or change the negative effects of work stress on performance.

Afifah, *et al.*, (2015) the results of his research show that *self efficacy* and *professional ethics sensitivity* have a positive effect on auditor performance while role conflict negatively affects auditor performance. These findings indicate that auditors with high levels of *self efficacy* and high levels of ethical sensitivity professionals will produce high performance. Conversely, role conflict will reduce auditor performance. Furthermore, the data of this study prove the moderating role of emotional intelligence on the relationship between role conflict, *self efficacy* and *professional ethical sensitivity* on auditor performance.

Based on the description above, it can be emphasized that emotional intelligence can influence performance directly but can also act as a moderating variable (strengthen or weaken other variables on performance), so the hypothesis formulation in this study is:

H₃ : Emotional intelligence moderates the influence of budget time pressure on auditor performance

Emotional intelligence moderates the relationship of task complexity to the performance of the auditor

An auditor who is faced with complex tasks is his performance, but if the auditor is able to use and utilize emotional intelligence, then the goal can be achieved. Research Nafsiah (2014) shows that an auditor with an emotional intelligence will be able to influence the auditor's performance with a significant influence of 10%. an auditor has self-awareness, self-regulation, self-motivation and social competence consisting of empathy and social skills and an auditor will be able to work well and professionally so that the resulting performance will be better and as expected. Patria (2016), his research findings show that the interaction of roles conflict and emotional performance on auditors.

Based on the above description, it can be asserted that emotional intelligence in addition to affect performance can also act as a moderating variable with the task complexity variables, so the hypothesis formulation in this study are:

H₄ : Emotional intelligence moderates the effect of complexity on the performance of the auditor's task.

VI. RESEARCH METHODS

The research method used is a survey method using exogenous variables namely budget time pressure and task complexity, moderating variables namely emotional intelligence and endogenous variables namely performance variables. The respondents are the financial auditor of 120 people who are certified auditor functional position. Primary data collection through questionnaires The unit of analysis used is individuals with the analytical method used is the structural equation modeling Partial Least Square (PLS).

VII. RESULTS AND DISCUSSION

7.1. Research result

Evaluation of structural model testing by looking at the R² value of the relationship between constructs. The R² value states that variations in endogenous constructs can be explained by exogenous constructs which are identical to the magnitude of the contribution of the exogenous construct to the endogenous construct. From the results of data processing, it can be seen the value of R² as in the following table:

Table.1: Structural Model

Variable	R-square	Information
Budget time pressure		
Task Complexity		
Emotional Intelligence		
Emotional Intelligence *		
Budget Time Pressure		
Emotional Intelligence *		
complexity of tasks		
Auditor Performance	0.431	Good

Based on the table above shows that the auditor's performance 43.1% can be explained jointly by variable time budget pressure, task complexity and emotional intelligence both directly and interact with budget time pressure and task complexity.

From the evaluation results of the outer model (*measurement model*) and structural model (*inner model*), it can be described in the structural model path as follows:

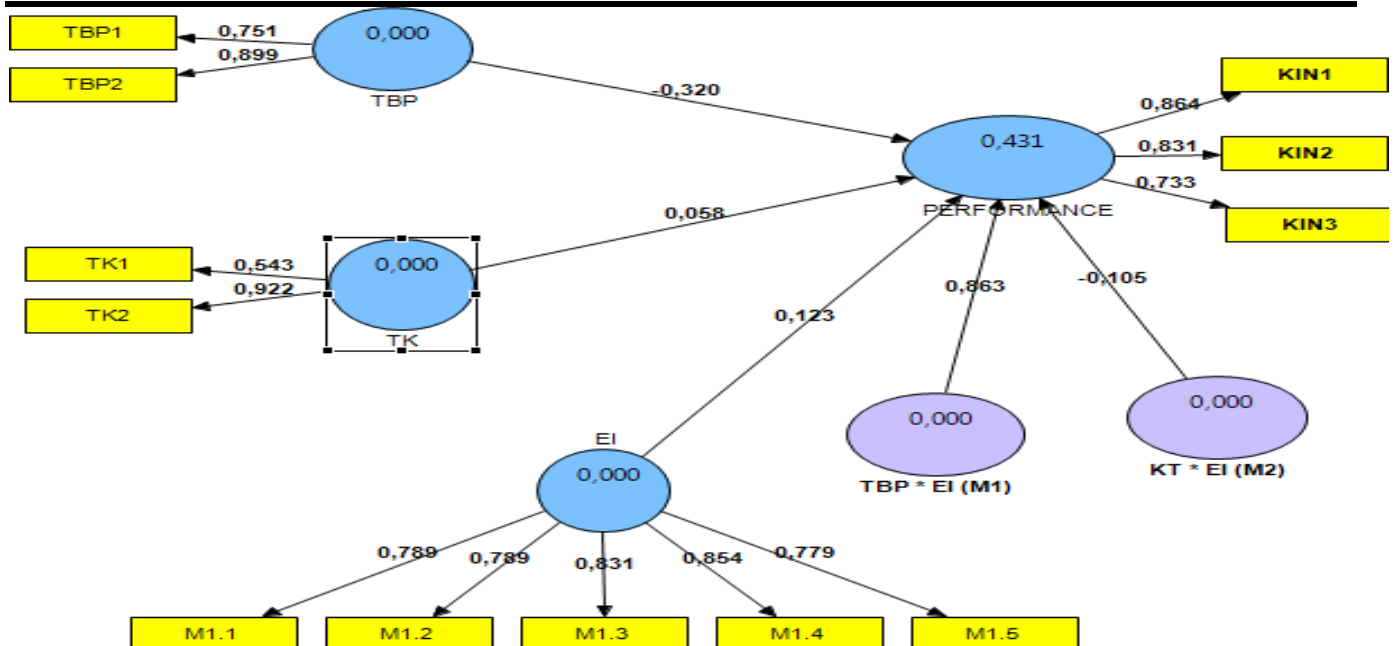


Fig.2: Results Estimated effect of budget time pressure and task complexity on Auditor Performance; Emotional Intelligence as Moderating

From the results of the outer model evaluation (*measurement model*) and structural model (*inner model*), it can be seen the magnitude of the relationship between exogenous and endogenous variables and the significance test of significance in the following table:

Table.2: Value of the Inter-Variable Relationship Coefficient

Construct	Supply Relationship Coefficient	T_Count	T_Tabel	Information
TBP -> Performance	-0. 320	1.96	0.518	Not significant
TK -> Performance	0, 058	1.96	0.132	Not significant
IE (M) -> Performance	0.123	1.96	0.271	Not significant
TPB * EI (M1) ->Performance	0.863	1.96	0.941	Not significant
Kindergarten * EI (M2) ->Performance	-0.105	1.96	0.123	Not significant
R ² <- TBP, TK, EI, TPB * EI, TK * EI	0.431	1.96	0,000	Model accepted

Information

*) Significance at the level of 5% (0.05)

7.2 . Discussion of Research Results

7.2.1. Time Budget pressure has a negative effect on auditor performance

The variables of budget time pressure empirically show a negative relationship to the performance of government internal auditors, with a coefficient of -0.320. This finding indicates that the higher the budget time pressure will result in a decrease in the performance of government internal auditors. The budget time pressure felt by the auditor in the implementation of the audit program can affect the auditor's behavior in the implementation of the audit program, among others, can override some audit procedures and dysfunctional behavior so that the quality of the audit is reduced.

The main contributing factor to the negative time budget pressure on the performance of government

internal auditors is the tightening of budget time in this case that when auditors carry out audit assignments with limited time can reduce audit quality, then internal government auditors feel disturbed in carrying out their duties so that they do not seem can work optimally, then the role of the government's internal auditor feels heavy in carrying out assignments so that it needs to require sufficient time in accordance with the assignment.

The second cause is the achievement of budget time in this case that the government's internal auditors force themselves in completing their work on time because they have to follow the planned time, so that internal government auditors rarely reach the target *time budget* in conducting audits. Besides that, it was caused by the limited number of internal government auditors in Gorontalo Province (not comparable with the availability of the number of internal auditors of the government with

the number of audit targets). There fore the role of internal government auditors is required to be able to make efficiency on budget time. In addition, the internal auditor in carrying out the role should be allocated time or budgeted for each work unit of the regional apparatus must be rational with the objective of inspection and supervision. Likewise from the element of capacity, it is necessary to increase the number of internal auditors considering that the number of internal auditors is still very limited in the Province of Gorontalo when compared to the number of *auditees* who are subjected to the object of examination.

This study supports the theory of *self efficacy* proposed by Bandura (1970) which states that *self efficacy* beliefs influence people's choices in making and carrying out the actions they pursue. Individuals tend to concentrate on tasks that they feel capable and trustworthy can solve and avoid tasks they cannot do. *Efficacy* beliefs also help determine the extent to which an effort will be deployed by people in an activity, how long they will be persistent when facing obstacles and how resilient they will face unsuitable situations. So, in difficult situations, we feel that individuals who have low self-efficacy tend to reduce their efforts or give up, while high-effectiveness individuals will try harder to overcome challenges.

This study supports previous research conducted by Broberg, Pernilla, *et. al.*, (2016), Ettredge, *et al.*, (2008). McNair (1991), Gundry & Liyanarachchi (2007), Otley & Pierce (1996), his research findings show that there is a negative relationship between budget time pressure and audit quality, arguing that *time budget pressure* is the biggest cause of audit quality deterioration. Similarly, research by Azad (1994), his research findings indicate that budget time pressure induces internal auditors to react negatively to auditing through *premature sign-off*, *underreporting* time, and overriding audit programs, thereby reducing the effectiveness and efficiency of internal audit functions.

Zohreh Hajih, and Elaheh Khodamoradi (2016), his research findings indicate that there is a negative and significant relationship between *time budget pressure* and audit quality. Penelitian Muslim Al Kauthar (2016) shows that the pressure of the budget period that could potentially reduce the performance of auditors in performing audit engagements. This is also in line with the research of Shaun M. McNamara and Gregory A. Liyanarachchi (2008), whose research findings suggest that there is an inverse relationship between the time budget pressure on the quality of audit practices (RAQPs). Cahyaningrum, *et al* (2015), his research findings indicate that compliance pressure has a significant negative effect on audit decisions.

Wagnor and Cashell (1991) research shows that 48% of respondents agree that *time pressure* has a

negative impact on auditor performance and 31% of respondents admit that excessive *time pressure* will make the auditor stop the audit procedure. The same results were also obtained by Conram *et al* (2003) in Piter (2008) which states that where auditors tend to prefer information that is considered most important under time budget pressure, this will cause the planned testing not to be fully implemented. Likewise Sari's (2017) research shows that the *time budget pressure* variable has a negative influence on auditor performance in KAP, this shows that the increased *time budget pressure* will reduce auditor performance.

However, Rizal's research (2016) shows the difference with previous research which shows that time pressure has no effect on audit quality, this means that auditors in conducting audits despite the time reduction (time emphasis) have no effect on audit quality. The non-influence of time pressure on audit quality shows that the Public Accountant Office (KAP) strongly safeguards the reputation or name of the company and also safeguards the existence of sanctions contained in Law No.5 of 2011 concerning Public Accountants.

Based on the results of the research and empirical evidence above, shows that the implications of this research variable is that with the time budget pressure which includes the level of budget tightening and the level of achievement of the budget given to the government internal auditors in carrying out their functions and responsibilities tend to deviate several procedures - audit procedures that can potentially reduce the quality of audits so as to reduce the auditor's performance in carrying out his duties and his role as examiner and supervisor.

7.2.2. Task complexity has a negative effect on auditor performance

The results showed that the complexity of the task had a positive and insignificant effect on auditor performance with a *coefficient* of 0,058. These results indicate that task complexity tends to improve the performance of functional auditors in Gorontalo Province. Contributing factor is that the tasks are handled by the internal auditor of government in Gorontalo generally *audit repeat* and *penugasan* audits tend to be structured or too difficult where the internal auditor governments tend not mengala mi difficulty in assigning aud it like working with aud the matter to get auditeddocuments / information and evidence that is relevant to audits .

The results of this study are in line with the theory of *self efficacy* (Bandura, 1970) which states that *self efficacy* beliefs influence people's choices in making and carrying out the actions they pursue. Individuals tend to concentrate on tasks they feel

capable and trustworthy can solve and avoid tasks they cannot do.

This study supports previous research by Rustiarini (2013), the research findings indicate that the complexity does not affect the performance of duties as auditor. In this case the auditor has realized that the work carried out in a public accounting firm often has a high task complexity considering the auditor must test the fairness of a company's financial statements and issue an opinion on the financial statements. The existence of business competition also requires auditors to work as efficiently as possible in accordance with a predetermined time budget.

Research by Tan *et al.* (2002), found that auditor performance may not be influenced by the increasing complexity of the task when the auditor has high knowledge and accountability, or has low knowledge and accountability. Research Marganingsih and Martani (2010) concluded that the complexity of the task does not affect the performance of auditors, it is because the complexity of the task according to the perception of auditors to vary where some audit tasks can be considered to be very complex and difficult, while other tasks are relatively easy (Jiambalvo and Pratt in Bonner and Sprinkle, 2002)

Zulaikha (2006) states that the complexity of the task has no significant effect on the accuracy of judgment. Research Chung *et. al.*, (2003) in Jamilah *et. al.*, (2007) which states that task complexity does not have a significant influence on decision performance. Jamilah *et. al* (2007) also showed similar results that the complexity of the task did not significantly influence audit judgment, meaning that the auditors knew clearly what tasks they were going to do, did not experience difficulties in carrying out their duties and could do their tasks well. Likewise, research by Restuningtias and Indiariono (2000), Prasita and Adi (2007) concluded that increasing complexity in a task or system can reduce the success rate of tasks

But in research Bonner's (1994), The question shows that the increase in task complexity causes a decrease in performance appraisal. research Cahyaningrum, *et al* (2015), finding shows that the complexity of the task has a significant negative influence on the decisions of the audit. The more complex audit assignments given to junior auditors, the more difficulty they have to determine the client's misstatement potential. Junior auditors are more difficult to collect evidence, process and evaluate information. Difficulties increase potential errors and ultimately inaccuracies in making audit decisions. The refore, examination decisions under high task complexity will show a low level of accuracy of audit decisions under low-complexity tasks.

Based on the results of research and evidence emp slices on top, indicates that the implications of the variables of this study is that the complexity of the task facing internal control apparatus governments tend to reduce performance, but if the complexity of the task is high on the current auditors have the knowledge and high accountability tends not to reduce performance. This study contributes that the determinants of the performance of government internal auditors are clearer when describing the conditions under which performance is affected by complexity and task conditions where performance may not be sensitive to the complexity of the task. The refore internal auditor in Gorontalo Province should always be given strengthening knowledge, competence and capacity in carrying out duties as supervisors, examiners, reviewers and mentors in regional financial management.

7.2.3. Emotional intelligence moderates the influence of budget time pressure on auditor performance.

Referring to the research data, the interaction of emotional intelligence variables with budget time pressure on the performance of internal auditors with a *coefficient* of 0,863 which indicates a positive relationship. These results indicate that the higher emotional intelligence influences the higher influence of budget time pressure on the performance of internal auditors, which can be seen from the height of recognizing one's own emotions, managing emotions, motivating oneself, recognizing the emotions of others and building relationships with others. internal auditor performance. Because direct emotional intelligence does not have a significant effect and its interaction has no significant effect on auditor performance, the emotional intelligence variable in this case is a potential moderating variable, which is a potential variable to be a moderating variable that has the strength of the relationship between predictors and dependent variables. (Ghozali, 2013)

Emotional intelligence interacts positively with budget time pressure on auditor performance, the cause is the limited time at the time of audit assignments for government internal auditors, the auditor can adjust conditions with the team and be able to adapt to the work environment, can control the situation, control emotional yourself, can recognize emotions with colleagues and the auditee, and can maximize the competencies and skills they have in conducting the examination. The insignificance of emotional intelligence interacting with budget time pressure on the auditor's performance is the main contributing factor is the strengthening of emotional intelligence not maximized because training in the form of emotional intelligence is still at the level of echelon 1 (one) and 2 (two) or at the *top management* level.

The results of this study are in accordance with *contingency* theory. Internal auditor as government

auditors in an effort to improve performance when faced with time constraints, the auditors in carrying out their duties trying to adjust to the conditions of the tasks carried out and adapt to the work environment when faced with adverse conditions allow so that the role and function of the auditor internal government remains in maximum condition. The essence of this theoretical approach is that the auditor's performance is not optimal in the organization if the task is limited by time but not followed by emotional intelligence. With the interaction of emotional intelligence with time pressure related to the audit carried out by internal auditors, it will have the ability to think abstractly, and can adapt and motivate themselves in solving problems correctly.

This study supports the research of Lu Kangyin (2009) which shows that the emotional intelligence of employees or some aspects of emotional intelligence can improve their performance positively. The four dimensions of emotional intelligence have a significant positive effect on performance. This indicates that the emotional intelligence of employees has a prominent influence on performance.

Erisna, Nuria, *et al.*, (2012), that emotional intelligence has a positive effect on auditor performance in industrial companies in Bandar Lampung. His research findings indicate that with emotional intelligence which is a skill that can influence a person to succeed can deal with demands, meaning that people who have good emotional intelligence have the skills to achieve success. Emotional intelligence also turns out to be able to foster self-motivation. Self motivation is one dimension of emotional intelligence, self motivation is the ability to realize and use self-motivating sources to face failure and try to get up. Furthermore, this research data proves the moderating role of emotional intelligence on the relationship between budget time pressure and auditor performance. Emotional intelligence can improve auditor performance even in uncomfortable situations.

Research Sari (2017) that spiritual intelligence is able to moderate the relationship between *time budget pressure* on auditor performance. This finding is also in line with Huy (1999) stating that *emotional intelligence* can help direct someone (employees) to change and adapt to their workplace. This is also shown by Cameron (1999) found that *emotional intelligence* can be a good predictor of the success of one's life both in the field of economics, life satisfaction, success in friends, and satisfaction in family life, including the achievement of work goals compared to *intelligence quotient* (IQ).

Wu *et.al* (2014) study that the emotional intelligence of employees in working towards an organization can reduce conditions that are less likely (the level of team conflict) as a result of team cohesion. Ashlea (2009) also argues that in all approaches to conflict management, emotional intelligence of service

staff, their level of attention to others and attention to customers towards others is an important factor for successful conflict resolution and prevention.

Findings Nasser (2011) show that emotional intelligence has a positive effect on performance. This study recommends that experimental studies be conducted to compare performance before and after providing training on emotional intelligence so that a clear picture can emerge. Pooya (2013) says that emotional intelligence is negatively associated with problem solving and negotiation strategies. But there is no significant relationship between emotional intelligence and control strategies. This was also stated by Gamero (2008) saying that conflict relations fully mediate the relationship between task conflicts and influential teams. Team member interaction about team issues moderates the relationship between task conflict and relationship conflict, so that when interaction with team members is low the relationship increases.

Mc.Grath (2013) research shows that for the frequent emergence of conflict in teams caused by the presence of low emotional intelligence so that the conflict in work frequency of emergence is always repeated. This is also stated by L. Melita (2003) that *emotional intelligence, leadership, effectiveness and team outcomes* are interrelated with one another, but emotional intelligence is dominant in handling individual stress.

Thus the implications of this research variable indicate that with the existence of emotional intelligence possessed by internal auditors if faced with budget time pressure, the internal auditors will be able to compensate for the decline in work quality. High budget time pressure on the internal auditor environment requires a high emotional intelligence as an indicator that he is able to suppress personal and team emotions, is able to motivate themselves and foster relationships with others so that it has an impact on handling performance improvements.

7.2.4. Emotional intelligence moderates the influence of task complexity on auditor performance.

Referring to the research data, the interaction of emotional intelligence variables with task complexity variables on the performance of internal auditors with a *coefficient* value of -0.105, which indicates a negative relationship. These results indicate that the lower emotional intelligence influences the lower influence of task complexity on auditor performance, which can be seen from the high level of recognizing one's own emotions, managing emotions, motivating oneself, recognizing the emotions of others and fostering relationships with others. internal. Because emotional intelligence was not directly significant effect yet and interaction had no significant effect on the performance of auditors, then the variables of emotional intelligence in this regard is the

potential moderating variables, namely variables as potential moderating variables that have a strength of the relationship between predictors and the dependent variable. (Ghozali, 2013)

Emotional intelligence interacts negatively with the complexity of the task on auditor performance, the cause is that in conditions that are less likely in this case the complexity of the task at the time of audit assignments for government internal auditors, the auditor has not been able to maximize in adjusting conditions with the team and not maximally adapt to the environment work, not maximal yet in reversing the situation, it has not been maximized in exercising emotional control of yourself, it is not maximized in recognizing emotions with coworkers and auditees, and not being able to maximize the competencies and skills they have had in conducting an examination. The insignificance of emotional intelligence interacting with the complexity of the task on the performance of internal auditors is the main contributing factor is the strengthening of emotional intelligence not maximized because training in the form of emotional intelligence is still at the level of echelon 1 (one) and 2 (two) or at the *top management* level.

Emotional intelligence interacts negatively with the influence of task complexity on auditor performance, this shows that the *contingency* theory approach has not made a real contribution to improving auditor performance.

This research is in line with Wu *et al* (2014) states that performance is indirectly influenced by emotional intelligence, but emotional intelligence between parts of the organization have a positive effect on performance. Study Chen (2014), which shows that emotional intelligence creates a positive effect on the work structure in an organization. On the other hand, emotional intelligence does not have a direct influence on performance but plays a moderate role. This shows that emotional intelligence is the determinant of work, and that the quality of communication functions as a mechanism by which this influence is present in an institution. Emotional intelligence can be combined with the construction of other groups to predict performance. Empirical facts also show that existing performance fully mediates the relationship between emotional intelligence and performance and communication.

Research by Naseer *et al*, (2011) that emotional intelligence plays an important role in improving team performance. Sometimes, employees engage in positive and negative emotions, it is important for them to understand, analyze their own emotions as well as others, use them in an effective way, and organize them in such a way as to give them maximum benefits rather than harm. Emotional reactions provide useful insight into where interest can be focused, while emotions that are not

managed can inhibit effective information processing. Beam (2012) suggests that as a person's total EQ score increases, so does the assessment of his team's cohesion. This is also supported by the findings of Brown (2002) which shows that emotional intelligence with stable mastery can improve performance in organizations.

Another case with previous research by Afifah, *et al* (2015) shows that auditors with high levels of *self efficacy* and high levels of ethical sensitivity professionals will produce high performance. Research Holt and Jones (2005) suggest that the role of emotional intelligence in the success of organizations, consultants, practitioners, and researchers can improve the quality of the work and life for the individual as well as improving the effectiveness of the organizational arrangements.

Research by Noor and Sulistiawaty (2010) which shows that emotional intelligence which includes: emotional skills, emotional skills, and emotional values and beliefs together (simultaneously) significantly influence auditor performance. Where the model test results show that emotional skills, emotional skills, and emotional values and beliefs have a significant influence on the auditor's performance in the direction of positive influence.

Research Patria (2016) states that role conflict and emotional intelligence interactions have a significant effect on auditor performance. This is due to the role conflict which is a psychological symptom experienced by the auditor that arises because of two contradictory demands that cause work discomfort which can potentially reduce overall performance, but through good emotional management, the auditor's performance will remain stable and maintained, so that auditors will remain resilient, able to survive in situations of conflict and good interpersonal relationships. This also happens to auditors if faced with complex tasks in terms of difficult tasks and unstructured tasks will certainly lead to work discomfort which can potentially reduce overall performance, but through good emotional management, the auditor's performance will remain stable and stay awake, so that auditors will remain resilient, able to survive in situations of conflict and good interpersonal relationships.

Cahyaningrum, *et al* (2015), his research findings show that the interaction between pressure adherence and task complexity significantly influences audit decisions. Junior auditors who have experience with high obedience pressure and high task complexity show a low level of accuracy in determining the potential of clients misstatements that ultimately affect their audit decisions. In contrast, junior auditors with low compliance pressure and low-complexity tasks will show a high degree of accuracy in determining potential client misstatement so that their audit decisions are also more appropriate. But another fact stated by Hansenne (2008),

that emotional intelligence is assessed using a modified version of *schutte emotion al intelligence scale* and compactness with group *cohesiveness scale* .

This study proves the moderating role of emotional intelligence on the relationship between task complexity and auditor performance. Emotional intelligence can not always improve auditor performance, except if the situation is possible and accompanied by high knowledge . Thus the implication of this research variable is that the interaction of emotional intelligence possessed by the auditor when faced with a complex task, the internal auditor's performance tends to reduce performance, but this can show better if accompanied by high knowledge.

VIII. CONCLUSION, LIMITATION AND IMPLICATION OF RESEARCH

From the results of research and discussion, it can be noted the conclusions and recommendations were sebagai follows:

1. Variable budget time pressure has a negative but not significant effect on auditor performance, this is due to tightening of budget time in this case that when the auditor performs an audit assignment with limited time can reduce audit quality, then the government's internal auditors feel disturbed in carrying out their duties so that they do not seem can work optimally, then the role of the government's internal auditor feels heavy in carrying out assignments so that it needs to require sufficient time in accordance with the assignment. The second cause is the achievement of budget time in this case that the government's internal auditors force themselves in completing their work on time because they have to follow the planned time, so that internal government auditors rarely reach the target *time budget* in conducting audits.
2. Variabel task complexity positive effect but not significant to the performance of the auditor it is because p enugasan audits tend to be structured or too difficult, in which the internal auditor governments tend not mengalami difficulty in assigning aud it like working with audItan to get documents / information and proof of audits that are relevant to audits .
3. Emotional intelligence becomes a potential variable that influences the strength of the relationship of budget time pressure on auditor performance which shows positive but not significant. This is because emotional intelligence interacts with budget time pressure on auditor performance. The main cause factor is strengthening emotional intelligence not maximized because of training in the form of emotional intelligence. So far, it is still at the level

of echelon 1 (one) and 2 (two) or at the *top management* level .

4. Emotional intelligence becomes a potential variable that influences strength The relationship between task complexity and auditor performance that shows negative but insignificant is due to the fact that in conditions that are less likely in this case the complexity of the task at the time of the audit assignment to the government internal auditor, the auditor has not been able to maximize the conditions with the team and not maximally Adapting to the work environment, not maximized in reversing the situation, it has not been maximized in exercising emotional control of yourself, it is not maximized in recognizing emotions with coworkers and auditees, and not being able to maximize the competencies and skills they have had in conducting an examination .
5. Future research can be developed by expanding the number of research respondents and adding variables that can interact with emotional intelligence for example roles conflict and stress in improving auditor performance.
6. This research can provide guidance to local government management about the description of the relationship between budget time pressure and task complexity to auditor performance both directly and indirectly, and provide an overview of the interaction of emotional intelligence implications for performance.
7. This research is expected to provide further policy of existing mechanisms in the region to the wheels of government employees will always be able to manage his emotional intelligence so that it can improve performance
8. The impact of local government services on the public in upholding a good and clean government from corruption, collusion and nepotism.

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Coffee Production: An Analysis of Opportunities for Competitiveness

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Abstract— *This study involved rural properties of the Brazilian Cerrado, which are necessarily consistent with the requirements of good agricultural practices for quality, innovation, and technology in the production and management of properties. Based on the knowledge and information as value-added production factors, we sought to highlight the opportunities for improving competitiveness, and thus a review of the literature on competitiveness, knowledge, and information as a differential factor for production with added value, innovation, and territorial technology as well as entrepreneurship. With the data from the field study, the objective was to show how knowledge and information, applied in production and social capital, can leverage competitiveness. The analyzes carried out using AHP indicate that some initiatives already aid in the promotion of innovation and technology applied to production, making it necessary, however, to encourage knowledge and information among producers and other stakeholders collectively, for the best costs and results. They also point to the low concern of producers with training and other productivity improvement techniques, such as selective harvesting. Authenticated that the producers opt for the sale of their production via commodity, aiming to profit quickly. Reasons for this are, in the non-perception of value added (sales in commodity); in the absence of rural structure for the processing and harvesting of the coffee required for special sale; in the precariousness of collective export agents (cooperatives are dependent on traders) and deficiencies in management for positioning in the properties (most work in scale).*

Keywords— *Knowledge, Social Capital. value added.*

I. INTRODUCTION

Brazilian coffee growing over the years has survived numerous economic crises, which have resulted in severe losses to coffee farmers and the nation.

The monitoring of production costs and social capital, up to the mid-1990s, was not a constant

administrative activity in the processes of management of coffee growers, limiting the strategies of positioning in competitiveness.

At present, administrative management strategies point to a knowledge of production costs and synergy of the workforce with innovations and productive technologies, as factors for the decision-maker of the coffee grower, for the search for greater competitiveness and permanence in the marketplace.

In the productive context of coffee for the 21st century, increasing consumption boosts new markets or specific niches (market positioning) and, on the other hand, the search for new partnerships, better agronomic practices (irrigation, management, precision and integration) and create opportunities to reduce costs and risks in the production cycle.

The scale production characteristics for coffee plantations require effective cost controls, thus becoming a factor influencing the quality of the final product. However, there is little visibility in the perception of profit and empowerment for the producer when it comes to the production of special coffees with high added value for sale.

In Brazil, Arabica coffee is usually worked as a special quality coffee and receives added value when is sold. The total area planted in Brazil, with coffee cultivation (arabica and conilon) totals 2,223,464.1 hectares, for the 2016 harvest. Only for arabica coffee the area planted in Brazil amounts to 1,759,730.1 hectares, which corresponds to 79.13% of the existing area with coffee plantations (IBGE, 2017).

Minas Gerais has the largest Arabica production area, with 1,184,384 hectares, corresponding to 67.3% of the area occupied (UFLA / BUREAU, 2016). For the 2016 harvest, considering the two species (arabica and conilon), an average yield of 26.33 sc/ha is estimated, equivalent to a gain of 17.1% concerning the last harvest, (CONAB, 2017). Favorable climatic conditions in the main Arabica producing regions of Brazil, coupled with

the cycle of the positive biennial, favored crops and justify gains in productivity in most states.

The greatest productivity gains were observed in São Paulo, with 46.7%, Mato Grosso, with 39.4% and Minas Gerais, with 32.2%. According to data released by CONAB and UFLA, in 2016 the minimum price of coffee paid to arabica mining producers for 2016 was R \$ 490.73 / sc. In general, the coffee activity in Cerrado Mineiro received a great stimulus from governmental policies, be it in research, generating technological innovations, or in the financing and regulation of the market (FARINA, 1997).

In the Cerrado of Minas Gerais the irrigation of the agriculture, is predominantly obligatory in the production, differing of the other producing States. Because of the spatially differentiated productive arrangements, the use of both partial and total mechanical harvesting becomes an important tool for improving profitability.

A mechanical harvester harvests on average 60 sacks of coffee per hour, working 18 to 22 hours a day uninterruptedly, thus replacing approximately 120 workers in one day's service. As for the cost of production, for a mechanized and irrigated crop, according to experts, there is an average reduction of 30% in costs compared to the manual.

It is also important to emphasize that mechanical harvesting improves the quality of harvested coffee, not the same as for manual harvesting. Reason for this is that it is not feasible economically (manual and selective harvesting) to make a separation of the "cherry-coffee" (ripe fruit) and the green fruit (FUNDAÇÃO PRO CAFÉ, JACTO, 2004).

As Cerrado coffee cultivation develops in relatively flat areas, mechanization is present at all stages of production, from soil preparation, crop, phytosanitary and nutritional treatments, to harvesting (ORTEGA & JESUS, 2011).

The definition of climate stations constitutes the great trump of the Cerrado, allowing recognition as the first geographical designation of coffee production in Brazil and the World, according to the World Intellectual Property Organization. Irrigation has provided highly positive results on crop productivity, so it has observed that irrigation is increasingly by coffee farmers in the Cerrado and Brazil. (SANTINATO et al., 2008).

IBGE / CONAB - 2016 data indicate that the Cerrado region has a large influence on the volume sold of specialty coffee in Brazil, but there is still a gap between the quality differential of production and the respective sale as special coffee, directly by the producer. In this way, this study shows if the lack of knowledge and information (management) constitute the main barrier to

the exploration of opportunities for inclusion and differentiation in the coffee market for rural producers.

The objective of this article was to find evidence of the contribution of management and the adoption of good management practices in coffee production, identifying knowledge and management indicators that influence the differential in the product and create opportunities to increase the sale of value-added production.

II. THEORETICAL FOUNDATION

Recognized as the first geographical denomination of coffee in Brazil and the world, according to World Intellectual Property Organization rules, the Cerrado Mineiro has achieved with the use of irrigation, highly positive results in crop productivity, with product innovation, according to Santinato et al. 2008, every day more is used by coffee growers.

The process of globalization of the world economy, witnessed by the introduction of the environmental concept in the economy, has been responsible for the significant changes that have occurred in the economic, social and political activities of the agricultural sector. Is understood that this process is collective, guided by a set of forces and actors, such as government policies, technological progress and central management of production management (value chain).

Michel Porter, 1985 expands the context of an organization's value chain concept with the definition of activities focused on an "extended and collective" value system. Currently, these concepts permeate the value chains of suppliers, distributors, employees, shareholders, financiers, among others, such as APL's (LASTRES, and CASSIOLATO, 2005) and the exploitation of collective synergies among stakeholders (PRAHALAD, 2010).

Prahalad (2010) points out in his concepts that the globalized economy opens space for innovation and collective efficiency in companies, since a management process needs for its development and consolidation, to share tools for proposition and identification of solutions.

Already before Porter (1985), he introduced in his analyzes of business practices the results of collective efficiencies, such as the integration of the different forms of relationship, between organizational entities and human work networks, whether formal or informal, internal or outside.

In this way, PRAHALAD (2010), PORTER (1985) and SCHMITZ (2005) retake and introduce economic concepts, about gains with collective efficiency. It thought by Marshal (1920), for whom, often, these collective gains were in the value chain in an intangible way and represented by human capital (social capital).

Considering in this study that the indicators for environmental management and social capital are often intangible, the evaluation of impacts resulting from organizational, environmental and institutional interventions, are also in agreement with the current concepts of UTTING (2009). These concepts used in the analysis of the production of fair trade coffee in Nicaragua, where it was sought to recognize the relevant stakeholders and possibly conflicting interests to achieve competitiveness in agricultural production.

To complement the exploration of the influence and recognition of the components of efficiency, economies of scale and technological progress in organizations, competitiveness is understood to be a description of the capacity of a firm, a sector or a nation to remain competitive, and reflects the ability to protect and / or improve its position in relation to competitors operating in the same sector (BOJNEC, FERTŐ, 2009, LATRUFFE, 2010).

When analyzing opportunities, we highlight indicators that influence performance, improve the production management environment and consequently have a reflection on production in quality and value added.

The innovation principles of the Oslo Manual (OECD, 2005) were instrumental in recognizing evidence in organizational activities, with the ultimate goal of improving performance and gaining the market advantage.

Still in UNICAFFEE, 2017 are some opportunities for growth and differential in coffee production, divided into actions to dominate the indicators of climate change (emergence of new areas, vertical integration and development of new varieties of

cultivars), cost indicators production (stimulation of precision agriculture, mechanization and integrated and participatory management) and quality and market indicators (traceability, appellation of origin, certifications, production in terroir).

III. MATERIALS AND METHODS

In these analyzes the validation and improvement of the indicators and variables used obtained through the responses of the owners, technical consultants in technical assistance, to extrapolate the results and analyzes better.

To improve the validations, the AHP (Analytic Hierarchy Process) data analysis methodology, adapted to the sample, was used. The cerrado region was besides being the largest producer of Brazilian special coffees, and it has as an appropriate great use of techniques of management, mechanization, and irrigation in its rural properties. In addition to the owners' responses, technicians and technical assistance consultants were heard to extrapolate the results and analyze better.

The Cerrado Mineiro region, which is a determinant of data collection, is located in the State of Minas Gerais, Brazil, and is considered a vital coffee production area with differentiated quality.

The application of a questionnaire in five properties was instrumental in recognizing in the analysis of the results, evidence of the influence of knowledge management and training (producer and social capital) for competitiveness and the hierarchical importance dispensed in the management of production by the producer in his decision-making.

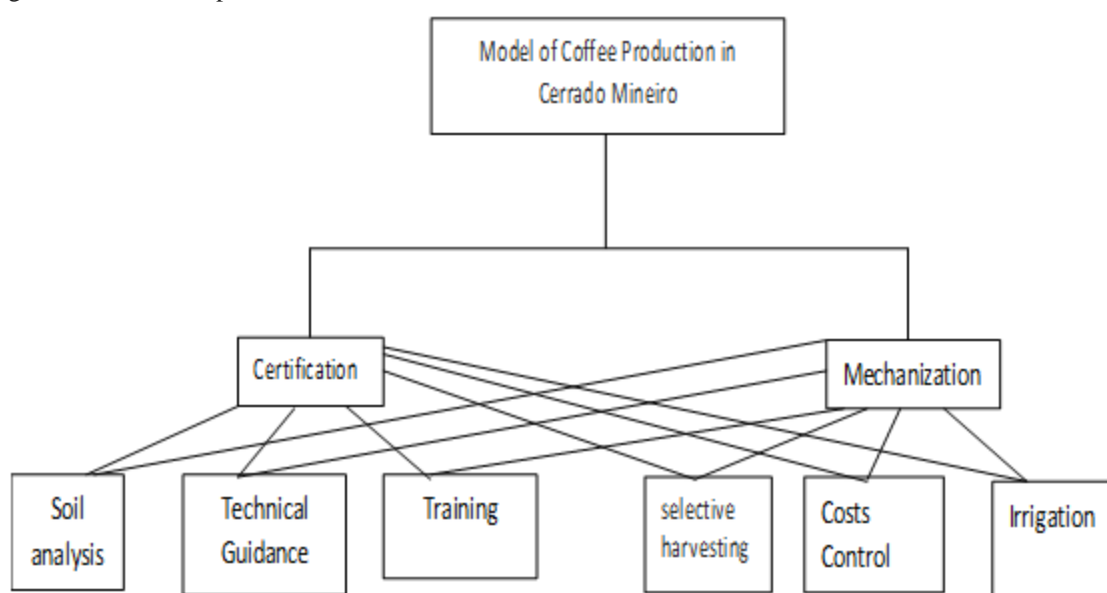


Fig.1: Model for Hierarchy Formation in Decision Making

Source: AHP

Firstly, a questionnaire was applied for AHP analysis, taking into account the non-individualization by alternatives of the production model, that is, the options for capacity and form of coffee production were considered similar in the four farms where the data collected.

In order to construct the hierarchical global consolidation and understanding of the priority decision making, in the four rural properties, the applied questions addressed comparisons between the indicators of certification and mechanization, sub-levels of indicators of soil analysis, technical guidance and training and selective harvesting, control of costs and irrigation, respectively, as visualized in (Fig.1).

The analyzes of the knowledge and information applied in the Cerrado Mineiro coffee production were carried out with a questionnaire composed of 64 questions grouped in three dimensions (analysis of coffee farms in Nicaragua by UTTING in 2009).

The socio-environmental and economic indicators of the questions divided into the management of the production environment, production management, social capital management, with analyzes of the general characteristics, implementation, innovation, technology and are of quantitative and qualitative scope.

The construction of the questionnaires of analyzes of economic, environmental and social capital performance (UTTING, 2009; LATRUFFE, 2010), encompasses the dimensions of environmental management (production, management, machinery and improvements), social capital management (quality of life, welfare and legal compliance) and economic management (ownership and characterization of the organization).

The indicators grouped in environmental management consists of 35 indicators, divided into the dimensions, of machinery and equipment management, production management and management, to show the characteristics of the production environment as to the quality of the presented conditions.

The economic management dimension was investigated with 17 indicators for property management and management, involving information on productive efficiency. It includes indicators on an income of the

establishment, the diversity of sources and the distribution of income among those involved in the productive processes among other data of compliance with good agricultural practices.

The third set, the social management dimension is composed of 12 indicators, to verify the consolidation of integration mechanisms among the actors of the chain for continuous improvement. Is because buyers and consumers of coffee, have demanded products with differentiated quality, in addition to preserving respect for the environment and social responsibility, requiring an effort of the producers to maintain their improvements continuously.

This third dimension also includes considerations on the quality of life of the residents of the property, access to education, essential services, characteristics related to quality and benefits, occupational safety and health, and employment opportunities at a qualified place.

To environmental, social and economic balance forces of the analyzes, the indicators grouped into 11 variables of each dimension (Fig 2). In the economic dimension, the indicators of the area of the property, planted area, total production in bags, productivity per hectare, cost per bag, cost per hectare, certification and quantity of sacks harvested, the percentage of coffee sold with added value, production by input and number of fixed employees.

The 11 indicators chosen for analysis of environmental management of machines and improvements, production environment and management and production, are formed by quantity of tractor, irrigation, amount of chemical fertilization, amount of organic fertilization, insecticide, fungicide, mechanically harvested area, orientation technique, cost control, number of plots, number of tables, soil analysis, selective harvesting.

In order to verify the social balance of properties, the indicators selected are: types of labor used and quantity, compliance with labor standards, housing and housing, access to safe drinking water and safety equipment, portfolio and social security registration, training, and training, heirs give continuity to the activity and children of employees remain in the activity.

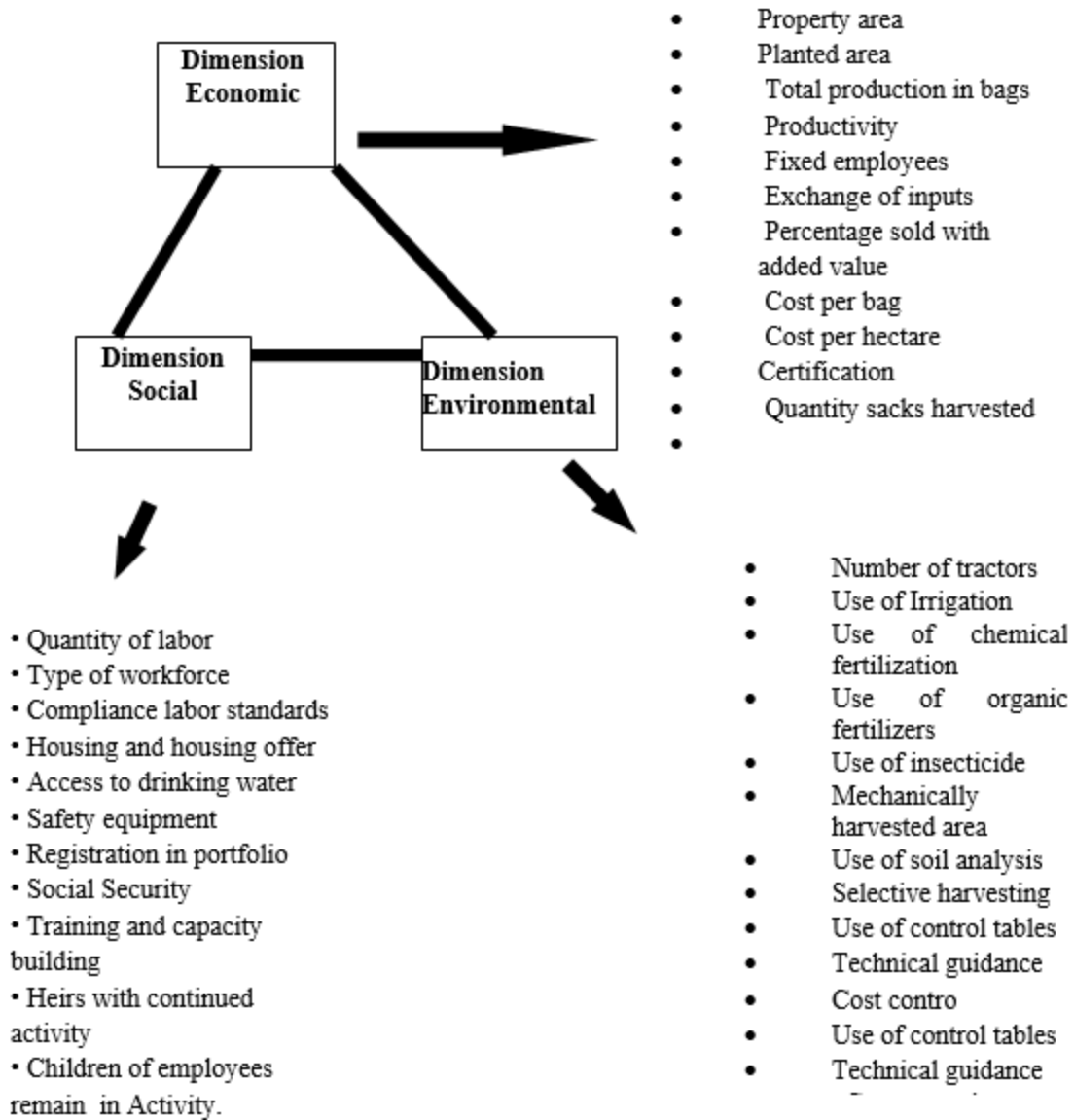


Fig.2: Equilibrium Analysis of Environmental, Social and Economic Forces

IV. RESULTS AND DISCUSSIONS

From the comparative analysis carried out between the data collected in the IBGE and CONAB database in 2016 and analyzes of the responses of the owners of the farms investigated, it inferred that. Although the Cerrado region has a significant influence on the volume sold of specialty coffee for Brazil, the differential for the sale of this production does not necessarily reach the producer.

To mainly because the producers sell their coffee as a runner (traditional sale), that is, they only do the first post-harvest harvesting. In this type of harvesting process, the selective separation of the grains with better quality not favored.

In Costa Rica, for example, a country where producers (from a given region) receive a collective processing unit from the government, for the 2015/2016

crop, 1,634,000 60-kilogram coffee bags were produced and 995 thousand bags exported.

In contrast, Brazil in the Cerrado Mineiro region produced 7,401 thousand coffee bags in the same period of 2015/2016, but the statistics show a weak performance in Brazilian exports of differentiated coffee, for the 2015/2016 harvest period, there is a total export of 2,170 thousand bags of coffee of 60 kilos, according to CECAFE, 2017.

While it is the case that Costa Rica exports 61% of the exceptional coffee, the Cerrado Mineiro exports only 30%. This finding is consistent with the evidence presented and analyzed in the data collection. When the value-added production sold, the surveyed farms are not in line with the average for the Cerrado of Minas Gerais.

Only one farm effective sales of coffee produced special type on the market, even so with 25% of

its production. Still only the 01 farm, uses 20 hectares of its area for other plantations, in the corn case.

The commercialization of the coffee produced in the runner (traditional) by the farms 02,03 and 04 and to a lesser extent by the farm 01, causes that the information about the quality of the coffee drink produced is often completely lost or ignored by the producer, and consequently not recognized as part of the remuneration received.

Thus it is common for the producer to perceive little incentive to produce high-quality coffees since besides not privileging the quality of his coffee, he still does not receive a remuneration that values and encourages it.

Although farms 02,03 and 04 refer to themselves as producers of exceptional coffee, a prioritization of the management of the properties for production in scale in the search for higher productivity is common to the three farms. In these properties, the production of differentiated and special coffee is sold to the market, together with the other grains harvested, without an improvement in the separation of the grains of a better sieve and lower defect.

When collecting data on the farms surveyed, the technical assistance areas (private or public), observe that the rural owner prefers to offer his total production to the market, rather than worrying about small differentiated lots and particular lots, even though aware of the need, benefits, and costs of innovation and technology applied to their properties.

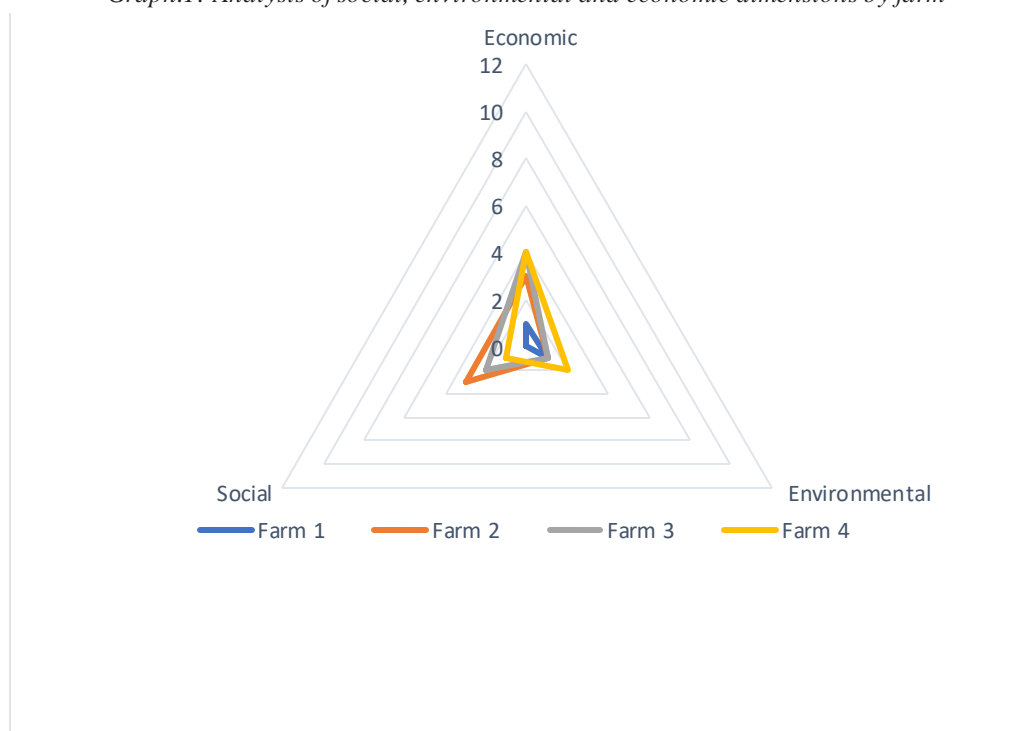
The economic management analyzes of the investigated farms do not observe considerable variations between the costs per bag, as well as the productivity per hectare in 2016, year of data collection. It can notice that the average productivity of the Cerrado (IBGE, 2016) is well above the Brazilian average, and the higher productivity is associated mainly with modern coffee cultivation, with appropriate use of irrigation, mechanization (favorable topography) and fertilization.

The production areas of farms 01 and 02 are equivalent in 42 ha, reaching productivity of 40 and 45 sacks per hectare. The productivity of farm 03 highlighted because it is a productive maturation period for the cultivar so that the negative biennium characteristic of coffee does not appear in this harvest of 2016 specifically.

In the analyzes for the determination of the balance between the social, environmental and economic dimensions, for the 36 indicators analyzed, Farm 01 accounts for 94% and Farms 02, 03 and 04 account for 80%. When analyzing the dimensions individually, it can see that there are opportunities for improvement in the economic dimension more markedly and environmentally, since they are further away from the zero reference axis, according to graph 1.

The application of the AHP model for coffee production in the region investigated characterized by harmony with the other analyzes of the data collected with the IBGE / CONAB 2016, as well as the responses of the rural owners to the analysis model of the balance of social, environmental and economic dimensions.

Graph.1: Analysis of social, environmental and economic dimensions by farm



Source: Prepared by the Author

In the comparative analysis between Certification or Mechanization (AHP), as an investment option, 26.2% of the owners indicated that they preferred to obtain certification and the remaining 73.8% recognized opportunities for improvement in the improvement of mechanization in their properties.

Is observed that in the priorities of the owners, cost control (44.5%) is the most critical variable and influence for their production and market decisions. The producers comply with the good agricultural practices that demand the attention of the consumer market, according to the answers to the questions about environmental and social management.

Soil analysis and technical assistance, both with 10.9% influence on the productive decisions of the owners in comparison to the priority given to the selective harvest (4.9%), which can provide higher quality for the beverage and grain produced. Fig. 3 consolidates the general priorities in decision making and their respective degree of influence for the owners and application in their management of the properties.

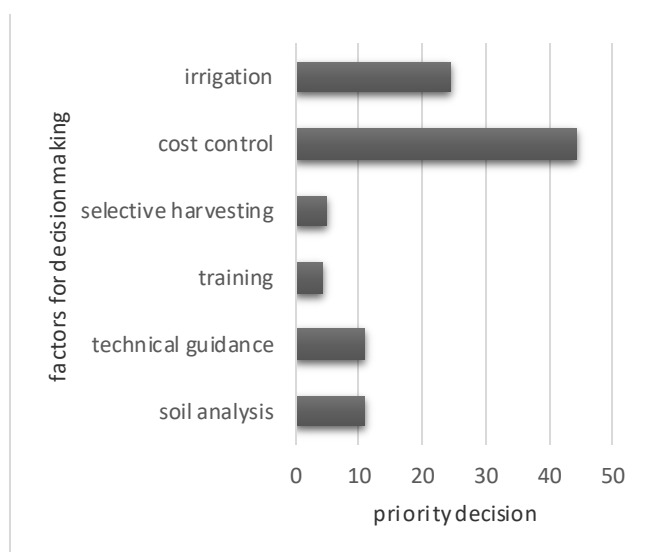


Fig.3 *Error! Reference source not found.*: Priority of Factors for Decision Making in Coffee Farms

Source: AHP

The analyzes of the social capital management of farms 01 and 02 show in the indicators of fixed

employees, tractors and crop worker small differences, which reflect the line of environmental management of the individual production of each property.

In these variables of social capital and technology the farm 01 (sells 25% of its production to the market of differentiated quality and price), presents differential of allocation for the costs of production, being that it has 20 ha of its total area with corn production.

However, in the analysis of the number of employees in farms 3 and 4, we can see a predominance of traditional and intensive labor, indicating a paradox, since we do not observe the full use of this intensive social capital when selling value-added or selective harvesting.

According to several authors and studies (SANTINATO et al., 2008, CONAB, 2016, IBGE, 2016, BRADESCO, 2016), the mechanized harvesting of coffee reduces, on average, 30% harvest costs about the manual.

It is important to point out that mechanical harvesting improves the quality of harvested coffee, not the case of manual harvesting, as it is not economically feasible to separate the "cherry coffee" (ripe fruit) and the green fruit. In the cerrado, the labor costs represent 40%, and the expenses with pesticides and fertilizers account for 22%. (BRADESCO, 2016).

Comparatively, in the southern region of Minas Gerais, the labor costs applied to the coffee crop account for 53% of operating costs and the use of pesticides and fertilizers for 24%. Labor costs are high because most of the harvest is manual, due to the topography of the region that makes operation with harvesters difficult. (BRADESCO, 2016).

As Cerrado coffee cultivation develops in relatively flat areas, mechanization is present at all stages of production, from soil preparation, crop, phytosanitary and nutritional treatments, to harvesting (ORTEGA & JESUS, 2011). It is possible to consider the 02 farm more intensive in mechanization and the farm 01 more intensive in social capital, respectively 25 fixed and crop employees against nine fixed and crop employees of the farm 02 (Table 1).

Table.1: Comparative Social Capital x Mechanization x Productivity

Indicators/2016	Farm 01	Farm 02	Farm 03	Farm 04
Fixed Employees	5	2	60	12
Tractors	1	3	26	5
Crop Employees	20	7	40	15
Total Production /scs	2100	1800	60000	3652
*revenue total/000R\$	1066900	883315	29443800	1792146

**revenue total 000R\$	294000	n/a	n/a	n/a
***loss of revenue		252000	8400000	511280
Production area/000/ha	42	42	1300	160
Productivity sc/ha	40	45	75	30

Source: search data

* estimated according to price index CONAB/CACCER

** estimated by the sale price informed by the farm 01, calculated as 25% of the production as value-added sales

*** by the non-sale of special coffee (at least 25%)

The use of labor-intensive can provide the opportunity for a selective harvest for lots of coffee, which add value.

As far as the perception of the proprietary farmers about their living standards and their collaborators, there was no statistically significant difference. The four farms comply with the basic standards of good agricultural practices, as well as interact in legal compliance with the benefits and obligations of their collaborators.

The improvements regarding knowledge and information, permeate the value chain of Brazilian coffee in a general and unique way.

V. CONCLUSIONS

The results recognized in the proposed analyzes indicate that the management of the production environment and social capital are dynamic differentials for the diversity, pioneering and entrepreneurship of the region in the search for and maintenance of quality production.

The application of the concept of the value chain allows us to find answers to the reasons why the rural landowner who uses technological advance (irrigation, mechanization, and BPA) in their production, at the moment of sale does not seek added value (to the product with differential quality).

The answers to the hypotheses of the work respond that: it is in the predisposition to the sale in the run spout and the non-perception of the added value to the product by the producer. Moreover, a second answer presents itself in recognized opportunities, when analyzing the balance of social, environmental and economic dimensions in the farms surveyed.

The analysis of the indicators of competitive advantage allows indicating opportunities for new sources and practices of business management, mainly in what concerns the evaluation and promotion of profitability in product sales, positioning in the particular and differentiated market. In the farms analyzed, the low predisposition for producing special coffee (with quality and consequently of lower value added), justifies the search for innovations, knowledge, and training applied to employees and along the value chain.

Is also noted that small actions to implement micro innovations to improve the routines and organization of the coffee farms researched, exploring the potential of the various stakeholders of the value chain in the processing and processing of coffee, can reverberate positively.

Higher availability of special grains, with improved costs and the remuneration of sales in specific lots, brings better prospects for the profitability of the business and consequently the quality of life of the community and the environment. From the standpoint of knowledge and capacity building of the social capital of the analyzed farms (owners and labor), there are opportunities for initiatives of competitiveness and product quality.

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Learning Strategies in a Municipal Public Health Organizational Environment

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Abstract— This study focuses on learning strategies in municipal public health administration of the environment in the Municipality of Porto Velho, Brazil. Ali bureaucracy focuses on the predictability of institutional operations, to enable the achievement of efficiency and organizational efficiency. The question to be answered is: What learning strategies fit into this scenario for improving the service offered? The general objective is to analyze the learning strategies in the body of a Municipal Health work environment to verify their existence and use. The task here is based on Piaget's Theory of creativity, and the concepts of other authors committed to organizational learning. This research was characterized as descriptive, with quantitative approach, basic in nature, Case Study prepared by Method. The sample consisted of 52 servers in crowded health body searched; We used a questionnaire to collect

data. It was proved the internal consistency by Cronbach's alpha coefficient. The research concluded that the Extrinsic reflection, Interpersonal Help Search, and Help Search for Material Written, relate significantly with demographic variables: gender, age and income. It also concludes that the servants are in the majority, use these strategies for the implementation of work. This document concerns the public managers committed to the efficiency of their results from learning your team. We used a questionnaire to collect data. It was proved the internal consistency by Cronbach's alpha coefficient. The research concluded that the Extrinsic reflection, Interpersonal Help Search, and Help Search for Material Written, relate significantly with demographic variables: gender, age and income. It also concludes that the servants are in the majority, use these strategies for the implementation of work. This document concerns the public

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Keywords—Administration. Learning. Efficiency. Strategies. Public administration.

I. INTRODUCTION

The public organizational environment is still inserted in the bureaucratic issue, that is, searching predictability of its operation to obtain greater efficiency and organizational efficiency, mainly through your body servers. In this context, it seeks to understand how the learning strategies fall, for improvement of the service offered.

The target learning mechanism of the organization is the server, which is the essential gear of public administration and is responsible for apprehending and acquire knowledge, and then process it efficiently and effectively. Therefore, it is interesting to identify the strategies and understand them so that it can acquire and extract knowledge and apply it in the workplace.

In this conception arises the interest of researching how public organizations learn and how to pass on such knowledge through learning strategies that can be embedded in the organization, and also the existing demographic variables. Faced with this vector, it was chosen as analytical scope to municipal secretary of health old Port. The complex bureaucracy, facing a reality of rapid change, calls for a new organizational vision before public bodies in this way it is evident that knowledge is a feature which can provide greater efficiency effectiveness that this scenario requires.

The understanding of knowledge as a form of strategy depends on the value of their human capital. Given the above, the survey was conducted in order to answer the

following issues: What are the learning strategies used in the servers desktop in health body searched?

II. OBJECTIVES

This study has the general objective to analyze the learning strategies in servers working environment of a municipal body health Porto Velho, Rondônia, Brazil. And has as specific objectives to identify the demographic profile of the body of the servers in the study (1), describe the learning strategies used by the servants of the body studied (2), and correlate the learning strategies identified with demographic variables (3). The motivation this study arose from the need to check the current status of the servers that make up public bodies are in relation tract learning, since their activities involve standards detailing its implementation, making it repetitive and routine, or be,

III. THEORETICAL-CONCEPTUAL REVIEW

Pantoja (2004, p.109) who was prompted by the search for new knowledge to conceive research on the relationship between learning strategies and organizational environment and individual variables, which is one of the research objectives.

This theme "learning strategy" is very challenging way, because today public organizations are routine in short, the object of the research and analyze the way that knowledge is being passed on in these organizations. In the perception of Fleury and Fleury (1997) and learning as a process that is constantly changing, resulting from practice or experience already contained, it should come or not to manifest itself in a noticeable change in behavior.

The organization man is moved by his capture of knowledge, this prism realize that this ability to learn enables its development. Upon this many scholars built their theories analyzing how humans acquired knowledge, and its capitation vector learning. Early theories have been leveraged by Learning Psychology, their main chains are Behaviorist (Skinner), Cognitive (Piaget, 1978), Humanistic (Roger) and constructive (Piaget, 1975).

The Behaviorist theory has as its main creator of the American psychologist B. F. Skinner. Skinner (1974), the human or animal can be trained to perform almost all actions and the reinforcement that follows would be responsible for determining the behavior that can be of two types: respondent and running. This aspect does not take into account what happens in the mind of the individual during the learning process.

Cognitive and facing internal mental process rather than on external behavior, are interested in how the mind draws the

senses from the environment influence how information is processed, stored and returned.

Humanistic theory is structured to be learning essentially as a person or individual and seen as a whole, influencing their choices and attitudes.

The Constructive theory derived mainly from the theories of Jean Piaget (genetic epistemology) and Lev Vygotsky (socio-historical research) of the idea that man is not born smart and is not passive in half, but it responds to external stimuli to build and organize knowledge, not wanting to be in the truth, but as an adaptation of the organism to the environment.

According to Piaget (1975), knowledge is constituted by the interaction of the individual with the physical and social environment, to human symbolism, with the world of social

relations, and it is by virtue of the action and not by any previous allocation in hereditary baggage or in the middle.

Several studies since the 90s show that organizational learning and synergy vector in the mechanism collection of knowledge, since its design is embedded in the organization both at the individual level and in organizational as well as variables that are influenced in their characterization.

Its concept is still a matter of difficulty, as several authors have in their papers and disagreements of opinion among its concepts. Thus, the authors emphasize that the generation capacity and seizure of knowledge have been the main competitive advantage of organizations in the current context. In the table below is the list of concepts of organizational learning through time to the year 2000.

Table.1: Organizational Learning Concepts

Conceptual Sources	Ratings Generated
Argyris and Shön (1978)	Organizational learning is the process of detecting and correcting errors
Shrivastava (1983)	Organizational learning involves the process through which the organizational knowledge base is developed and delineated
Fiol and Lyles (1985)	Organizational learning is the process of improving actions through increased knowledge and understanding
Levitt and March (1988):	Organizational learning is the result of a process of coding inferences based on history in routines that guide new behaviors
Huber (1991)	An entity learns whether through its processing of information, the breadth of its potential behavior is altered.
Swieringa and Wierdsma (199)	The term organizational learning means the change in organizational behavior
Kim (1993)	Organizational learning is defined as an increasing increase in organizational capacity to take effective action
Garvin (1993)	A learning organization is one that has skills in creating, acquiring and transforming knowledge, as well as modifying its behavior to reflect new insights and insights.
Slater and Narver (1994)	Organizational learning, in basic terms, refers to the development of new knowledge or insights that have the potential to influence behavior.
Nicolini and Mezner (1995)	Learning can refer both to the endless process of cognitive modifications (in the sense that learning is an endless process) and to the outcome of this process (which is achieved in the learning process). In other words, the verb "learn" can be a result verb or a process verb.
Bibella et al. (1996)	Organizational learning is the ability (or process) in an organization that maintains or enhances performance based on experience. The concept includes the acquisition, sharing and use of knowledge.
Tsang (1997)	Organizational learning is a concept used to describe certain "types of learning" that occur in organization
Senge (1998)	Learning organizations are those in which people continually expand their ability to create desired outcomes, where new thinking patterns are nurtured, where collective aspirations are freed and where people continually learn how to learn together.
Popper and Lipshitz (2000)	They suggest that, regardless of the definition of organizational learning used, it will always be mediated by the learning of the members of the organization, since an organization can only learn through the individuals who understand it.

Source: authors' adaptation

Organizational learning and the exchange of individual knowledge with organizational setting allow to say that the organization is not learning, but your employee's body. In an analysis of this issue and Lipshitz Popper (2000) suggest that, regardless of the setting of learning. These clarifications make it evident that organizational learning and the acquisition of knowledge and its transfer as a result, since the subject learns and teaches the same time, where the being understands the process and thus implements the fortifying learning the purpose of the organization.

An example of organizational learning setting as a result is delineated by Levitt and March (1988): Organizational learning is the result of inferences encoding process based on history into routines that guide new behaviors. Differently, and Argyres Shön (1978) define organizational learning as the process of detecting and correcting errors.

Several authors position in different ways about the concept of organizational learning, but these concepts are assimilated in three factors that influence the success of the organization: The skills, attitudes and renewal capacity of the organization. Corroborating the elucidation of that organizational learning begins with the individual, which is the intellectual capital of the organization.

There is with these theories that the intellectual body has its importance in the organizational setting because the individual is knowledge generator, and that their skills influence the organizational life. Although surveys show that there studies that correlate training with organizational learning, due to lack of knowledge sharing both individual and organizational.

Study on the strategy reports its importance related to the growth of the organization, before it authors describe that organization learns through its staff or intellectual capital. Despite being, its employees pickups knowledge, this will not be immediately transferred to the organization, but in time this knowledge will be shared.

The importance of the study on organizational learning is the mode that is characterized, since a plurality of concepts summarizes this matter it was found in studies by Araujo Jr (2008) the plurality in conceptualization of Organizational Learning, notes a range of thoughts about your process. Despite this diversity, is summed up in two interdependent and overlapping phases, forming a cyclic and uninterrupted process, in the form of approaches treated Nonaka and Takeuchi (1997), Davenport and Prusak (1998) and Tacla and Figueiredo (2003).

Corroborating this study the fact that the organization teaches and learns at the same time as it creates and disseminates knowledge of its staff, creating a learning cycle. An

organizational learning is important when you can get through your knowledge competitive advantages before the others, using all his knowledge content.

The contribution of studies on knowledge Nonaka and Takeuchi (1997), in relation to the literature on the process of knowledge creation is very deep. The authors argue that the interaction between tacit and explicit knowledge raises the spiral of organizational knowledge creation through the dynamic flow of lower ontological levels to the highest levels. Thus knowledge begins in the individual that is transmitted between people, level level and especially among organizations.

For Nonaka and Takeuchi (1997), so that the organization can experience the spiral of knowledge creation, it must provide an appropriate context, which requires an understanding of the dimensions of knowledge, enabling conditions for knowledge, conversion modes of knowledge, the model of the five phases of knowledge creation and management models. By everything that has been reported so far, it finds that the importance of organizational learning is related in the capitation of knowledge and its transfer to the organization by the individual and their socialization in the organization.

Learning at work has traditionally been associated with the training and development activities, which are defined by Abbad and Borges-Andrade (2004) as organizational actions using an instructional technology or are deliberately arranged. Knowledge is a strategic aspect in the organizational setting because its development affect the life of the company. Thus, the competitiveness of a company is becoming the basis of their ability to create, transfer and reuse knowledge which is relevant to their core business (Nonaka, 1991).

You can not talk about knowledge strategy without first course about knowledge itself, Nonaka and Takeuchi (1997) explain that the primary distinction is between two types of knowledge: tacit and explicit. Tacit knowledge is personal, context specific, hard to formalize and share with others, depending on the experiences, values, emotions and relationships of individuals and their transmission (RODRIGUES, 2001, p. 89).

Although many concepts of organizational learning draw a shape with several clarifications, these two types of knowledge are characteristic, therefore there is no learning without its existence. All knowledge starts from the individual and organizational knowledge only happens through learning of its members and research of knowledge of the new members that the organization does not already

own the importance of knowledge of individuals in the design of organizational knowledge.

Kim (1998) reports that the knowledge of an organization lies mostly on the individual's head, and even if you can register or store in memory a large part of this knowledge, much more exist in individual models, as these involve a mixture of what it is absorbed explicitly and implicitly it is absorbed.

Thus, the challenge for organizations is to make explicit these individual mental models to constitute in shared mental models. In the public work environment that itself is a structure committed to providing citizens with a wide range of services, the so-called public services

Demographic variables is the set of demographic information (age, education, and gender). Studies on Learning Strategy have demonstrated that demographic variables can influence organizational learning, since the individual is characterized by demographic information, and this information can have a great influence on the individual's decision at the time of learning. Warr and Downing (2000) found in their work that demographic variables vary and relate to the types of learning strategies between them.

From the perspective of that demographic variables may have different associations with each of the learning strategies, Lopes-Ribeiro, Borges-Andrade, Assis and Marra (2003) studied the influence of demographic variables such as gender, age and education level, the use of learning strategies. In this study the demographic variables were

identified individual characteristics related to gender, age and education level of the research participants.

It was observed that the so-called Extrinsic reflection strategy was used more by women and had corresponding level of education to graduate, thus analyzing this data, it is clear that the demographic variables influence the ability of the individual tends to capture knowledge.

This occurrence corroborates those found by Warr and Downing (2000) when indicated significant relationship between gender variable, age, type of course (Arts and Sciences) and travel time (one to three years), Moreover, the similarity of the results by Warr and Downing(2000), with Lopes-Ribeiro et al. (2003) it was found significant direct effect between aid search strategies Interpersonal and gender variable.

The results also denoted that older people in both erudition, tended to use more intensively breeding strategies. These studies showed also that there is an association between individual demographic and learning strategies, thus resulting in a new focus for further studies.

IV. METHODOLOGY

The technical procedures often handled for research design using the classification by some criteria, about the objectives, nature, approach and procedures. In the opinion of Prodanov and Freitas (2013) the procedures and the manner in which we obtain the data necessary for the preparation.

Table.2: Technical Procedures

Aspects	Ranking	Discription
Nature	Basic	It aims to generate new knowledge, useful for the advancement of science without predicted practical application. It involves universal truths and interests.
PurposeOfTheStudy	Descriptive	Such research observes, records, and describes the observed facts without interfering with them. Thus for such data collection, specific techniques are used, among which, the questionnaire, the test and the observation.
Procedures	BibliographicReserch.	Elaborated from published material, aiming to habituate the researcher to the topic addressed. Books, magazines, periodicals and scientific articles, monographs, dissertations, theses, etc. are used.
	Case Study.	It is based on the analysis of a real case and its relation with existing hypotheses, models and theories. It is developed from the deep study of a specific reality, which can be: an institution, community, family, small group of people, a single individual.
ProblemApproach	Quantitative	It requires the use of statistical resources and techniques, to translate the information collected into numbers, and to classify and analyze them.

Source: authors, 2015

In order to seek greater insight into the thread of the relationship between learning strategy and demographic variables of the servers surveyed in this research work scenario inhabits its nature in the basic aspect. Basic research involve truths of universal interest that is intended to generate new knowledge. (Prodanov and Freitas, 2013).

The study aims to operationalize the goals described, using a quantitative approach. Quantitative research uses mathematical language to describe the causes of a phenomenon and relationships between variables (Fonseca 2002, p. 20).

As to the objectives, it is a descriptive study, opting for the questionnaire as a tool standardized technique of collecting data. In this view, to Gil (1987) the questionnaire and a technique that does not expose the subject to the influence of opinions and personal aspects, aiming only its shape and its handling. Prodanov and Freitas (2013) show that the descriptive notes without interfering situations and describes

the population and determining the phenomena and the relationship between variables.

Given these principles are developed the objectives of this research (a) Identify the Demographic Profile of Servers of the Municipal Secretary of Porto Velho city Health - SEMUSA and (b) identify learning strategies and correlate them with each other. The survey was conducted in order to meet the proposed objectives, as well as their problems. To Padua (1998, p.30), "[...] all research has an intention, which is to develop knowledge that allow understand and transform reality [...]."

Following the thought of Gil (1987) the conclusions obtained from the samples are based on statistical laws that give scientific foundation. Upon this the survey universe consists of 52 servers that make up the Human Resources SEMUSA, all survey participants answered the questionnaire. Corresponding to 100% of the sample.

Table.3: Sample Characterization.

Profile Indicative	Data Collected From Responses	Frequency	Percentage Representation
Office	Administrative Assistant	4	7,7%
	Administrative assistant	28	53,8%
	Endemic fighting agent	6	11,5%
	Assistant in Health Service	5	9,6%
	Director	6	11,5%
	Nursing Technician	2	3,8%
	Nursing	1	1,9%
Genre	Male	16	30,8%
	Female	36	69,2%
Age	Between 18 and 27 years	6	11,5%
	Between 28 and 37 years	20	38,5%
	Between 38 and 47 years	20	38,5%
	Between 48 and 57 years	3	5,8%
	Above 58 years	3	5,8%
Marital Status	Not married	18	34,6%
	Married	27	51,9%
	Separate	3	5,8%
	Stable union	4	7,7%
Education	High school	15	28,8%
	Incomplete Higher Education	14	26,9%
	Full Higher Education	16	30,8%
	Postgraduate studies	7	13,5%
Average Monthly Income	Up to 1 minimum wage	5	9,6%
	From 2 to 3 minimum wages	41	78,8%
	From 4 to 5 minimum wages	5	9,6%
	From 6 to 7 minimum wages	1	1,9%

Source: authors, 2015

Field research was carried out in a municipal health agency in the municipality of Porto Velho, Capital of the State of Rondônia, in the North of Brazil. The unit has the normative competence to organize, execute and manage the services and actions of Basic Attention, in a universal way. It also develops technical mechanisms and organizational

strategies to qualify human resources for the evaluation of basic care.

The servers inserted in this scenario are statutory, in this regime server is named through a unilateral act, not being able to modify it, since they are governed by a statute that is a law. The table below lists the number of employees and the number of participants in the survey.

Table.4: Employee Ratios by USF, PSF and UPAS

Units	NumberOf Employees	Quantity HrStaff
USF* + PSF** Agenor de Carvalho	52	1
*** UPA Ana Adelaide	173	2
USF Areal da Floresta	30	1
USF + PSF Aponiã	70	1
USF + PSF Caladinho	70 (90)	1
Medical Specialties Center Alfredo Silva	103	5
USF + PSFERNANDES Índio (P.A****)	101	3
USF + PSFHAMILTON RaulinoGondin (P.A)	111	1
USF + PSFJOSÉ Adeline da Silva (P.A)	85	2
USF + PSFMANOEL Amorim de Matos	98	4
USF + PSFMARIANA	73	1
USF + PSFNova Floresta	54	1
USF + PSFOsvaldoPiana	45	7
USF Pedacinho de Chão	78 (65)	1
USF + PSFRENATO Medeiros	59	2
USF + PSFSÃO Sebastião	60 (30)	1
USF + PSFSANTO Antonio	20 (20)	3
USF + PSFSOCIALISTA	73	1
USF + PSFVila Princesa	14 (15)	1
SAE (NursingCare Service)	33	1
SEMUSA	8	6
UPAEast Zone	217	4
UPA South Zone	184	2
Total	1811	52

*USF (Family Health Unit), **PSF (Family Program Unit), ***UPA (Emergency Care Unit) and ****P.A (Ready Attendance)

Source: The authors.

In order to capture relevant knowledge the topic was analyzed various bibliographic sources, articles, monographs, dissertations and materials made available on the Internet. The bibliographical research will serve to know how the subject is found, as well as the works that have already been done about it, and the opinions regarding the subject, according to Prodanov and Freitas (2013).

Still in agreement Gil (2002) describes that to collect data is also used as a standardized instrument, the questionnaire, which enable the interaction with the quantitative nature.

The time of application of the questionnaire was extended during the year 2015, due to the inherent difficulties of the bureaucratic complexity of the public scenario. The application of the questionnaires took place in two stages described below: in the first application, the online questionnaire was sent to the e-mails of each of the services that were the target of the Human Resources research; questionnaire manually, as well as the analysis of information.

The questionnaire was composed of 35 closed questions, using the Likert Scale at the level of doing, being 1 - Never

do, 2 - Rarely do, 3- As times I do, 4 - I often do and 5 - I always do, reproduced in figure 2.

Fig.1: Five-point Likert Scale.

12345

I never doI always do

Source: Adapted by the author.

The ease of handling the Likert scale with respect to the respondent and the fact of issuing a degree of agreement on any statement described by Costa (2011). However, the Likert scale may suffer interference when it involves a large number of issues, in a situation in which the five-point scale should be chosen, according to Vieira and Dalmoro (2008).

The Survey tool was subdivided into two parts. Containing in the first part the demographic variables Cronbach that analyzes the internal consistency of the ferment and its scale. Hora, Monteiro and Arica (2010) clarify based on: position, sex, age, civil status, schooling and income. In the next part, in order to observe the research objectives, the closed questions with perception in the Learning Strategies, constructed by Pantoja (2004), revalidated by Beviláqua (2007), Carvalho-Silva and Brandão (2009), were elaborated. 35 intensities were required.

Prodanov and Freitas (2013) They argue that one of the descriptive characteristics is the use of the questionnaire as standardized techniques of data collection. To continue the research, the procedures and reliability analysis of the data

will be specified through the application of the questionnaire, as well as the results obtained, below.

The electronic platform Microsoft Excel was used in the tabulation of data collected from the research with statistical procedures, and later verified in the program Statistical Software for Social Sciences - SPSS (version 13), giving greater thorough validation of the statistics. In order to give greater reliability to the questionnaire it was improved by the Alpha method that the Cronbach alpha coefficient (α) was presented by Lee J. Cronbach in 1951 as a way to estimate the reliability of a questionnaire and to measure the correlation between the responses, where the closer to the numeral one (1) is the result of the analysis, the more reliable the questionnaire will be. This tool has great acceptance in the middle academia, being applied in several areas of knowledge.

Freitas and Rodrigues (2005) suggest the reliability classification from the Cronbach alpha coefficient, which vary between five degrees of reliability, the table shows this reliability well. Value of α

Table.5: Reliability classification from Cronbach's α coefficient.

TrustLevel	Very Low	Low	Moderate	High	Very Tall
Value of α	$\alpha \leq 0,30$	$0,30 < \alpha \leq 0,60$	$0,60 < \alpha \leq 0,75$	$0,75 < \alpha \leq 0,90$	$\alpha > 0,90$

Source: Freitas and Rodrigues (2005, p.4).

V. RESULTS

The case study was carried out in the human resources sectors of a public health organization and its annexes with headquarters in Jorge Teixeira Avenue with 7 de Setembro Street. Being of its competence as normatized to organize, to execute and to manage the services and actions of basic attention, of universal form. It also develops technical mechanisms and organizational strategies to qualify human resources for the evaluation of basic care. The servers inserted in this scenario are statutory, in this regime the server and appointed through a unilateral act, not being able to modify it, because they are governed by a statute that is a law.

They will present in this section the data obtained with the use of questionnaires, as well as their due analysis, by means of graphic tables and illustrative tables. According to the data, the demographic variables (age, gender, marital status,

schooling and income) were listed according to the profile of the research participant. The subsections identified and described the Learning Strategies Used by sampling the universe in question.

5.1. Identification of the Demographic Profile of the Servers of the organism under study.

In order to obtain conditions to act on the first specific objective established, the following variables were used as the basis for the demographic variables: position, age, sex, marital status, schooling and income.

The study reveals that active servers are mostly female. And that the position with more frequency and the Administrative Assistant with 53.8%, the function of nurse has 1.9% with lower index among the others, then comes the technician of nursing with 3.8%, the administrative assistant also follows with a low frequency of 7.7% of the total, the auxiliary health service function comprised 9.6%, the position of head

(direction) was 11.5%, and the position of agent to combat endemic diseases was equal to that of leadership with 11.5%. In the age group of servers, it is observed that 11.5% are between 18 to 27 years, ages between 28 to 37 years correspond to 38.5%, from 38 to 47 years are also with 38.5%. From 48 to 57 years, they were 5.8% and public employees were over 58 years old, respectively, with 5.8%. The data show that the population that participates in the research is mostly in the adult age group. According to IBGE (2010) the adult age group is between 29 to 59 years of age. In the civil status with 51.9% are married, 34.6% claim to be single, the separated civil status had lower percentage with 5.8%, to the stable union with 7.7%. Therefore, sampling validates that most servers are legally married and that few are in the role of stable union.

Corroborating in the view of identifying the demographic profile of the analyzed population the degree of education that presented a prevalence of the others with, 30.8% is the complete upper level, the minority is postgraduate 13.5%, the incomplete superior have 26, 6%, high school with 28.8%. Considering that the civil servants who are active in the human resources sector that participated in the research, have entered their work environment in the medium level position. Research shows that there are many graduates holding middle-level positions

The remuneration of the servers of up to a minimum wage and 9.6%. The salaries of 2 to 3 minimum salaries are 78.8%, and 4 to 5 minimum salaries 9.6% of the total number of employees who participated in the survey and 1.9% receive salary of 6 to 7 minimum salaries. Sampling is getting above the minimum wage and below 6 to 7 minimum wages.

5.2 Descriptive of the learning strategies used by the servers of the organism studied.

Following analysis of the data we will now take the second objective as a focus, identifying and describing the learning strategies used by the SEMUSA servers and their annexes.

Second reading in Ford and Cols (1998); Warr, Allan and Birdi (1999); in Warr and Downing (2000); Pantoja and Cols (2003), the strategies of Learning at work have a significant relation with the individual relative variables: age, gender, schooling, anxiety to learn, orientation to learning, type of course and length of service at work.

According to the data analyzed, the strategies were divided into two stages, for a better detail: cognitive strategy and behavioral learning strategy. According to Rigney (1978), learning strategies are cognitive operations and procedures used to acquire, retain and retrieve different types of knowledge and performance.

The research demonstrates that the scope of the research exists the occurrence of Learning Strategies in general, but nonetheless the cognitive strategies on leave significantly on the behavioral, that is, in the scenario studied individuals acquire knowledge reproduced and analyzed by context, from the whole and through the verification of its relationship with the organizational system.

The reproduction and the part of the cognition that the individual, mentally repeats the acquired knowledge in a way redrawing what was presented to him. Continuing the research, it extracted from the questionnaire the questions that the basis and the focus on reproduction.

Corroborating Gagné and Cals (1993) emphasize that one of the ways people can do, more things at the same time, and through automation. Based on the study described previously the subdivision reproduction of cognitive strategy, the population cares about how that knowledge is repeated, as well as its execution.

Regarding the cognitive strategies subdivision intrinsic reflection, focused on the individual's opinion about the way of learning in the organization through the understanding between the relationship and interdependence between all parts of the work. Therefore, it follows the study on the data analysis process inserted in the drawn context. Extrinsic Reflection aggregates the perceptions about the way they perceive in the work scenario through the search for understanding with relation to the organizational system with a whole. Being the communication between the parts of the system component intra and extra in the organization aiming at the interaction of the information of the development of the professional activities. The research also allows to demonstrate the existence of the Behavioral Strategy, where the servants who work in the public work apprehend knowledge seeking interpersonal assistance, in written material, and in its practical application.

In the Behavior Strategy the thematic of the relation of the individual with social interaction of the learning, as well as the tools used for capturing knowledge. The server absorbs knowledge, seeking interpersonal help, searching for written material, and practical application of theory. Search for Interpersonal Help refers to the concept that the individual to acquire knowledge or pass it on, utilizing the active search for help from other staff. Already in the Search for Help in Written Material, the individual seeks to learn researching writings, as well as the use of the internet as a fast search tool with a large collection of university articles and other reliable sources. Finally, in short, in the strategy, practical application and how the apprentice puts his own knowledge into practice while he learns.

We will follow the details of the analysis of the data, verifying the correlation of the strategies, with their demographic variables found in the chosen scenario.

5.3 Correlation of the learning strategies identified with the demographic variables.

In order to reach the third specific objective of correlating the learning strategies identified with the demographic variables inserted in the researched scenario, the questionnaire was applied via docs.google.com. The table shows that the demographic variable is directly related to the income variable, 0,322 correlation based on this finding.

The age variable is correlated with the cognitive strategy with 0.436, as well as the behavioral strategies with correlation 0.293. Contributing to this view Warr and Downing (2000) when they identify that the Variables Demographics vary or relationship between themselves with the types of learning strategies.

Regarding the behavioral strategy its correlation is strictly with the variable civil status with 0.279 of correlation and 0.45 of significance. The data obtained indicate that the variables are mostly related to the general learning strategies presented in this study.

Table.6: CorrelationDemographicVariable

Demographics Variables		Income	General	CognitiveStrategies	BehavioralStrategies
Office	Correlation	0,322 (*)	0,128	0,055	0,164
	Significant	0,431	0,534	0,712	0,171
Age	Correlation	0,072	0,389(**)	0,436(**)	0,293(*)
	Significant	0,611	0,004	0,001	0,035
MaritalStatus	Correlation	0,146	0,233	0,127	0,279(*)
	Significant	0,302	0,097	0,371	0,045

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

Source: The authors

Finally, it appears that the demographic variables, "age", "Status" has more frequent relationship with "cognitive strategies" as well as "Behavioral Strategies".

Such evidence demonstrate that the age group with higher incidence and adult, this means that older people tend to use

all learning strategies, Suit participants servers of research are mostly female, and who are married legally use these strategies as a way of learning and sharing it

Table.7: Correlations demographic variables and Learning Strategies

Demographics Variables		ExtrinsicReflection	InterpersonalHeal p	WrittenMaterial
Sex	Correlation	0,035	0,326(*)	0,072
	Significant	0,804	0,019	0,614
Age	Correlation	0,459 (**)	0,164	0,269
	Significant	0,001	0,246	0,053
MaritalStatus	Correlation	0,308(*)	0,216	0,374**)
	Significant	0,026	0,125	0,006
Income	Correlation	0,133	0,158	0,275 (*)
	Significant	0,348	0,262	0,049

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

Source: The authors

According to the data in the table, no significant correlation describes the female (prevalent among searched) using the strategy helps interpersonal more frequently in the workplace.

A significant correlation shows that the age variable uses the extrinsic reflection .459 strategy more often, but, however this variable correlates with little significance 0.269 to Help Search strategy in written material.

The variable Marital status also expressed significant correlation of 0.374 with seeking help strategy in written material, and also the reflection Extrinsic 0.308 strategy. Continuing notes is also the equity has its correlation only with seeking help material written with 0.275 significance.

Based on the above data, those strategies but commonly used by servers were "Extrinsic reflection", "Interpersonal Help Search" and "Help Search written material". In correlation analysis, this association was found with the variables: sex, age, civil status and income. However the strategy "play", "Reflection Intrinsic" were related to these variables, and the variable Education in the workplace.

VI CONCLUSION

This study focuses on the key learning strategies in the servers of the municipal body searched desktop, and correlate with demographic variables.

To try to answer the main problem of the study, the data collection tool was a questionnaire, built in two different sections. The first requested demographic data, in the second section closed questions related to learning strategies, having used the metric Linkert scale of five points. Technical Statistics Cronbach's Alpha, applied to measure the safety of the instrument which resulted in reliability factor ($\alpha = 0.824$) for data analysis treatment used to Excel and SPSS software. As regards the first objective to identify the demographic profile of the SEMUSA servers, if delineated, mostly by servants, to age with little difference in the data demonstrated by research, where 28-37 years accounted 14 servants and 13 are between 38 and 47 years, found that college degrees stands out as level of education, and the serving mostly are legally married.

In understanding the second to identify and describe The Learning Strategies Used By The SEMUSA Servers, the study found that the cognitive strategies before the extrinsic reflection and that stood out from the rest. Regarding behavioral strategy were to search interpersonal strategy Help and Help Search for written material. Still referring to the second objective is detailed each learning strategy for your better understanding.

Finally, the third objective of this research brought the light of knowledge Correlations of learning strategies and demographic variables.

The variables: age, gender, marital status, had frequent significance with the strategies extrinsic reflection, search interpersonal assistance, and for help in written material, he realized that the local health department and its attachments, has in its framework servers with the majority female,

married civil state, it is believed that this should be the influence on the correlation with the strategies described above. In contrast variables: income and education neither had an influence on learning strategies.

Completed so that the learning strategies and demographic variables do not correlate at all aspects, yet research drew a scope of scenario that the servants, to perform their activities try to understand the relationship of its activities with the organization as a whole, aiming also to interaction organizational information. In Human Resources SEMUSA and attachments, the servants to perform their tasks, ask for help from other servers when doubts arise arising from work and use opium in matters written as: standards, articles, and the Internet as a means to help in the understanding of activities. Among the limitations of the research, it was given over to the questionnaire, due to bureaucracy, bar the entry of researchers in their environment publishes work.

Therefore, the results show that contrary to what was thought public organizations have learning strategies, which is extremely important that managers have a sense of direct dais development of such methods, to build a learning process, to collaborate with the bureaucracy arising from this environment, which may thereby increase its principles of effectiveness and efficiency.

The study was successful to be able to fill the gaps of the listed goals, and answered the question of the survey, in addition to enabling the theory interaction with the reality of the study by empirical. Contributing to future research concerning the subject organizational learning. Interest to managers of organizations interested in efficiency by strategically treated learning. It is a further contribution to scholars committed to excellence in the public sector.

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Monitoring System of the Parameters of Operation of internal Combustion Engines in Thermoelectric Plants for Fault Detection.

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Abstract—In this work, it shows the specification of a system for monitoring operating parameters of generators, for diagnostic and fault detection on power generation of thermal power plants (TPP). The objective of this system is to collect real-time information of the engine operating cycle dual-fuel, while working with diesel and natural gas, in order to organize a database with the pressure information from the combustion temperature and cooling water pressure. The use of local or remote monitoring is performed by sensors to detect variations or sudden changes in the generator mode. Through this real-time monitoring can be identified early failures, adapt to changes or repairs parts preserving the integrity of the machines.

Keywords—Sensors, operation of generators, fault detection, TPP.

I. INTRODUCTION

The Domestic Energy Supply - OIE in 2016 stood at 288.3 million Tons of Oil Equivalent (TOE), or (MTEP), showing a decrease of 3.8% compared to 2015, equivalent to 2.07% the world's energy. The significant fall OIE, consistent with the decrease of 3.6% in the economy was mainly inducing a reduction of almost 20% in transformation losses due to the lower thermal generation and the reduction of 5.3% in the sector consumption energy (decrease of 7% in ethanol). The total demand for petroleum products fell by 5.6% (-7.2% in 2015), there including end uses in the sectors of the economy and the uses in the generation of electricity. The consumption in light vehicles decreased by 1.6% (an increase of 6.2% in

2014 and 2015 in stable (MME 2016). Generation of Electric Energy (EE) is increasing in developing countries due to the massive consumption of EE, although in Brazil the main source of EE be Hydraulic generation with 66% of total generation (Trinity, Sperling & Bourbon, 2017). Still have a significant percentage coming from non-renewable energy sources accounting for 18%, in northern Brazil 18.2% of the total energy are Thermoelectric (EPE 2017). In the industrialized world Brazil has the energy matrix with the highest share of renewable sources to 43.5% of its production comes from hydropower, biomass and ethanol, including solar and wind power, pointing out that the non-renewable oil and its derivatives is the highest percentage 36.5%, reflecting the dependence of fossil fuels in Brazil (MME 2016). In Brazil, it uses the thermal energy in a strategic way, as it can be produced in a constant amount throughout the year, unlike hydropower, which have the dependent production level of rivers (Lima & Souza, 2014).

For generating thermal energy is used, a set of Internal Combustion Engines and Generators (ICEG), which sometimes occur untimely interruptions due to internal set of problems, which can cause major losses to the dealership. A careful evaluation of the operating conditions of these motors, can lead to a substantial increase in its reliability and an effective program of asset management (Mendonca et al., 2007). Failures and outages can result in high costs and severe fines. Because of this high cost, predictive maintenance based on the ICEG's runs parameters, is earning more and more importance in preventing failure of these engines. Rapid

detection and identification of faults that affect a process can help make decisions, correct and reduce the damage that can cause the system (Cabeza Santiago Vicedo, & Vega, 2018).

The use of local or remote monitoring is performed by sensors to detect variations or sudden changes in the generator mode. Through this real-time monitoring can be identified early failures, adapt to changes or repairs parts preserving the integrity of the machines.

The smooth operation of these machines, represents a strategic advantage for the electric power generation systems, especially in developing countries. Different technologies for fault detection in ICEG's have been implemented, such as: Martinez uses a model-based approach with a multi-variable generation of waste from the main fault situations, arranged in a matrix characteristic of fault signatures, establishing a standard reference to continuously evaluate waste in on-line operating conditions (Martinez-Coronado, Ruiz-Sanchez, Cerda & Suarez, 2017) Fonseca performs a diagnosis of the technical conditions of the engine using a lubricating analysis, vibration analysis, and thermography (Fonseca, Bezerra, Brito Milk & Birth 2018), A new technique for failure prediction in a plant controlled by computerized SCADA system (Mayadevi, Vinodchandra, & Ushakumari, 2012), A method that detects combustion failures caused by a fuel deficiency in a cylinder, even in its early stages is presented by Nieto (Nieto, Blazquez, Platero, & Marriage, 2017) A cylinder balancing method is disclosed which minimizes the crankshaft torsional vibrations at medium speed internal combustion engines (Ostman & Toivonen, 2008) A systems Supervisory Control and Data Acquisition are designed to allow human operators supervise, maintain and control critical infrastructure (Samtani, Yu, Zhu, Patton, & Chen, 2016), Sanchez and Suarez for fault detection in fossil power plants operation using recurrent neural networks (Sanchez, Suarez, & Ruz, 2004). This paper proposes the specification of a system to collect real-time information of the engine operating cycle dual-fuel, while working with diesel and natural gas, the pressure values of the combustion temperature and pressure of the cooling water in order to identify flaws and preventing the integrity of ICEG's.

II. LITERATURE REVIEW

Internal Combustion Engine (ICE)

An Internal Combustion Engine (ICE) is an artifact que generates mechanical power from the chemical energy, released by burning or oxidizing the fuel inside the engine (Thus the name "internal") There are two main types of engines: Spark Ignited (SI) and Compression Ignited (CI). The first is the engine Which needs a spark to ignite the

fuel inside the combustion chamber (the full cycle is Performed in four strokes or 2 revolutions) while the second Relies on the volatility of fuel under Certain pressure and temperature characteristics That permit the ignition (The full cycle is completed in two strokes or one revolution)). There are many applications where an ICE can be found, and the configuration of the engine is closely related to the specific use. In Fig. 1, is visualized the main components of this engine (Molinar-Monterrubio & Castro-Linares, 2007).

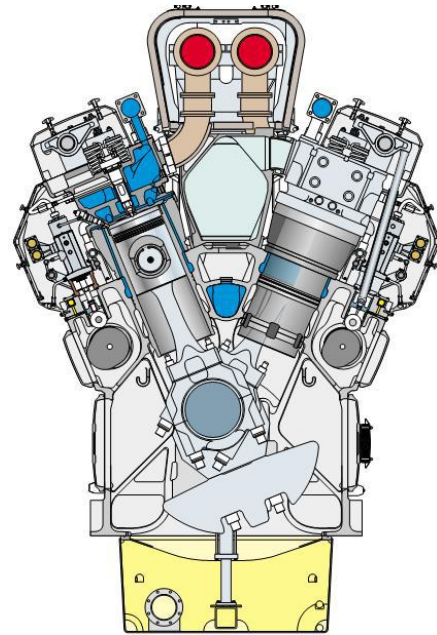


Fig.1: Motor 46 in cross section Wärtsilä® V.

Source:(Wärtsilä, 2015).

In general, the functionality of an ICE can be described in four main phases, Which Can Be Performed in four strokes (two revolutions) or in two strokes (one revolution) cycles (Molinar-Monterrubio & Castro-Linares, 2007):

- Admission, the fuel enters the chamber by means of the mechanical aperture in cylinder together with the aid of the piston draw stroke;
- Compression, the fuel is compressed by the piston stroke up to the top dead center;
- Expansion, the thermic artifice ignites the combustible mixture, which in turn generates mechanical and thermal power;
- Expulsion, the piston stroke pushes out the burned exhaust gas past the mechanical aperture.

Faults in the combustion engine can be identified and Analyzed based on the information collected from the engine environment. Currently, techniques such as engine oil analysis, exhaust gas analysis, analysis engine vibration signal and processed data from various engine sensors are used for fault identification in combustion engines (Liyangedera, Ratnaweera, & Randeniya, 2013).

Industrial instrumentation

The term "instrumentation", according to engineering, is associated with the theoretical and practical study of the instruments and their scientific principles. Are used to monitor continuously, or discrete, the control variables of behavior that, in some way, will interest the man in various areas of human knowledge applied, that is, not only in industrial manufacturing processes (Fialho, 2006). From the point of view of science industrial instrumentation studies, develops and improves techniques for use suitability of measuring instruments, seeking to carry out the collection and transmission of data for the registration and control of physical variables in various equipment allocated in industrial processes.

Measurement Systems

A system is a combination of components that work together and accomplish a certain goal. A system is not limited to something physical. The system concept can be applied to abstract dynamic phenomena such as those found in economics. The word system should therefore be construed to designate physical, biological, economic and other systems (Ogata, 2007). A measurement system is a set of devices (sensors, circuits, cables, displays, equations, computer programs, etc.) whose purpose is to provide information on the value of the physical quantity to be measured, the measuring (Aguirre, 2013).

Measuring Instruments

In general, an instrument can be analyzed in terms of a functional description of its subsystems. Any instrument is usually made up of more than one element. An element or a group of them performs a specific function and a description of the instrument in terms of these functions is called the functional description (Aguirre, 2013). Analyzing some kind of instrument as an entry and exit system. In principle, virtually every physical process can be interpreted as a system with input and output. Following this line, an instrument can be represented as illustrated in Fig. 2, wherein the input is the variable to be measured and the output indication is provided by the instrument. In metrology texts it is common to refer to the input and measuring (Aguirre, 2013).



Fig.2: Perfect representation of input and output of an instrument.

Source: adapted from (Aguirre, 2013)

Automation and Control

The control word of French origin (contrôler), denotes the act or power to exercise control, monitor, supervise, maintain balance. Its understanding is ancient and was always the target of achieving common objectives of a

nation, region or community as a whole. Variably found as an asset in the mind of the individual: to control not be controlled (Silveira & Santos, 2004).

Engineering concerns the knowledge and control of materials and forces of nature for the benefit of mankind. Relate to the control system engineers the knowledge and control segments around, often called systems, in order to provide society with useful and affordable products (Dorf & Bishop, 2011).

Automatic control has played a vital role in the advancement of engineering and science. In addition to its extreme importance for space vehicles, for guiding missiles systems, robotic systems and the like, the automatic control has become an important and integral industrial processes and modern manufacturing (Ogata, 2007).

It is the technology that allows the realization of sequential mode of operation, fast and accurate, with little (or no) human intervention. Contrary to what many think, it did not come to "take" jobs, but to generate them (Capelli, 2008).

Sensors

The sensors are the components most used in the world of electronics. They are present in the day-to-day in various situations (cars, elevators, automatic doors, appliances, etc.). These devices are also the entire base of automation, be it industrial, building (domestic) or commercial (Capelli, 2008).

One of the first sensors used in automation were very robust electromechanical and with a good performance. On average, the life of this component is 10 million maneuvers, depending, of course, usage conditions (current and operating voltage and speed). Generally, this sensor provides at least one normally open contact (NA) and a normally closed contact (NC) (Capelli, 2008).

Conduction temperature measurement sensors

All materials consist of particles. These particles are atoms or molecules that are in constant motion. In this constant movement is called as kinetic energy. Thus, the higher the stirring in the particles, the greater the kinetic energy. The zeroth law of thermodynamics: If two bodies A and B are separately in thermal equilibrium with a third body T, A and B are in thermal equilibrium with each other (Halliday, Resnick, & Walker, 2008).

The temperature measurement principle using resistance thermometers based on variation of the value of electrical resistance of a metallic conductor as a function of temperature. Equation (1) is excellent approximation to the variation of electrical resistance versus temperature (Fialho, 2006).

$$R_{(T)} = R_0(1 + \alpha \cdot T) \quad (1)$$

On what:

$R_{(T)}$ - Electrical resistance "T" temperature;

R_0 - Electrical resistance temperature of 0°C ;
 α - coefficient of electrical resistance versus temperature measured in $^\circ\text{C}$;
 T - measured temperature in $^\circ\text{C}$.

As a temperature measuring device consisting of two different conductors which are in contact with each other at one or more points. The thermocouples are widely used as a temperature sensor for measurement and control. Converting into electricity temperature gradient (Fialho, 2006). Fig. 3 is shown the basic assembly of a thermocouple.

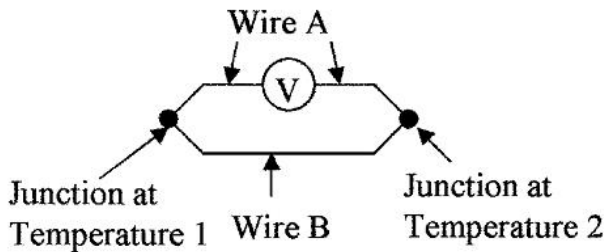


Fig.3: Thermocouple (basic assembly).

Source:(Dunn, 2005).

Strain gages or Gages

These devices whose resistance varies with its deformation. The operating principle of the strain gauges is described mathematically by equation (2), which shows that a resistance element also depends on its geometrical aspects such as length and cross-sectional area. Thus, the strain gauges are resistive elements constructed in a manner to maximize the resistance variation with deformation (Aguirre, 2013).

$$\frac{\partial h}{\partial \rho} \frac{\partial h}{\partial T} \frac{\partial h}{\partial L} \frac{\partial h}{\partial A} \tag{2}$$

Pressure

It can be defined as the pressure measurement orthogonal uniform force exerted by a surface whose area is divided such same strength, which is commonly indicated by the equation (3) (Aguirre, 2013).

$$p = \frac{F}{A} \tag{3}$$

On what:

- F - force [N];
- A - area [m²];
- P - pressure.

Among pressure sensors generally used are the piezoresistive the operation of these sensors is similar to the transducers based on strain gauges membranes, although they are generally smaller and more compact (Aguirre, 2013).

Transducers

Devices running the conversion of a physical quantity in another are called in general TRANSDUCERS (Natale 2001).

The transducers are divided into two categories (Aguirre, 2013):

The first category are passive transducers. Here the energy of the output signal is provided entirely by the input signal generating means or at such signal;

The second category, unlike the former, are the active transducers. In this case, the energy at the transducer output is not from the input signal (at least mostly).

Signal Conditioner

Generally, the output electrical quantity transducer is not directly manipulable. For example, the range of the output voltage is not the desired one, the power of the supplied signal is very small, the type of electrical quantity is not that we need, etc. For all these reasons, the transducer is never presented alone, but accompanied by a SIGNAL CONDITIONER (Natale 2001).

III. MATERIALS AND METHOD

The proposed monitoring system in real time was developed aiming to meet the technical requirements for data acquisition from the sensors accurately and efficiently. Fig. 4 shows a representation of the system simulation and data acquisition.



Fig.4: System simulation and data acquisition.

For the acquisition of temperature data is used the temperature sensor (thermocouple Type K) viewed in Fig. 5.



Fig.5: K-type thermocouple

For acquisition of the air pressure values simulating the pressure of combustion is used VKP Pressure Transmitter-027. IP65, illustrated in Fig. 6.



Fig.6: Pressure Transmitter VKP-027. IP65.

For the acquisition of water pressure values is used Pressure Transmitter Mini VKP-011. IP65, illustrated in Fig. 7, which has the most compact design of the market. Designed to meet industrial applications and meet the challenges of small spaces with precision and efficiency. Its construction is entirely in AISI316L, which makes it compatible with a massive majority of industrial processes.



Fig.7: Pressure Transmitter Mini VKP-011.

In FIG. 8, the prototype machine was installed where the pressure sensors and the cooling water temperature of the combustion system is illustrated.



Fig. 8: Mechanical prototype.

In Fig. 9, illustrated is the combustion pressure of the compressor prototype used to perform the simulation of the combustion pressure variation to the gas inlet into the cylinder. This compressor that injects air chamber to a pressure of 20 bar. This data will be captured by a pressure transducer.



Fig. 9: Prototype combustion pressure.

In fig. 10 is shown the prototype of water pressure with the compressor to simulate enters from the combustion gas within the cylinder of the water chamber in order to simulate the turbulence which can occur due to failure or malfunction of the head gasket .



Fig. 10: Prototype water pressure.

In Fig. 11, is displayed the DAQ assistant, logic block that has the tools for configuring the physical modules of data acquisition and turn it into a digital output that is used to power other blocks to generate graphs of monitored variables.

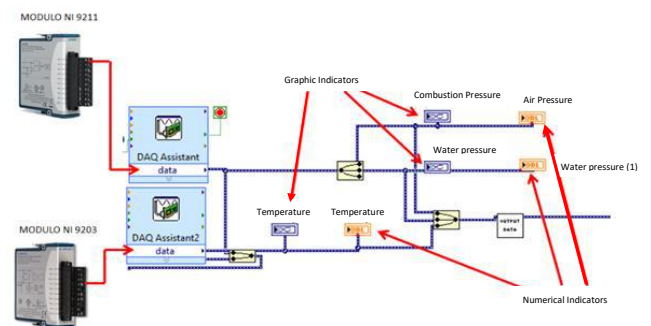


Fig. 11: DAQ assistant.

Fig. 12 illustrates the second part of the logical blocks monitoring the three variables of the proposed monitoring system.

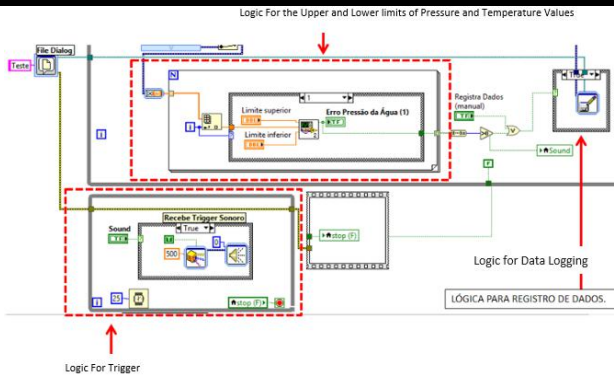


Fig. 12: the second part of the logic blocks.

IV. ANALYSIS OF THE APPLICATION OF THE PROPOSED SYSTEM

Once the sensors are installed and the system started, information is collected through the developed software, the results of a real engine in laboratory scale are simulated. In this case they are tested combustion pressure, temperature and cooling water pressure.

Each test was carried out in stages in order to verify the functionality of the hardware and software and the accuracy of the results.

In Fig. 13, the monitoring screen is displayed combustion pressure.

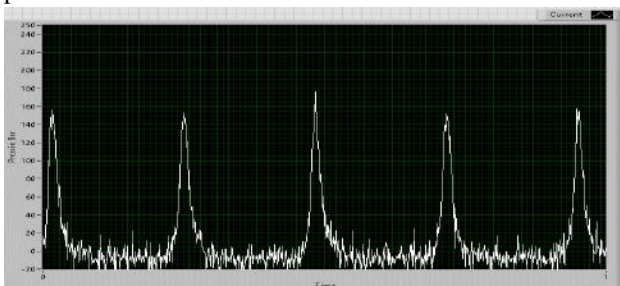


Fig. 13: Graph Combustion pressure.

The values shown are within specifications for engine combustion system.

In Fig. 14, is displayed on the monitoring screen cooling water pressure.

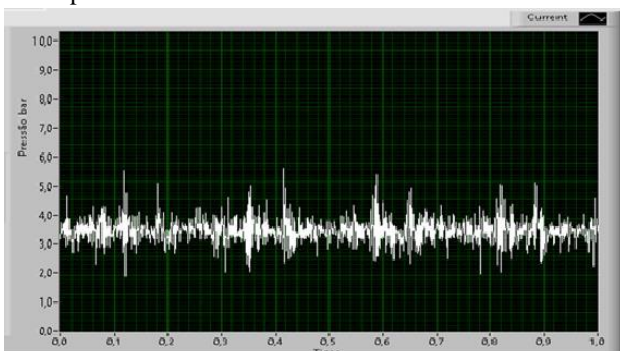


Fig. 14: Graph of water pressure.

The figures are within the specifications for the engine water pressure system.

In Fig. 15, is displayed on the monitoring screen cooling water temperature.

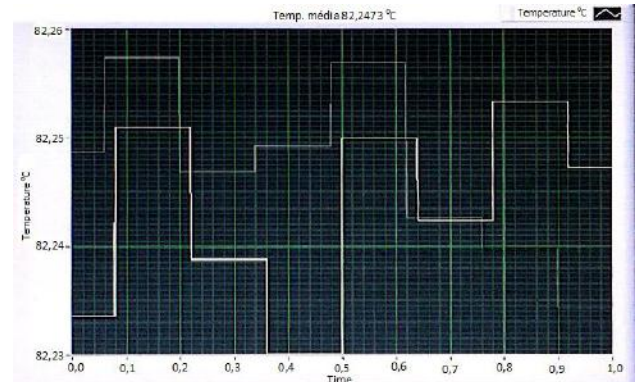


Fig. 15: Graph water temperature.

The values obtained are within the specifications for the engine cooling water temperature of the system.

V. CONCLUSION

The prototype proposed for the monitoring system of the generator operating parameters from the values collected from the combustion pressure and temperature variables and engine cooling water pressure provides data for diagnosis and fault detection in the power generation process this engine. The use of sensors for real-time data capture, proved to be streamlined and efficient, providing parameters for fault detection in the engine operating conditions, enabling greater reliability and safety in power generation. Monitoring these variables proved to be indispensable to preserve the proper functioning of these machines TPP.

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Cultural and Natural Heritage as Inputs of Sustainable Planning: A Theoretical Framework

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Abstract—For some cities like İstanbul, Rome, Paris and Cairo etc. as being the ones having natural and cultural heritage intensively, the most dominant planning data is the heritage itself. If we talk of sustainable planning, we should talk of not only the true planning regarding ecological principles, but also protection and reassessment of cultural and natural heritage at circumstances regarding sustainability, therefore this has to be recognized as a true sign of ecological approach. On the other hand, one of the applied tools of Sustainability; “Sustainable Planning” as a correspondence of “Sustainable Development” in planning, is meant to use the nature and resources in the name of protecting them, for the sake of caring future generations. Today, World’s energy strategies based on solid fuel and petrol, unbalanced resource consumption with least sense, consuming environment negatively, increasing rates at population, consumption and urbanization, the lack of fast regeneration in nature, and many other parameters like the ones above which will remain unmentioned, threaten ‘Sustainability’ in direct. The purpose of this article, instead of consuming resources in the sense above, is to show of assessing cultural and natural heritages (for being ecological resource in essence and reflecting histo-cultural aggregation of humanity) and of using it as an input, by verifying the feasibility of it to be a parameter providing-supporting the mentality of ecological planning and cultural sustainability. Sustainable planning must be expected to create principles and decisions regarding to protect-use balance for this heritage which is under the threat and pressure of civic developments. The use of cultural and historical heritage as an argument in Sustainable planning is given as of work and reports, international contracts and reported decisions related to these all are also given as references

Keywords: Sustainability, Urban Development, Sustainable Planning, Natural Heritage, Cultural Heritage.

I. INTRODUCTION

This process, which the world has been experiencing, has been discussed for a long time because of some reasons such as rapid changes around the world and the

consumption of resources via wrong usage. Moreover, nature is not able to renew itself in spite of its renewable structure, because too much pressure has been put on natural resources. National and international studies are carried out within this concept as it has been understood that the world, in which we live, is unique and natural resources are about to extinguish rapidly. Environment friendly approaches in terms of urban planning and structure design began to appear a long time ago, but the awareness concept in terms of comprehensive, scientific and international studies is something quite new. This studies lead to some new concepts such as sustainability, sustainable development, sustainable urbanization, ecological planning, ecological designs..etc.

This study within this framework addresses sustainable planning as an important tool for sustainable urbanization; and one issue to be discussed within this concept is that whether it should contain the protection and the new assessment period of cultural and natural heritages. According to a thesis, the definition of cultural and natural heritage represents an important resource for sustainability, while the content of this heritage is to be considered as an important contribution in terms of sustainable urbanization planning. Therefore, this topic shall be considered within the framework of this thesis.

II. LITERATURE REVIEW

The researchers have done a lot of research on the subject. Some of these researches have been published as articles. Some are published as books or book chapters. In a number of studies, the sustainability of cultural and natural heritage has been addressed together with tourism and touristic routes. Some of the related articles are: “Tourism, Environment, and Sustainable Development, Environmental Conservation” (Butler, 1991); “Developing Sustainable Tourism for World Heritage Sites” (Drost, 1996); “A new model to assist in planning for sustainable cultural heritage tourism” (du Cros, 2001); “Challenges of sustainable tourism development in the developing world: the case of Turkey” (Tosun, 2001); “Planning for Urban Heritage Places: Reconciling Conservation, Tourism, and Sustainable Development”;

(Nasser, 2003); “Sustainable development prospects for Italian coastal cultural heritage: a Ligurian case study” (Callegari, 2003); “Relationship between tourism and cultural heritage management: evidence from Hong Kong” (Mc Kecher et al., 2005). “Culture as the fourth pillar of sustainable development” (Nurse, 2006); “Managing for sustainable tourism: a review of six cultural World Heritage Sites” (Landorf, 2009); “Sustainable development and cultural heritage management in Botswana: towards sustainable communities” (Keitumetse, 2011); “Social and Cultural Sustainability: Criteria, Indicators, Verifier Variables for Measurement and Maps for Visualization to Support Planning” (Axelsson et al., 2013); “Culture as the fourth pillar of sustainable development” (Astara, 2014); “Built cultural heritage and sustainable urban development” (Tweed & Sutherland, 2007); “Cultural ecosystem services provided by landscapes: Assessment of heritage values and identity” (Tengberg et al., 2012). A few of the books on the subject are: “The Fourth Pillar of Sustainability: Culture's essential role in public planning” (Hawkes, 2001); “Tourism, Recreation, and Sustainability: Linking Culture and the Environment” (McCool & Moisey, 2001); “Sustainable Tourism in Protected Areas - Guidelines for Planning and Management” (Eagles et al., 2002).

III. METHODOLOGY

This study is aimed at determining whether cultural and natural heritage can be the source of sustainable planning. In this study, a theoretical framework will be established for the determination of all variables that cultural and natural heritage may have entered into the plan. For this purpose, firstly, international policies and scholarly work on sustainability and sustainable urbanization and planning will be examined. Second, the relationship between cultural and natural heritage and sustainability will be addressed within the framework of international basic policies and contracts and decisions. The relationship between cultural and natural heritage and planning will be examined, and whether this heritage contributes to sustainability will be discussed. Third, sectoral headings and subcategories related to planning will be determined. The factorial effects of cultural and natural heritage may be introduced into the planning sectors. Finally, a theoretical framework for the topic will be established. International policies, agreements, decisions, charters etc. all texts have been examined through basic primary sources.

IV. SUSTAINABILITY

The concept of sustainability occurred on the basis of some concepts related to environment and ecology human environment, environmental management, ecological process, ecosystem, ecological balance) that were

presented through the Stockholm “Conference of the Human Environment” declaration in 1972 and the principles and rules (UN, 1973) related to the environment law together with the concepts of optimum sustainable productivity, environment and development that were presented through the “World Charter for Nature” and accepted by the General Assembly of UN in 1982 (UN, 1982). A broader sense of discussion and examination related to the sustainability concept was recommended by The World Commission on Environment and Development (WCED) with a report published under the name of “Our Common Future.” According to this report (WCED 1987), sustainable development is “development that meets the needs of present without compromising the ability of future generations to meet their own needs.” The sustainability term was used together with the development term in those years and this usage aimed to define the issues that had to be taken into consideration within the concept of sustainability. Namely, a general framework in terms of sustainability was aimed. Different comments related to the concept occurred after the publishing of “Our Common Future.” According to a commonly accepted approach, sustainability is “to supply a long term based social link between the society and the environment” (Becker et al., 1997). It is possible to find out that various definitions and comments related to this concept were revealed until 1994 and those comments and definitions shared the same vision, which was defined in “Our Common Future” (Mebratu, 1998).

It can be said that the concept of sustainability is based on two important concepts: Requirements and limitations. The Requirements concept is related with providing acceptable levels of opportunities in terms of food, wearing, accommodation and job, so that everyone can increase his own life quality. On the other hand, the concept of limitations includes the protection of all natural resources, living fields and varieties and the inspection of the qualities. Sustainability does not only include the protection of biological varieties and human health, but also the maintenance of acceptable soil, air and water quality for the benefit of human existence, human welfare, and animal and plant life (EC, 1994). According to the sustainability concept, the speed of our consumption in terms of renewable resources such as water and energy shall not exceed the speed of the renewing process.

The report of “World Protection” includes nine important principles, which can form a basis for the sustainability strategies. These principles are; To protect the common life standards and interests and to pay respect, to increase the life standards, to protect life and variety on earth, to decrease the consumption of un – renewable resources, to remain within the borders of the natural environment capacity, to change personal behaviors and applications, to protect the own natural environment of the societies, to

form a national framework for unifying the development and protection terms and to establish a global partnership (IUNC, UNEP & WWF, 1991).

In this framework, resource consumption is inevitable to establish a sustainable environment and according to this information, sustainability may appear as a concept based on a dilemma because it requires both consumption and consumption limitations in terms of resources. Therefore, understanding and accepting this concept has led to many discussions. An important point in terms of sustainability is to adapt the life styles and standards according to the natural environment capacity. To inform people about this issue has become the most important aim of sustainability.

V. SUSTAINABLE URBANIZATION AND PLANNING

The framework of this concept has become narrower, since it has been thought that sustainability as a whole can be achieved by sustaining its components. Sustainability in environment, economy, production, society, health, urbanization, planning, architecture... etc has become an objective because of a restructuring need in terms of natural, individual, physical, economical, institutional, technological, cultural and social systems that compose the world (Hatfield, 2000; Paehlke, 1999; Sachs 1999).

Sustainability can be defined as the ability to provide a limitless renewal opportunity for the current system and maintenance in terms of environment, society or any other system operation by using the system resources in a productive way and by avoiding excessive consumption. Like all other environment friendly concepts, sustainability also has brought new approaches related to developing and planning urban areas. "When the sustainability concept is applied on urban areas, it means that the urban areas and regions continue to sustain the life quality levels desired by the society by not limiting the opportunities of the present and future generations and by avoiding negative impacts within and outside the involved city borders" (Keiner, 2005). It is obvious that the concept of sustainable urban development includes issues such as social justice, sustainable economy and environmental sustainability.

A sustainable urban development approach aims to unify the below mentioned objectives for the purpose of achieving a balanced development. The involved objectives are: to strengthen economic welfare and employment within the scope of urban areas; to encourage equality, social participations, and urban restructuring activities in urban areas; to protect and develop urban environments; to contribute to urban management and local capacity (EC, 1998).

Three dimensions have to be examined in order to obtain a sustainable urbanization definition by taking the urban definition of "to harmonize socio-economic worries with

worries related to environment and energy in order to provide sustainability and change process" (Nijkamp and Perrels, 1994) into consideration. Natural and cultural environment has been an important point when providing sustainability in terms of urban areas. Environment contributed directly to the quality of human life, the natural atmosphere of humankind, general peace and welfare. Moreover, it increases the tendencies towards the idea that the heritage of past will be transferred to the future. (WCED, 1987). The objectives to be achieved in order to obtain urban sustainability are: to minimize the consumption of natural resources; to manage the urban flows effectively; to protect the health of urban population; to provide equal access to resources and services; to maintain cultural and social variety (Lautso et al., 2004).

The Brutland report and studies related to the meetings held after this report define the environment as a resource group that has to be protected and emphasize that it has psycho – social effects. Moreover, environment is an economic criteria that imposes a direct effect on social health. The ecologic debates that are handled under the concept of sustainable development support an environment friendly planning system. Therefore, we can consider "sustainable development" as an area included within the sustainable development plan that aims to protect the environment/ nature and to transfer the current opportunities to the future generations by taking the productive and optimal usage principles into consideration. The sustainable development plan includes all of the structured environments, natural and social environments and economic factors that affect the urban developments and that are also affected by urban developments. Moreover, it foresees the unification of economic and social development with environment protection and improvement aims and it requires the determination in terms of the development style (Conclusions of Bristol, 2005).

According to Wheeler, the concept of "sustainable urbanization" approach complying with the general framework formed by the sustainability principle should include issues such as: the inspection of growth and the planning of area; urban design; buildings; transportation; environment protection and restoration; energy and material usage; green architecture and structuring; variety and environmental justice; economic development; population etc (Wheeler, 2004). Restoration studies are related with cultural and natural heritages. Therefore, they include activities that aim to protect the nature, the species, the ecosystems and the damaged urban environment. The main strategies of sustainable resource usage are reduction, reuse and recycling. The reduction strategy aims to decrease material usage and to protect the current products in order to prolong their usage lives. The reuse strategy is related with using the same product again within the same

cycle. The recycling strategy is applied for the purpose of reproducing products by using waste materials. (Wheeler, 2004).

Different models reveal different features related to urban planning and sustainable planning. These features may be listed as: Complete planning and strategy development, minimum and optimal resource and energy usage, the protection of basic ecological processes, the protection of biodiversity, a high life quality, a high economic welfare level and a strong employment condition, a balance between economic growth and the natural resources, a qualified physical environment, diversity and environmental justice, optimum diversity, a controlled and inspected growth process, living areas with mixed functions, a strong transportation and road traffic, an effective and strong local management, equality in terms of opportunities, a strong social interaction, equal access to resources and services, cultural and natural heritage sustainability, historical and cultural sustainability, cultural and social diversity, a strong ownership and urban feeling, a living city center, individual and social behaviors and applications that provide sustainability, a long term based productivity, a growth that provides opportunities so that environment is protected for future generations, the ability of a city to stand as a whole...etc.

VI CULTURAL AND NATURAL HERITAGE AND SUSTAINABILITY

3.1. Cultural and Natural Heritage

According to definition of cultural and natural heritage, this issue has an important place within the concept of sustainability and it includes some ecological features. Therefore, it is one of the most important components of a sustainable urban planning process. International definitions and categorizations in terms of cultural and natural heritage also support that the content of this heritage is environment friendly.

The world assets that have to be protected are categorized and defined by UNESCO under the topic of “cultural heritage and natural heritage” (UNESCO, 1972b). The assets that have to be protected in Turkey are examined under two categories: Immovable Culture Assets and Immovable Natural Assets. Moreover, the man made immovable assets that include archeological, historical, aesthetical, and ethical importance are also considered as heritage (Resmi Gazete, 1983). The definition has been broadened in 2004 and according to this new definition, cultural heritage assets include movable and immovable assets on and under the earth related to scientific, cultural, religious and artistic values of historic and pre – historic times (Resmi Gazete, 2004) .

UNESCO and the Council of Europe categorized the assets to be protected as: monuments, structure groups and sites. Moreover, they emphasized that the involved sites must

bear historical, aesthetical, archeological, artistic, scientific, natural and social values. (UNESCO 1972a; COE, 1985). Benchmarks related to protected monuments and sites were later also extended. According to these extensions, monuments must bear archeological, artistic, historical or scientific values, while sites must bear topographic, archeological, historical, ethical values. (UNESCO, 1972b).

According to the European Charter of the Architectural Heritage, architectural heritage does not only include the important monuments, but also the ancient cities, the characteristic villages, the building groups that have less importance within the nature and human atmosphere. Moreover, this convention emphasizes that architectural heritage is something that aims to use and protect the spiritual, cultural, social and economic values (COE, 1975a). Cultural and natural heritage includes man-made structures that have an artistic and cultural value. Moreover, natural structures, which occurred as a result of the involved situation, topography, and climate, are also considered within this framework (COE, 1992).

It has been revealed that cultural heritage helps to establish a common approach and awareness among the people and it represents the fundamental richness of the present and future generations. As a cultural asset that should be protected the term “architectural heritage” is generally used for real cultural asset. The Council of Europe has touched on that architectural heritage is an economic asset that can be used for using resources carefully; expression of the cultural richness, variety and history; advisor of the social coherence and contributor of social integrity; it can also provide substantial material for the forms, styles, and the expression and comparison of their application forms; can take an important role in the field of education by keeping the evidences of different periods alive. It has been stated that architectural heritage includes the assets having mental, cultural, social and economic values. Architectural and cultural heritage communicates the primary elements of the identity of societies to the future (Osmanoğlu, 2018b). It has been also emphasized that architectural heritage contains the environment being essential for an equal and complete life and besides the structure of the historical center and sites are the advisors for a social coherence and accordingly the evidences of different periods should be kept alive (COE, 1975a). At the same time, social structure and process carry the cultural background and heritage of the past to our days and this heritage determines the way of the set of relations which we will experience both today and in the future (Osmanoğlu, 2018c). It is also stated that old structures contribute resource saving and waste preventing and the artificers and craftsmen taking part in the protection studies are needed. Renewal of the present settlement, reduction of using agricultural areas for urban functions

and the protection of present settlements help reducing and even preventing population movements (COE 1975b). Although it is not stated in definitions, historical, urban and street fabrics, squares, traditional construction practices, material, color, fabric and folk architecture; regional, traditional and rural architecture are accepted as going to be protected assets (Şahin, 2004).

3.2. Cultural – Natural Heritage and Planning

The most important means of protecting cultural and natural heritage is planning. It is implied that in the site areas defined within laws, by taking interaction-transition field of the area into consideration, the necessity of making reconstruction plan for protect cultural and natural assets in the direction of sustainability principle is stated (Resmi Gazete, 2004). But a protecting plan including only the site area is not sufficient. Today, protection cannot be thought alone. It is inadequate in providing sustainability alone. It is necessary to accept and aim the idea of renovation and conversion that are suitable for the requirements of the age. It has vital importance for the protection that cities with urban heritage perceive the protection of the heritage as a necessary aim for the sustainable and total planning in high scaled plans. That obliges the protection program to be in a sustainable approach. From past to present many opinions have showed that the studies of protection planning have positive contributions as well as studies of sustainable planning. In this sense, the principles for protection planning envisaged by ICOMOS share similarity with the principles of sustainable urbanization (ICOMOS, 1987). In international studies and acceptances it is admitted that urban heritage constitutes a reference for the next generations; integration of historical urban fabric with modern life by joining planning as a basic data. In this context, economic development can be brought to life with protection of urban heritage and cities can be seen as the guards of the tradition, culture and cultural heritage, so cities are responsible for protecting this heritage and carrying it to the future and for this reason the mission falls to the local authorities.

It is clear that in order to adapt sustainability in all fields of the cities and in urban settlements local authorities must necessarily take measures; cultural heritage and architectural heritage are essential for the sustainable cities (EC,1996). In this context, a sustainable urban planning with development of the projects, programs, strategies or plans designed by the specialists containing the physical, social, economic and environmental values of the city is demanded. Planning must be a means in order to find solutions to the problems in reaching sustainable development between development and protectionism (COE, 1992).

Studies of protection taking part in sustainable planning must be interdisciplinary and they must be carried on actively in cooperation with the other sector specific

policies such as environment, economic development, social policies, culture, housing, transportation, etc. This planning must put the other actors except the ones in public administration into effect and enable the people of the city to form actively the environment they live (EU 2007). The term “sustainable planning” must be thought as the total value of especially the cultural and natural heritage, economic, technologic, social and environmental / ecologic, health, etc. Sustainable planning must protect the cultural variety of the cities, provide social balance between the cities and create principles and programs reaching high quality in the fields of urban design, architecture and environment. For social justice, besides environmental sustainability, economic sustainability and equality are needed (EC, 1994).

But environmental side of sustainability is not limited with protecting the natural areas in our cities. It contains many other different factors such as important landscapes, traditional structure parties, archaeological fields, monuments, sites, traditional neighborhood, natural reserves and rural areas, Sustainable planning must be a means of sustainable urban development as well as for protecting the factors of natural and cultural heritage. Sustainable urban development should be a chance for creativity, innovatory discoveries, innovation of architectural styles and reacceptance and interpretation of the traditional applications (COE, 2008). It also should protect cultural assets through planning and reaccelerate the social, urban and architectural culture.

It is possible via planning, protecting and extending the important factors of the natural and cultural heritage (ECTP, 2003). It is a positive development for the future of the heritage that reviving the subjects such as protecting environment, sustainability principles, cultural/ urban heritage, natural heritage, cultural landscape in connection with sustainable urban development.

The "Notification Concerning the Tourism Management Certified Accommodation Facilities to be Given the Certificate of Environmentally-Friendly Accommodation Facility" (Green Star Symbol) published by the Ministry of Culture and Tourism is another positive attempt which encourages, promotes sustainability and regulates principles and procedures relating to the "classification of environmentally-friendly accommodation facilities for the protection of the environment, development of environmental awareness, encouraging and promoting touristic facilities for a positive contribution to the environment within the scope of sustainable tourism" (Osmanoğlu, 2018a). International public opinion mostly envisages that it can be only resisted with sustainable urban development containing culture, economy, social relations, environment, cultural and natural heritage and creative and total approach; against demographic differences and effects of that on the growth of the cities,

measures against environmental problems climate change, in a situation of economic and social changing providing social balance, protecting architectural and cultural heritage (COE, 2008).

3.3. Contribution of Cultural and Natural Heritage to Sustainability

As it is understood from the definitions about the cultural and national heritage and conceptual explanations, heritage is an existing important resource, and an economic value for urban and rural areas. It creates a coherent social balance and a cultural diversity. Thanks to its formation technique and ingredients of its materials, it does not pollute the nature or the environment. In contrast to this, as it completely consists of ecological materials, it is a friend of nature and life. With its features like sensitivity to nature and environment, consistency to climatic datum, usage of natural and low energy materials and creation of healthy and comfortable living environments, it constitutes a dominant data for the sustainable planning.

With the framework of the sustainability, cultural heritage has economic benefits and impacts like job creation, economic contribution (tourism), catalyst duty for technical innovations, tool for the transmission of information, education tool (information economy), tool for the regional development, energy conservation, energy of formation (energy balance), emission (Europe Nostra, 2009).

The protection of historical values also mostly means a successful urban economic revival. This heritage increases the attraction of the city for tourism and trade sectors. The re-usage of the old, in the areas where the industry partially founded, can provide an economic solution by transforming buildings to houses, hotels, business centers and similar usages. As the protection is a labor-intensive work, it is both a solution for the unemployment and it provides savings from infrastructure (COE, 1992). High quality architecture creativity, which the heritage contains in itself and contributes to its development, can revive the economy and be an attraction element for tourism to cities and towns (COE, 2008). The physical existence of cultural heritage is a source of information as a concrete document. Moreover, it is an indication of establishing dialogue with the past and next- generations, and respect to them. It is also a universal responsibility (Şahin, 2004).

The heritage helps the formation of common understanding and consciousness between people, and it is a basic source of prosperity and developing coherence of existing and future civilizations (UNESCO, 1972b). The historical heritage is an economical property to use the sources carefully; an expression of cultural prosperity, diversity and history; a guide of a coherent social balance, and an assistant of social integration. Furthermore, it not only provides rich material for the explanation and comparison of the forms, styles, and their way of

implementation, but also plays a decision-maker role in education by keeping alive the clues of products of different periods (The COE, 1975a).

Architectural heritage not only contributes the source saving and prevention of wastage, but also supplies the employment by creating the need to artists and high quality artisans, who should keep their talents and skills partaking in the protection works and carry them to future. The restoration of the historical/traditional settlements decreases the usage of agricultural areas for the urban purposes. Moreover, the protection of such existing settlements helps to decrease and even to prevent the population movement on a large scale (COE, 1975b). In our day, in which constructing techniques and architectural forms gradually resemble to each other and the danger of creation of a monotype environment all over the world exists, it is obvious that the protection of historical areas help the protection and development of the cultural and social values of countries, and by this way, it can be possible to contribute enrichment of the heritage of the world in terms of culture, nature and architecture.

Generally, most cities of our day consists of piles of stone, rock, steel, glass and asphalt and they have monotone green generations and areas which are not used enough (COE, 1992). Within this scope, the cultural heritage of the cities provides an individual identity, symbol, visual impact and aesthetic; and contributes the formulation of cultural identity and diversity. It is a key factor in defining the character of culture, and the character of a city or a region is defined by the cultural and natural heritage. The natural heritage has an important role in specifying the character of city or region by creating a natural or urban landscape identity. It provides and develops the natural, ecological and biological diversity, and forms a recreation area for cities.

With the protection of this heritage, the character of a region can be protected or renewed. The historical heritage also hides the memories/life experiences of the city. The architectural diversity, which is an important criteria for the sustainable urban development and a reflection of architectural quality and cultural diversity, can be reached by protecting and developing the architectural heritage. In addition to this, the new balances between the architectural heritage and technology cause the creation of new urban identities presenting more attractive urban environments (ECTP, 2003).

The cultural and natural heritage contributes the sustainability by promoting development of relations and peace environment between countries and societies by means of cultural diversity and intercultural dialogue. The cultural heritage also supports the sustainability by providing social benefits like contribution to social coherence, catalyst duty for intercultural dialogue, strengthening the local / regional / supranational identity,

improving the quality of life, development of sense of belonging and pride, and increasing the quality of life (Europe Nostra, 2009). The form of historical centers and patterns constitutes a consistent social balance. The creation of right circumstances for the development of the activities in the old city patterns provides social integration (COE, 1992).


As protection expertise training needs a different kind of expertise training, young people, who want to learn craft, help the growing up of people, who want to take additional training and gain additional skill, and artisans needing special expertise. These trainings contribute to the increasing the importance of trade relating handcrafts, and creation of professional and social opportunities (COE, 1992).

Findings reached with the researches show that, users in urban areas find the constructions forming our today cities generally indifferent, and they believe that they do not largely reflect social past, tradition, social culture, socio-cultural abilities of individuals and society; and these results reveal that cities have an identity problem. Within this scope, it shows that the cultural and natural assets reflect the social past, tradition, social culture, socio-cultural abilities of individuals and society, and it takes the most important role in creation of the identity with its architectural quality and diversity. It could be possible to reach rich comments and life experiences and historical continuity by taking not only activity, function and location, but also place, time, meaning, identity, symbol, and historical heritage composing visual impacts as an important data in planning the sustainable urban environment.

VII THEORETICAL FRAMEWORK

An institutional framework is required in order to evaluate the definitions, explanations and approaches in terms of this issue in a systematic way and to determine the topics

Table .I:. The inputs of cultural & natural heritage for sustainable planning

SUBJECT	CATEGORIES	MAIN ISSUES	SECTORAL AREAS OF FOCUS	INPUTS
C U L T U R	1 .NST The Natural Structure	NST1. Environment:	NTS1.1. Contribution to creating a natural identity,	
			NTS1.2. Determining the character of the city and the region,	
			NTS1.3. Prevention of the danger of a uniform environment creation,	
			NTS1.4. Reuse of the escape,	
			NTS1.5. Sensitivity to nature and environment,	
			NTS1.6. Being friendly to nature and life because it is made entirely of ecological materials,	
			NTS1.7. Contributing to the prevention of pollution & emission,	
		NST2. Ecology	NST2.1. Increasing and improving natural and ecological Diversity,	
			NST2.2. Maintaining biodiversity	
			NST2.3. Providing eco-tourism and ecological agriculture etc.	S
		NST3. Recreation	NTS3.1. Landscaping potential	U
			NTS3.2. Ceating a recreation environment for urban areas and regions,	S
	2. EST	EST1. Economic	EST1.1. Equipment maintenance for urban development and	

that can be considered as inputs within the concept of cultural and natural heritage. Sector specific topics and sub- topics related to this issue and the input factors of cultural and natural heritage are defined with the aim of establishing an institutional framework and determining the goals, targets, strategies and implementation tools for the sake of a systematic approach, which is formed in order to contribute to sustainable development. The involved sectoral areas of focus are: The Natural Structure, The Economic Structure, and the Socio-Cultural Structure (Table I).

The Natural Structure (NST)

- NST1. Environment: To contribute to the determination process of a natural identification; to define the characteristics of a city and region; to hinder the establishment of a uniform environment; to provide reuse; to behave friendly in terms of nature and environment; to contribute to the process related to the protection of the environment / nature; emission.


- NST2. Ecology: To increase and improve natural and ecological diversities; to maintain bio – diversity; to form concepts such as eco – tourism and ecological agriculture...etc.

- NST3. Recreation: To form a recreation atmosphere for cities and regions thanks to the landscaping potential.

The Economic Structure (EST)

- EST1. Economic structure: Equipment maintenance for urban development and regional development; the supply job opportunities; the supply of economic solutions by using historical buildings with the capacity of a house, a hotel, a business center...etc;

A L A N D N A T U R A L H E R I T A G E	The Economic Structure	structure	regional development, EST1.2. Creating urban economic revival, EST1.3. Supplying job opportunities, EST1.4. Supplying of economic solutions by using historical buildings with the capacity of a house, a hotel, a business center...etc, EST1.5. Contribution to the hindrance process in terms of excessive consumption, EST1.6. Providing training materials for information economy.	T A I N A B L E P L A N N I N G
	EST2. Manufacturing		EST2.1. Supplying materials and resources EST2.2. The use of natural and low-energy materials, EST2.3. The development of different types of craft products, EST2.4. To provide diversity and wealth in building material products, EST2.5. Creating culture and tourism industries, ETS2.6. Renewable materials	
	EST3. Trade and Services		EST3.1. Handicraft trade EST3.2. Urban charm Est3.3. Revitalization of trade and service sectors	
	EST4. Tourism		EST4.1. Economic development through tourism	
	EST5. Development in terms of Information and Technology		ETS5.1. Catalyst task for technical innovation, ETS5.2. The development of different types of crafts, ETS.5.3. Being a tool for transferring information, ETS.5.4. Contribution to the development of science on conservation, ETS.5.6. Making contributions to science and technology by transferring past information and technology,	
	EST6. Employment		ETS6.1. Creating professional opportunities, ETS6.2. To solve unemployment due to protection and restoration, ETS6.3. Creating the need for artists and highly skilled craftsmen,	
	EST7. Energy		ETS7.1. Energy saving ETS7.2. Energy balancing	
	EST8. Transportation		ETS8.1. Pedestrian-oriented and priority traffic, ETS8.2. Pedestrian areas, controlled traffic ETS8.3. Reduction of emissions due to closed traffic areas	
	EST9. Infrastructure		ETS9.1. The use of existing infrastructure ETS9.2. The use of existing superstructure	
	EST10. Urban Function		ETS10.1. Use of existing structures for urban functioning, ETS10.2. New areas for urban functions not planned ETS10.3 Reducing the use of agricultural land for urban functions,	

SUBJECT	CATEGORIES	MAIN ISSUES	SECTORAL AREAS OF FOCUS	INPUTS	
C U L T U R A L A N D	3. SST The Socio-Cultural Structure	SST1. Demographic and Social Structure	SST1.1. Providing a harmonious social balance, SST1.2. Creating social integration, SST1.3. To add a rich commentary to social life, SST1.4. Contribution to the creation of social opportunities, SST1.5. Moving the social tradition to the future SST1.6. Guiding for social equilibrium, SST1.7. Contributing to dialogue with past and future generations, SST1.8. To significantly reduce population movements through the protection of historical settlements,	 S U S T A I N A B L	
			SST2. Social Infrastructure		SST2.1. Contribution to the proliferation of non-governmental organizations, SST2.2. Contribution to the activities of non-governmental organizations,
			SST3. Housing		SST3.1. Contributing to the housing problem with the existing building stock
			SST4. Urban Life Quality		SST4.1. Creating health and wellbeing life circles
			SST5. Urban Identity		SST5.1. The city owns and urbanism consciousness, SST5.2. To provide an authentic identity, SST5.3. Symbol, visual effect, creating aesthetics and symbols,

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	SST5.4. Contributing to the consolidation of local / regional / transnational identity,	E
	SST5.6. Creating feelings of belonging and pride,	
	SST5.7. Prevention of the danger of a uniform environment creation,	
SST6. Technical Infrastructure	SST6.1. Facilitate potential spaces for cultural activities	P
SST7. Education	SST7.1. Training for different types of craftsmen and craftsmen,	L
	SST7.2. Protection expertise training,	A
	SST7.3. Education for the tourism industry,	N
	SST7.4. Providing additional training opportunities for young people,	N
SST8. Culture	SST8.1. Cultural diversity,	I
	SST8.2. Architectural diversity creation,	N
	SST8.3. Historical and cultural continuity,	G
	SST8.4. Being a source of information for communities,	
	SST8.5. Transfer of knowledge of the past,	
SST9. Social Relations	SST9.1. The development of community relations,	
	SST9.2. Development of intercultural dialogue	
	SST9.3. Contributing to the development of the peace environment,	
	SST9.4. Creating a common understanding and consciousness between individuals and communities,	



Contribution to the hindrance process in terms of excessive consumption and to provide training materials for information economy.

- EST2. Manufacturing: The management of resources, raw materials and infrastructure; the usage of natural material that requires lower levels of energy; the development of different kinds of agricultural products; the supply of diversity and richness in terms of products related to the construction sector; the creation of culture and tourism industries.

- EST3. Trade and Services: The operation of commercial activities related to handicraft; contribution to the attractiveness of the city for the sake of commercial sectors and service sectors.

- EST4. Tourism: Financial contribution thanks to tourism activities.

- EST5. Development in terms of Information and Technology: The role of being a catalyzer for technical innovations; the development of different kinds of crafts; The role of being an equipment while transferring information; contribution to scientific areas that focus on protection; contribution to science and technology by transferring information and technology from past.

- EST6. Employment: The creation of vocational job opportunities; creating solutions for unemployment; creating employment areas that require artists and high qualified craftsmen.

- EST7. Energy: Energy savings; embodied energy (energy balance)

- EST8. Transportation: Contribution to pedestrian traffic; pedestrian areas; controlled traffic; reduction of emissions due to closed traffic areas.

- EST9. Infrastructure: Contribution to the present infrastructure; economic contribution due to the use of existing infrastructure and superstructure.

- EST10. Urban Function: Decreasing the usage of agricultural areas with the aim of urban functions; the use of existing structures for urban functioning, and therefore no new areas to be planned

The Socio-Cultural Structure (SST)

- SST1 .Demographic and Social Structure: To establish a harmonic social balance and to provide social unification; to provide a rich approach in terms of the social life; to contribute so that social opportunities shall be available; to undertake the role of being a leader in terms of social balance; to establish a connection between the past and future generations; to decrease the population movements with the aim of protecting the historical placement.

- SST2. Social Infrastructure: To contribute to the establishment of non – governmental organizations; to contribute to the activities of non-governmental organizations.

- SST3. Housing: To provide additional contribution to the housing problem by benefiting from the present housing stock.

- SST4.Urban Life Quality: To create healthy and comfortable life standards.

- SST5. Urban Identity: To adopt the city and to be aware of the urban policy; to create a unique identity to the city; to create symbols, visual effects and aesthetic

features; to contribute to the process related to reinforcing the city identity on a national/ regional and local basis; to create the feelings of ownership and proud; to hinder the establishment of a uniform framework.

- SST6. Technical Infrastructure: To provide opportunities for potential places, so that cultural activities shall be carried out.

- SST7. Education: To provide training and education for different kinds of crafts and craftsmen; to provide training in terms of security; to provide additional education opportunities for youth.

- SST8. Culture: to create concepts such as cultural and architectural diversity; to maintain sustainability in terms of historical and cultural values; to undertake the role of being an information source for societies; to transfer information from past.

- SST9. Social Relations: To create a dialogue among the societies and cultures; to contribute to the establishment process of a peaceful atmosphere; to create a common understanding and approach among the societies.

VIII. CONCLUSION

One of the most important issues that have to be taken into consideration when discussing this issue is that cultural and natural heritage, economic, social and environmental goals, and the sustainable urban planning policies compose a unique framework. In a broader sense, it can be said that the creation of a close and positive relation between the regions, urban and rural areas and cultural and natural heritage is very important within the concept of sustainable country and region. The planning process shall be carried out on an accurate basis by considering that environmental sustainability is not only related with natural resources, but includes also the cultural / natural heritage of a city. It is strictly important to encourage the dissemination of economic and social benefits related to the cultural and natural heritage and to consider the heritage as one of the most significant inputs of the planning process. Moreover, the aim of sustainable planning shall be based on the protection of the resources included within this heritage and the interpretation of those resources by applying suitable operations.

Additionally, a unique framework shall be created and this framework shall aim to protect the environmental and cultural heritage and the cultural and natural assets; and to consider all those assets and heritages as documents, economic resources and an ecological and social values. According to this study, sustainable planning includes environmental, economic and social components and it aims to maintain sustainability in terms of the cultural and natural assets. The usage of data related to sustainability is inevitable within this planning process.

This study reveals that cultural and natural heritage

includes some topics and sub –topics that are related to issues such as sustainable urban planning, natural structure, economic structure, and social structure. Moreover, it is obvious that benefiting from present stocks is related with an ecological approach. The evaluation of historical heritage composes another part and dimension within the framework of sustainability because this evaluation focuses on a productive usage in terms of rare resources and a protection in terms of environmental areas. Protection is related with historical sustainability. If this concept is accepted by societies and if people achieve to integrate those concepts into their daily life, it shall be possible to maintain an accurate process on the basis of a proper sustainability plan. Sustainability in terms of life requires a sustainability process, which is based on structured and physical environments. The key factor, which is taken into consideration within the framework of natural and environmental (structured) heritage sustainability, is related with the life style of the involved societies.

This study points out that cultural and natural heritage is related with previous know – how, experience and information. Moreover, the study focuses on how to find information about the multifunctional structure of this heritage and how to use it as an input for sustainability. This study and the institutional framework will certainly be a preparation for future studies and contributions in terms of this field.

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A Webibliomining Analysis of PPC in the Perspective of Creating an Educational Software for Brazilian University Education

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Abstract— *The teaching of practical subjects such as PPC (Production Planning and Control) can be enhanced through the use of suitable educational software as it engenders aspects of dynamism and interactivity in the learning process. The present article aims to develop a webibliomining analysis in order to expose the theoretical framework and to explain the state of art of research related to PPC in scientific literature. The key content of PPC topics will be used as a guideline for the development of an specific educational software framework. As for the methodology, bibliographic and bibliometric research resources were used to compose the webibliomining analysis, thus making the article acquire the character of qualitative and quantitative research. The renowned Web of Science database and Nails software were used in order to formulate and prioritize the PPC content. As a result of this, the product of the article consists of the framework of the referred software which has highly relevant content because it is aligned with the inputs generated by the use of webibliomining resource as a facilitating tool on content selection of PPC subjects seeking to increase the learning process efficiency by students of engineering and business at Brazilian universities.*

Keywords— *Bibliometric Analysis, Educational Software, Planning and Production Control, Webibliomining.*

I. INTRODUCTION

In the context of university teaching and learning, the practical subjects, such as Production Planning and Control (PPC) course, can be improved by means of so-called educational software frameworks which, despite of being relevant, are still little used in Brazil. The use of those software frameworks assisting teachers in classroom has being made relevant by its dynamism and interactivity factors.

The present article proposal makes use of webibliomining analysis as a methodological tool for selection and prioritization of PPC themes to be addressed in a conceptual model used for the creation of educational software with the objective of increasing the teaching-learning efficiency of this subject for students of engineering and business at Brazilian universities.

The themes inherent in the content of PPC addressed in university classrooms and laboratories should follow not only the basic theory founded by traditional authors, but also the progress and trends that are occurring in practical field.

The article is divided into the following sections: Literature Review; Methodological Aspects; Webibliomining Analysis of PPC; Application in the Educational Model; and, Final Considerations.

II. LITERATURE REVIEW

In the scientific literature of the macro field of study of PPC it is possible to find efforts to produce models of reference in order to enhance the learning process of this subject.

According to Sauaia & Zerrenner (2009), such educational models offer as main advantages the low investment cost (time, energy, resources) and the effective contribution in learning the proposed theme.

The same authors also warn that systematic errors may occur, since the models are not able to cover all the variables of the real dynamic scenario that is intended to model.

2.1. Tubino (2000)

One of the pioneering and still relevant contributions to educational software models in Brazil continues to be the scientific work of Tubino (2000), as a way to stimulate the learning of PPC themes, the author proposes a business simulation in the form of a game that represents,

in turn, the operation of a manufacturing productive system, as can be seen in figure 1.

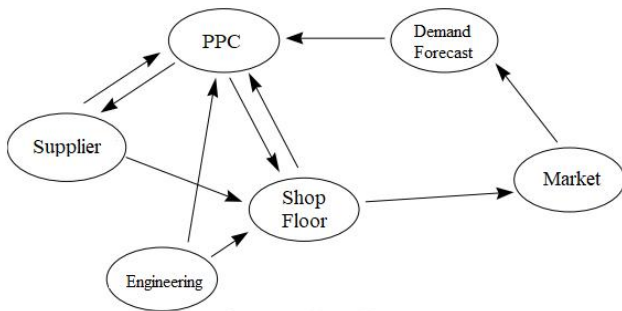


Fig.1 : Basic model of a manufacturing productive system

This model, called GPPC-1, was developed following the basic logic of the PPC, focusing on Production Programming:

- a) Forecast sales from previous sales;
- b) Production based on expected demand;
- c) Sale of finished products;
- d) Cycle feedback.

The dynamics of this model emphasize that the maintenance of inventories, raw materials or finished products, generates costs. On the other hand, the lack of such items also generates significant losses. Finally, the company efficiency is evaluated through the cost of production indicator, given the PPC decisions made in the purposed simulation.

2.2. Barretini and Campos (2010)

Another proposal of an educational model aimed at improving the learning of PPC concepts, both by managers and students can be found in the work of Barretini e Campos (2010).

Using the CIMOSA modeling language, through the computational tool CIMTOOL, the Brazilian authors develop an Aggregate Planning model, in which the user is able to observe its dynamics aspects through the behavior of general variables.

The demands of product families for certain periods should be foreseen and planned; make a decision about the type of labor to be used (normal shift, extra, outsourced); observe and manage inventory costs, lack of products and unit cost of production.

2.3. Ferreira et al. (2014)

Dissering about dynamic scenarios, there is the study promoted by Ferreira (2014) et al. adapted from Tsai & Sato (2004), who, despite not focusing on university education, develops a UML class diagram model on the theme of Agile Planning and Production Control and its respective methods and attributes, and the interaction relations between these.

Such a theme is centered on make-to-order manufactures where quick changes in customer orders require agile reactions on the PPC model adopted.

III. METHODOLOGICAL ASPECTS

In this section the research methodology to be used in the development of this article is presented. Conceptual aspects of bibliographical and bibliometric research are used in an approach that covers both quantitative and qualitative characteristics.

3.1. Type of research

According to Ciribelli (2003) the definition of research focuses on the act of investigation from a problem situation; Its purpose is to broaden the understanding of a particular research topic, maximizing scientific knowledge, improving or developing new theories, and characterizing new principles.

Already in the view of Rampazzo (2005), research is an activity focused on the solution of problems through the processes of the scientific method; It is characterized as a reflexive, systematic, controlled and critical procedure that allows discovering new facts or data, solutions or laws, in any area of knowledge.

For the present article, it was used the bibliographic methodology research that, according to Gil (2002), is developed from previous elaborated material, which is consisting mainly of books and scientific articles.

This research material has been expanded and improved through the concept of webibliomining research, defined by Vanti (2002) as a set of research methods that uses quantitative, statistical and data visualization analyzes. It is a useful tool not only to map the knowledge structure of a scientific field, but also to analyze the behavior of researchers in their decisions in the construction of this knowledge.

In the spectrum of webibliomining analysis as a tool, Costa (2016) classifies the five main types of methodology used as: citation analysis; co-citation analysis; bibliographic grouping; co-word analysis; and "webmetry". This work is focused on the citation analysis methodology.

3.2. Type of approach

Regarding the approach of this scientific article, it can be defined as qualitative and quantitative. This fact implies in qualifying and quantifying the data obtained through information collected through observations, organizational documents and data analysis.

As an example of this, it can be cited the natural subjective behavior of the researcher in relation to the relevant content generated by the webibliomining of the

subjects carried out through the Web of Science database and classified by the software Nails. That is, relevance data are generated quantitatively by this software, which analyzes the number of citations and the impact factor of the articles to rank them in order of importance for the research.

However, the subjectivity of the researcher engenders the qualitative character of the research approach when the articles that have greater affinity with the project theme are analyzed, among those considered relevant in the first quantitative analysis.

In the scientific methodological framework, the present research can still be defined as being of an applied nature, since it is part of the proposal of this project to test the educational software in a sample of university students.

IV. PPC WEBBIBLIOMINING ANALYSIS

One of the most notable aspects of PPC processes is the general decision-making model that, according to Erol & Nakiboglu (2017), is relevant in the process that seeks to solve the problem through the generation and evaluation of alternatives and finally, the choice of the best of them, taking into consideration an organization oriented towards profitable and efficient results.

The importance of decision-making can also expand to its implementation and control the decision-making process to determine when additional decisions are required. In this case, decision making becomes practically synonymous with management.

In an educational model, with the objective of promoting the learning of the concepts of PPC, the decision making enters as one of the main philosophies, since it is an inherent attribute at all levels of planning having its relevance easily understood in the holistic concept of the subject in question .

Another attribute to be portrayed in the educational model would be mathematical models adjacent to the (complex) levels of planning, such as mathematical and computational models of inventory.

Nahmias (1997) explains that inventory theory naturally comprises inventory models because of their high complexity of variables. Such models have as their main objective to minimize the total cost of this and to balance the economy of large orders or large production launches against the cost of maintaining the stock and the cost of scarcity.

The market is rapidly advancing as companies incessantly pursue new methods and procedures in the constant attempt to outdo competitors; or stay at the top, dominating the largest share of sales in the market.

These factors are described by Mesquita (2008) as: reduction of production lead times, reduction of

inventory costs (raw materials, consumables and final products), reduction of production costs (idle, overtime, subcontracting), compliance with timeliness and agility of response to changes in demand.

Regarding the most relevant authors for the PPC themes, the list of the most cited authors (figure 2) generated by the Nails software was obtained from the bibliometric research data in the Web of Science database.

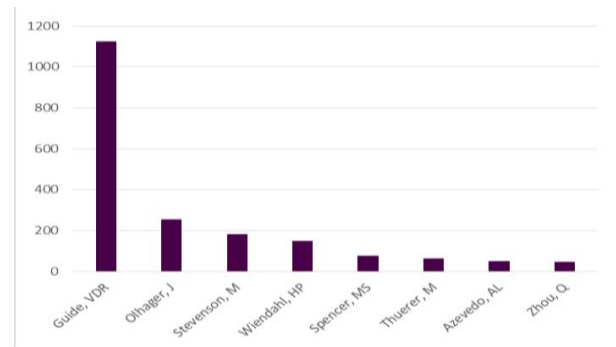


Fig.2: Most Cited Authors on PPC Topics

The most relevant author for the study fronts of PPC themes and their correlates is the Pennsylvania State University professor, VDR Guide.

One of the most important themes addressed by this author is the concept of remanufacturing, where the processes on PPC philosophy have to be remodeled to adapt to a production line with some particularities.

Expanding the remanufacturing aspects and exploring its theoretical concept, we have that it is consistent in production models in which the organization input promotes the transformation of its products with activities of disassembly, maintenance, repair of damaged parts and cleaning. The output, in a simplistic approach would be the same input product, however, remodeled, restored, remanufactured.

According to Gray and Charter (2006), a product can only be considered remanufactured when it is conditioned to the same specification of the original manufacturer from the perspective of the consumer.

Thus, a remanufactured product or component can be defined as one that can be brought to the condition of new after being used (or discarded) by the consumer.

In the view of Guide (2000), the most cited author, remanufacturing represents a greater form of value-added recovery than material recycling.

Remanufacturing systems are common and profitable in the United States. However, the author discusses that the management of PPC activities in the remanufacturing processes can differ greatly from management activities in traditional manufacturing and,

through their scientific research, proposes a PPC model adapted to this.

Another author considered relevant in the bibliometric research carried out is J. Olhaguer, professor of Supply Chain Management at Lund University. His research is naturally based on topics related to efficiency in supply chain management.

In his main work, Olhaguer (2003) discusses the Order Penetration Point (OPP). According to the author, the OPP defines the moment in the value chain where a given product becomes linked to a specific customer order.

Different manufacturing environments (make-to-stock, assembly-to-order, make-to-order, engineer-to-order) relate to different OPP positions. In these different ways, PPC displays varied strategies in delivering products, having different implications for manufacturing objectives such as customer service, manufacturing efficiency and inventory investment.

Finally, as the third most cited author, we have Stevenson (2006) who explains different approaches to PPC based on methodologies such as Kanban, MRP II and Restriction Theory.

This author considers factors such as the importance of the step of analyzing customer demand, company size, degree of customization and factory floor configuration and shows that they play an important role in the applicability of PPC concepts.

In this way, the aspect of raising awareness of researchers and professionals for the flexible options offered by the PPC philosophy to aid in decision-making in the selection of the management model is addressed.

The same author stresses the importance of a clear implementation strategy for such a model.

Therefore, there is a dynamism aspect inherent on PPC practices. For the creation of a reference model that serves as a teaching and learning tool on the subject, one should address its basic conceptual principles and foundations.

However, the various processes and their variables (depending on the type of industry, market, production) that impact the final PPC model for a particular organization should also be mentioned in terms of dynamism, flexibility and mutability.

As for the most relevant articles (classified according to the impact factor of the software Nails), there are works such as that of Kingsman (2000) who lecture on Workload Control (WLC), a PPC concept available for practical operations.

According to this author his principle is to control queues in front of the workstations on the factory floor by means of norms and rules pre-established. With better control of waiting times in the overall

manufacturing, queues are kept short, increasing the operational efficiency of the organization.

In addition to the objective of controlling the workload and queue length in workstations on the shop floor, it is desired at the same time to process the products in order to meet the promised delivery dates with machine capabilities available.

In this concept, the Workload Control in the Reference Model can be cited as a methodology to assist in the elaboration of the Master Production Schedule, since this includes a more operational and direct approach to the factory floor in the general theme of PPC.

Silva, Almeida and Roque (2006) discuss the adaptations in the PPC process to increase production efficiency in a specific mold industry.

Already in the article authored by Hendry et al. (2013), the WLC is treated with a greater degree of individualization in the company, that is, the specific needs of the organization dictate the priorities to be addressed in its operational planning processes. This corroborates the assertion of the dynamic character that the philosophy of PPC can assume.

As a result, the authors' approach is based on principles and methodologies of assistance to PPC such as MRP II, Kanban and even initial concepts of Workload Control.

With regard to the most frequent keywords classified by webibliomining research we have a view of the most elementary terms of the macro fields of study Production Planning and Control, as can be seen in table 1.

Table.1: Most Frequently Searched Keywords

Keyword	Frequency	Keyword	Frequency
PPC	245	Remanufactu- ring	25
Production Planning	76	Manufacturing	23
Simulation	52	Supply Chain Management	20
Scheduling	45	Production	
Workload Control	32	Optimization	17
Production Control	26	Make to Order	12

As expected, the words: Manufacturing; Production Planning and Control (PPC); Production Planning; Scheduling; Production Control and Production appear frequently because they represent the elementary basis of the methodological of PPC structure.

Macro specific aspects inherent to the theme which are also frequently cited are: Work Load Control and Supply Chain Management. These aspects guide the concept of PPC to be used. Be it in a more operational approach such as the WLC, or in a more strategic one such as Supply Chain Management.

Basic actions of PPC processes also appear as the most cited words: Optimization and Simulation. And finally, we have Remanufacturing and Make-to-Order as specific production styles often cited in scientific articles.

Having knowledge about the themes of PPC through the resources obtained from the webibliomining research carried out, one has the necessary knowledge base to foment the structuring of the content that will be present in the reference model for the learning in the said subject.

V. APPLICATION ON THE EDUCATIONAL MODEL

In the context of the construction of a basic conceptual model for the creation of an educational software in order to increase the efficiency of the teaching-learning processes of PPC, webibliomining process plays a very important role in exposing the theoretical framework and explaining the state of art of that subject.

The researcher is responsible for selecting the relevance that new research brings to the purpose of interest. That is, which topics on PPC should be explored in the Brazilian universities for engineering and business students.

The model proposed by this article is established in a software application that will act as a question and answer game about the themes inherent to PPC, a software interface is available in figure 3.

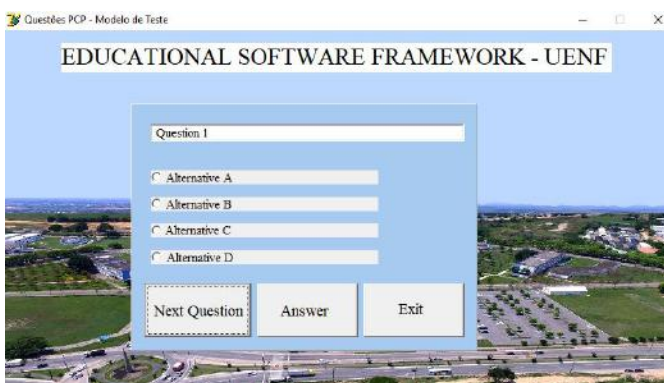


Fig.3: Purposed Educational Software Template

The student should be able to have an elementary and sequential learning of the themes of PPC through the game of questions and answers that bring, in addition to the principles and basic elements of the matter, the updates of relevancies generated directly from

the use of bibliometrics.

VI. FINAL CONSIDERATIONS

Webibliomining is an important instrument on formulation of programmatic content of a conceptual framework of educational software. From the specific search for the most frequent keywords, we have a quantitative notion of the topics of PPC most covered in the journals, that is, in which subjects the scientific research is most concentrated. Software, in turn, represents a field in the field of teaching-learning in which there is still much to explore.

It can be concluded that the webibliomining analysis plays a fundamental role by allowing to align in a coherent way the relevant theoretical content of the subjects of PPC collected from the scientific literature.

Concepts approached as: Workload Control; Simulation; and Remanufacturing, contrast with the traditional concepts of Production Planning and Production Planning. From this, there is a basis for prioritizing the most relevant subjects to be treated in the software, not only the classic subjects covered by the traditional books, but also the trends of PPC aligned to the new scientific researches in the theme and also to the needs industry.

Finally, the educational software models, from the perspective of the students, have great potential on increasing quality and efficiency of practical courses teaching-learning. Parallel to this, the use of webibliomining method is proven as being of extreme value for the selection and prioritization of the content to be approached.

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Critical Study of the Accounting Practices of Indonesians State-Owned Enterprises

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Abstract— This study aims to analyze the accounting tasks of state-owned companies with Indonesian-ness values. The Political Economy of Accounting (PEA) is an analytical tool used to measure a higher level of education which is then referred to as Indonesian PEA. The concept will be the rationale for conducting studies that provide relevant information. The data used are qualitative data from interviews and direct results, as well as quantitative data in the form of annual reports, reports and financial reports obtained directly from the finance department and the official website of PT. Semen Tonasa. The results of the study show that accounting practices by SOEs companies are still far from Indonesian values. The earth, air and natural wealth contained in the earth of Indonesia are the subjects of people's prosperity but the findings in the community that have not existed from the beginning of the resources managed by the company. The reality of social performance is only in the form of false sustainability because it is still formally legal only limited to broadcasting and even becomes a tool of corporate hegemony. It is important for companies to build awareness that is an integral part of the social and community environment, between companies and stakeholders built a "kinship" relationship. Based on the findings of this study, Indonesian character with social justice can be realized if the commitment to Pancasila and the 1945 Constitution can be actualized by the company through family members. The relationship of "kinship" in which there are human values, brotherhood, togetherness, mutual cooperation, and help, the relationship between the community and the relationship between mutual support.

Keywords— Accounting for SOEs, political economy of accounting, Indonesian, social justice.

I. INTRODUCTION

Capitalist, liberal and secular economic systems, as in the Neoclassical economic doctrine as if it had become the only economic system even though it has proven to have received criticism for its relevance to developing countries, Ormerod, 1994, Stiglitz 2006, Mubyarto 2010). Stiglitz's appeal for economic advisers not to rigidly hold on to the Neoliberal ideology of the Washington Consensus gave a signal of the need to adapt the ideology adopted by a nation. Economists in developing countries in thinking about the nation's economic problems need to embrace the state ideology. Indonesia is a country that embraces Pancasila ideology so that our economic basis must refer to the values of its precepts.

Oehr and Zimmermann (2011) in their research on accounting and welfare reviews that some forces continue to influence accounting practices, such as globalization and others such as accounting scandals, resulting in episodes of change. By adopting IFRS, the Anglo-Saxon paradigm of "information accounting" has become a paradigm that dominates accounting reporting. Convergence in accounting is considered part of the trend of global neo-liberalization (Rodrigues and Craig, 2007). "Neo-liberalization" captures the idea of political economy for human welfare by strengthening private ownership, free markets and free trade (Harvey, 2005).

Proponents of neo-liberalization believe that free markets lead to an efficient and equitable distribution of economic resources, and that increased market transactions maximize economic wealth (Everett, 2003). Part of the extension of market relations is to attract state activity and

delegate decision making to private experts. The international convergence of accounting regulations is consistent with neo-liberalization ideology. Nation states with a long tradition in accounting standards stipulates that they gradually hand over their organizational responsibilities to private (international) organizations or a committee of experts such as the IASB (Oehr dan Zimmermann, 2011).

The standard case for setting Indonesia is similar that the convergence of accounting standards has delegated to the private sector in its arrangement so that the Anglo-Saxon paradigm also colors Indonesian accounting, which in fact is based on cases of American and European countries. Building an Indonesian nation does not require the import of foreign values but what needs to be done is to knit the value of the nation's own wisdom through a deconstruction. Deconstruction is not based on Derrida's value but the value of the nation's philosophy of life. Derrida's deconstruction never leads to certainty of truth so that the nature of relativity is very open to further deconstruction (Mulawarman, 2013: 157). Similarly, O'Donnell (2009: 62) sees the deconstruction of Derrida as always a condition of meaning so that it will lead to multi-interpretation. Thus the version used is based on the values of Indonesianness, Pancasila and the 1945 Constitution, which is a paradigm that is the basis of the political economy approach in building meaningful accounting concepts in Indonesia. According to Mulawarman (2013: 161) in Pancasila there is a unification between science and religion and a real unity between the interests of objectivity and subjectivity, materiality of self, social and society as well as the inner spirituality of the social self and society that has the value of Godhead. This is what can then raise the value of the Indonesian personality in accounting.

The research findings that have been briefly reviewed previously show how business practices still highly prioritize capitalist oriented profit interests. As a result, the accounting practices applied in the company also serve the interests of power owners. Building a fair accounting concept in the context of the fifth principle, will only be realized if there is a balance between the material elements and the transcendental element. Not only trapped in mere material elements. Therefore, the attitude of mutual cooperation and kinship as in Article 33 of the 1945 Constitution will balance the material elements with holistic elements. Subyantoro and Triyuwono (2004: 203) said that the concept of the material used as the main direction in accounting measurement must be balanced with a holistic concept that cannot be measured by a quantitative approach. Using the values of Pancasila and the 1945 Constitution requires accommodating holistic values as well as differentiating them from the materialistic foreign

paradigm. Justice is only imaginary if it denies the value of Godhead and humanity, so the spirit of mutual cooperation and kinship is the trigger.

II. OBJECTIVES

The purpose of this study is to conduct a critical analysis of the accounting phenomena of state-owned enterprises in accordance with Indonesian values and to carry out a concept review of justice on the use of resources according to Pancasila and the 1945 Constitution and to develop an Indonesian accounting character concept.

The study is expected to provide a variety of uses, namely, Theoretical Uses, Can add valuable treasures to the development of accounting science, especially concerning the accounting issues of SOEs that can be explored from the perspective of the sciences of political, social and cultural economics. Practical usability, for writers can add to the author's insight into Indonesian-Indonesian accounting discourse and practice so that it can become a study of expertise to develop at later stages. For the Company can be a consideration for the company in improving its accounting policy on the commitment of justice in the distribution of profits. And for Science can be a reference material in understanding the flexibility of accounting knowledge for multiparadigm studies and can be a reference for researchers in the same field.

III. THEORETICAL- CONCEPTUAL REVIEW

3.1. Deconstruction of Accounting in a Critical Perspective

Critical social science is based on the philosophy of critical theory, a school of thought that departs from Kant's and Hegel's idealism. An attempt is made to combine orthodox Marxism with social science, thus providing an alternative way for social development (Dillard, 1991: 8). Furthermore, Dillard (1991: 10) determines the ontological, epistemological and methodological perspectives of critical social sciences and compares them to the notion of accounting non-functional views. Burrell and Morgan (1979: 23) present, albeit rather simply, useful comparative typologies that are presented briefly. A quadrant formed by two subjective-objective dimensions and radical rules of change, represents the four classes of paradigm: functionalism, interpretivism, radical humanism and radical structuralism.

One of the main themes of critical theory is about capitalism. In testing capitalism, the exponents of critical theory go beyond Marx's political-economic perspective. Horkheimer, Adorno and Marcuse acknowledged that Marx's political-economic theory had a significant role in shaping political and social theory. But according to them the theory is not strong enough as a basis for

understanding contemporary society. They agree with Marx that capitalism has created internal economic irrationalities, namely the concentration of economic wealth at the expense of workers who cannot consume the commodities they produce. But they are aware that capitalism has consolidated and developed effective mechanisms that can prevent the social revolution.

Conversely, forms of social control in industrial society are not based on physical or coercive aspects. But it is more with subtle and sophisticated forms of oppression that people are not aware that they are oppressed and do not assume that such conditions are abnormal. Such a situation is possible because of the degradation of critical thinking due to massive expansion and technology and the media. For this reason, the exponents of the Frankfurt School turned their attention from the analysis of economic politics to criticism of the use of instrumental reason in modern society. In their view, it is the use of instrumental reason that has produced an industrial culture that blocks the development of autonomous and independent individuals who are able to assess and decide consciously for themselves.

Habermas agrees with his colleagues that Marx's analysis is only relevant for the period of liberal capitalist society in his time, but not strong enough to be used to analyze the current capitalist society. In liberal capitalist society there is a strict dividing line between the state and society. It is the country that makes the rule of law to ensure that a free market economy can run correctly. But the role of the state is limited to making rules, it must not interfere with free markets fully controlled by the capitalist system. Now there has been a shift from private capitalism to state capitalism. The state, supported by technology, plays a significant role. Capitalists today cannot run the business without state support. Thus, what is called the free market is just a memory.

In the perspective of critical theory, positivism is the most effective new form of capitalist ideology and it has an investment in what Horkheimer calls eclipse of reason. Friedman said, "The social ideological function of positivism is to degrade critical reason. Under the authority of positivism, reason cannot inevitably stop its critical activity. The idea of objectivity in the positivism tradition has denied the importance of criticism of reality. In the name of objectivity, facts must be separated from values and findings must be isolated from human interest, even though this is not possible. Because humans when understanding and interpreting reality cannot be separated by certain views, paradigms, desires and expectations.

In critical theory, domination is classified as a dangerous aspect of capitalism. But what is the source of domination in a society? According to Marcus, the source is a one-dimensional awareness that comes from a kind of technological rationality (technological rationality) which

emphasizes diversity. Until now technological rationality requires actions that result in domination, both in nature and in society, because this can only be developed in its relationship with the possibility of technical control.

Like Marcuse, Habermas argues that domination and practical and emancipatory technical reasons lie at the core of domination in society. In his famous book *Knowledge and Human Interest* (1971), Habermas made a meaningful distinction between knowledge gained through self-reflection / communication and technical causality / rationality.

Critical social science is placed in a radical humanist paradigm where accounting is based on the subjective realization of one's life and the need to overcome inhuman circumstances that prevent self-fulfillment. From an objectivist perspective, accounting is firmly embedded in positivism and thus, sees knowledge of the physical and social world obtained through accumulation of activities by seeking consistency and causal relationships. The anti-positivism, epistemological perspective of critical social science, views the social world as relativistic and does not recognize causal relationships, knowledge comes from experience as active individuals in the social world.

Critical social science is rooted in critical theory, so that it focuses on subjective, voluntary actions of individuals as members of society in realizing individuals, and social emancipation. Critical social science is based on "humanistic self-isolation" and is designed to explain social life in general or certain examples in a scientific, critical, practical and non-idealistic manner".

The description of accounting as a socially determined technology does not exclude or dispose of the social dimension of accounting. On the contrary, explicitly recognizing the reality is often overlooked that the social system originates from capitalist-dominated sources. Technically, in fact, it is socially dominated, so substantially, and ideologically, limits possible technological manifestations. In this context, accounting is basically directed to preserve and enhance capitalist control of the means of production.

Uncharted lengthy accounting trips to explore the extent to which accounting domains can be considered as, or can benefit from, critical social science. The philosophical assumptions that underlie functionalist and critical social accounting are presented and compared. The critical social science framework is presented, along with the limitations contained therein. Furthermore, accounting criticism is carried out in a critical social-science view. Especially critical social science theory is used to evaluate two accounting theories that still exist. Laughlin (1999: 76) proposes accounting characteristics, he argues that there are at least four important characteristics of critical accounting. First, always contextual. That is, he

acknowledges that accounting has social, political and economic consequences. Second, he tried to provide meaningful involvement that was done to change (improve) the practice or accounting profession. Third, accounting is related or cannot be separated micro (individuals and organizations) and macro (social and professional). And, fourthly, it is interdisciplinary in that it is directly involved or from another discipline. Thus, accounting is important far more broadly with regard to practice, profession and accounting discipline from traditional research.

Indonesian political economy accounting studies are very much influenced by the regimes that have been in power. Even accounting scandals have shown the failure of the political economy system that prevailed at the time, forcing the government and the standard setter to carry out accounting reforms. Many academics write that the accounting system in developing countries will surely be more Western. Because developing countries occupy subordinate positions in the global economic system, they will have little choice but to adopt accounting policies that serve the interests of Western governments and multi-national companies rather than their own national interests (Rosser, 1999).

Indonesia's position in accounting standards oriented to the West makes our system continue to be hegemonized by them. Even when they also experience a crisis, it will also affect the national economy. Multi-national relations are indeed a necessity but that does not mean having to "parrot" with foreign interests but rather become an economic partner by remaining firm in the sovereignty of the nation. Building an accounting character by itself is not an impossibility as long as the commitment of the nation's ideology really becomes a frame in carrying out accounting reform, not trapped with the issue of globalization. Or maybe because indeed we ourselves are common with the ideology of the nation so that it is more literate towards foreign ideologies.

3.2. Political Economy of Accounting: Internalization of Indonesian Ideology

Caporaso and Levine (1992) explain that the classical period in political economy began with the publication of Adam Smith's (1776) *Wealth of Nations* book until the publication of the *Principles of Political Economy* by John S. Mill (1848). But if you use a looser periodization, you can say that the classical era of political economy began with the emergence of the thoughts of the physiocrats (physiocrats) in the midst of 18th century civilization to the year of Karl Marx's death in 1883, where Karl Marx was indeed regarded as a thinker important political economy. Marx himself is believed to be the first to use the term "classical political economy", where Marx considers that classical political economy

began in the life of William Petty. The term is described as the prevailing economic system in a country.

The development of political economy in accounting has also become an alternative study discourse or accounting research. Since the 1980s, there began to be attention from accounting researchers in understanding the value of accounting in a broader sense, for example in the social, economic, political and organizational context. This kind of attention results in accounting changes being changed, namely accounting begins to be understood as an entity that is always changing in other words, accounting is no longer seen as a finished or static product of a society, but is seen as a product that always changes every time depending on the environment where he lived and practiced

Political Economy of Accounting (PEA) is one of the theoretical frameworks in the realm of critical accounting studies. Critical study (critical study), which later became the inspiration for critical accounting studies, is a form of inquiry that is within the realm of naturalistic paradigm (Irianto, 2006: 144). Accounting studies using the PEA framework are aimed at understanding and evaluating the role of accounting in the economic, social and political context, or reviewing the role of accounting in a particular context, both organizational and broader in the environment. So that it can be said that the study based on the PEA framework, basically strengthens as well as broadens the study and understanding of accounting in its context (Hopwood, 1978), and (Tinker, 1986).

According to Cooper and Sherer (1984: 219), the characteristics of the PEA approach can be formulated in three important ways, namely being normative, descriptive and critical. This imperative is intended to be more radical than just change. Normatively Accounting researchers must be explicit about the normative elements of the framework adopted by them.

Contemporary accounting has thus become closely connected to the problems and priorities of capital and embedded in very social systems where it is used to generate and maintain false awareness of objectivity (Dillard, 1991: 21). Indeed, it has become very related to and influenced by transformative and speculative logic of capital. It is an integral part of the exchange adjudication process that not only strives to create markets but also helps maintain market confidence and thus provides an acceptable summary that ensures the reproduction of existing power relations.

There are three approaches in PEA, namely normative, descriptive, and critical of accounting research so that it can provide a valuable condition for more valuable accounting research. As a relatively new subject, it is not surprising that accounting research is not reflective of other social sciences (eg, criticism of conventional organizational theories found in Burrell and Morgan,

1979: 298). An approach to accounting science needs to be preceded by the assumption that problems in accounting are also a problem within and outside the community, so haruls are analyzed in more depth.

A modified or expanded PEA perspective (modified PEA or extended PEA), local values can be adapted and developed. Justice (and balance), for example, are the main values that need to be internalized in the construct and substance of the report. If not, then what will happen is exploitation, hegemony, and alienation of one or more interest groups against the other (Irianto, 2006: 149).

The established system will always be maintained, so that the injustices that it accumulates will always last forever in proportion to the system. Leaning these inequality must build public awareness to reject the oppressive establishment. In critical accounting, making changes to a system can be done through deconstruction with a theoretical / concept approach that is considered more ideal for creating socially just reality.

IV. METHODOLOGY

4.1 Type and Paradigm Research

This type of research is qualitative by using natural *setting* that aims to interpret and analyze the phenomena and done by involving a variety of methods. This research uses a critical paradigm, with the perspective of *Political Economy of Accounting (PEA)* modified by clicking adaptation of the values of Pancasila and the Constitution of the Republic of Indonesia (Article 33 of the 1945 Constitution), hereinafter referred to as PEA Indonesianness that is concept used to understand the role of accounting in the context of the economic, social and political, or social examine how the role of accounting in the context of the values of Indonesian-ness.

This research was conducted at SOE company in South Sulawesi region ie PT.Semen Tonasa (Persero) as the largest manufacturing company in South Sulawesi. PT Semen Tonasa is the largest cement producer in Eastern Indonesia which occupies 715 hectares of land in Biringere Village, Bungoro Sub-district, Pangkep District, about 68 kilometers from Makassar. The Company, which has an installed capacity of 5,980,000 tons of cement per year, has four factories, namely Tonasa II Factory, Tonasa III Factory, Tonasa IV Plant and Tonasa V Plant.

Informants selected from the leadership of the company, community leaders, employees of the company and NGOs amounting to 5 informants Data collection was conducted over 12 months. Collecting data using the method of documentation, direct observation, and observation *participate*. Other than that collect *online* data in the form of annual reports and *sustainability reporting* PT Semen Tonasa.

4.2 Analysis Method

Analysis of PEA in this study as did Tinker (1980) in analyzing the earnings figures in this study that discusses the accounting so that the analysis carried out by means of (1) to understand it as the relation between economic activity with the organizational structure and authority (*power*) of the parties who are interested. Furthermore (2) assess how the distribution of profits is made and whether the values of justice have proceeded properly in the process. Cooper made a similar way and Sherer (1984: 218-219) by connecting the data net income (loss) by the influence of power and conflict, the history and rules of the game (*institutional*) corporate, and foundation of motivation. Then analyzed the relationship between profit with distribution and justice. Therefore, the PEA analysis tools used in this study to *understand* and *assess the* earnings numbers in context.

Furthermore, to explore the meaning of justice appropriate distribution Indonesianness value, we then used the 5th principle of Pancasila and the 1945 Constitution to explore the accounting practices of social justice in a national perspective, the wisdom of the sovereign in the country of Indonesia. In the fifth framework is contained values that are the goals of the State as a goal in living together. So in the fifth sila embodied the value of justice that must be realized in life together. Justice is based and inspired by the essence of human justice that is justice in human relationships with himself, man with other human beings, human beings with society, nation and country and human relationship with God.

Some measures analysis carried out by incorporating the concept of PEA with Sila 5th Pancasila, namely: *first*, to understand in two stages: (1) reveal the meaning and importance behind the figures profit of informants based on understanding, feeling, vision, experience, ratings and its perception. Furthermore, (2) the meanings are revealed to be a guide in understanding the critical analysis of income associated with the context of power (*power*) the parties concerned. The analysis includes anyone who plays, how they portray the *power on*, and lebih important is the way they use power ratings.

The second step, assessing the practices of justice prevailing in shaping the economic reality. The value of justice in question is justice covering all parties without exception, including nature and environment. Justice in all joints and stages of human life according to the noble ideals of the Indonesian nation as contained in Pancasila and article 33 of the 1945 Constitution.

V. RESULTS AND DISCUSSION

5.1 Criticism of SOEs Accounting Practices: Indonesian Value Approach

Carry out business practices in accordance with generally accepted accounting principles that the problem has been solved. The resulting report is claimed to show the perfection of the information needed by the users. Is the information generated from the accounting system really needed and useful for all stakeholders? A definite answer is that if the information is given to owners, management, creditors and suppliers, it will be effective according to their needs. Why? Because they all have business interests, remember "business only".

What about other stakeholders? Society, nature, and future generations are parts that also influence and are influenced by accounting practices. They only become objects of sufferers, parts that are considered not important, do not contribute material, so that only become a burden on the company if it must be considered. Accounting standards do not require special treatment in business. Because businesses must be efficient, fair value, the cost-benefit principle must be a real measure in accounting calculations so that capital can be maintained and continue to bring benefits to its owners.

To make changes in accounting behavior, the most blamed thing is the accounting standard that is considered to be the basis for its application. So is it necessary to change accounting standards? McKernan and MacLulich (2004) say that there are two reasons why this regulation change will not improve the crisis of financial reporting. First, this crisis is substantially an independent essential matter, apart from problems / disturbances caused by regulation. In McKernan and MacLulich (2004) Analysis of the problems conducted by McBarnett and Lehelan (1992a, 1992b, 1999) and Shah (1995) concerning "creative compliance" with accounting regulation, clearly explains that the problem lies in attitude. Secondly, although a little away from the reason why we should not blame the accounting principle because of the problem of crisis financial reporting lies in our differing views on moral principles and moral considerations.

Accounting practices can eliminate the moral dimension and we see this crisis as the basis for the crisis of moral authority and judgment (McKernan and MacLulich, 2004). We see accounting regulations losing the power of moral legitimacy. Morals seem not to be accounting but only for religious activities or in Pancasila education which cannot penetrate the fortress of accounting coated with "steel capitalism". Why accounting science must be far from society and nature, while its existence departs from social reality for the interaction of its environment. It is power that can change all that and the most powerful is money. The rich group

has reduced the values of morality in accounting for greedy traits to accumulate wealth without distributing it for mutual welfare.

SOEs as government companies are also powerless to escape the entanglement of conventional accounting systems, why? The accounting system has been very well established both in terms of theoretical and practical so that it has been schemed so systemically. Its roots are like tangled threads that are difficult to find the knots. This does not mean that the accounting system, especially SOEs, cannot change according to the values of the nation's wisdom. Good actions taken by PT Semen Tonasa, for example, who are willing to share with poor people around the company in the form of "foster care" activities. This program was driven by Mr. Abdul Azis Tahir as the CSR Manager who, according to him, took the initiative with fellow employees through discussions. This program according to him is non-budget, meaning that it is not financed from the company's budget but purely from the salary of each employee who is deducted every month for each adopted child who is at least one person per employee. Other programs with the same scenario are teaching / teacher in high school every Saturday which is held once a month. Including the waste bank program is also an employee initiative program. PT Semen Tonasa's employees conduct social programs are a matter of pride for their commitment to the community and the environment. But at the same time it becomes a concern, because a question arises as to why only employees have such initiatives? It is to be expected that as employees they are well aware that the company should be able to be an economic and ecological solution for the community and the environment, but it seems that the company is ignorant of it, thus encouraging them to take part. Although it will not contribute as much as if the company implementing the program. PT Semen Tonasa's social commitment by the community will receive a variety of responses, some will feel useful, some will assume it is normal and less useful. It cannot be denied that this program will certainly benefit the community, only that they feel they have not touched the needs of the community. Mr. AlamSimpuang Ago as the Biring Ere Village Head (PT Semen Tonasa factory location) revealed that:

Ehhh ... Thank God, with the presence of Tonasa (meaning PT Semen Tonasa), in my opinion, it is enough to contribute only that we still expect more. Quotation expects more because it gets the impact (pollution in the form of dust) every day.

The view of Mr. Alam as the village head as well as the community showed dissatisfaction with the company contribution they got despite still appreciating the benefits of the program. Mr. Alam saw the need for

synchronization between people's expectations and the program, meaning that the company's assistance program should be carried out proportionally according to the level of negative impacts they caused.

This program is not just as if it is an "artificial sweetener" that makes those who feel it become irritating but it needs a program that sweetens naturally and proportionally. Society is not a passive being that is only an object of empty space to accommodate at will the program of policy makers but they are active energies that have critical power over what they experience. They can feel what really happened, they can distinguish honesty and lies. Their rights that have been taken away will not be questioned if they are directly proportional to their economic and social impacts. The irony is that when Article 33 of the 1945 Constitution affirmed the state's control over natural wealth that was used as much as possible for the prosperity of the people but became paradoxical with company practices.

5.2. Company Profit for Whom: Society and Nature as "Capital Owners"

Schumacher (1981, 98) criticized the use of natural resources that humans very freely grind mercilessly, as if competing to immediately spend at a very alarming speed. This condition by Schumacher occurs because natural treatment as income continues to be spent as soon as possible, even though it should be recognized as capital. The resources provided by nature, if only recognized as capital, would certainly influence the behavior of the industrial community to save even more. Users will try to reduce the rate of use, as capital is used as effectively and efficiently as possible in order to finance the production process.

The PT Semen Tonasa 2016 sustainability report reviews the Company's existence as one of the largest companies in eastern Indonesia, can be seen from the magnitude of its contribution to stakeholders, the public and the state. In 2016, the Company provided employees with salaries and benefits which increased by 6.5 percent from the previous year. Expenditures to the Government in the

form of taxes increased significantly by 16.68 percent from last year. To suppliers and contractors, the Company is committed to cooperation on the basis of mutual benefits. IDR 2,412 trillion has been issued by the Company to pay them. Compared to last year, it increased by IDR104 billion. Likewise the contribution to the community through the company's social responsibility program, the Company has participated in community empowerment of IDR. 29 billion. Not directly in the form of cash, but in the form of programs.

PT Semen Tonasa's claim is not directly proportional to what people feel. The company's perception as in table 5.1 gets a different response, the community has its own arguments according to what they feel. Bapak AlamSimpuang Ago as the Village Head where the factory location stood felt that the allocation of CSR funds was not distributed proportionally, but was evenly divided into eleven circumferential villages whereas the negative effects received were different. With a disappointed tone, Mr. Alam S.A. conveyed in an excerpt of the interview with him as follows:

..... just an illustration that eleven villages in this circle are uniform for the allocation of the budget, so both far and near are uniform, so I had time to complain to CSR, how could the nominal value of assistance be equated between the village where the factory was located and the village outside, while we the most affected by factory pollution.

Complaints from various parties of the community and NGOs still often become ripples against dissatisfaction with the company's performance, especially in terms of the distribution of economic resources of the company. Even in the company's report, it was acknowledged that there were still frequent complaints made by the residents even though they did not interfere with the operation because they were followed up directly by the Corporate Secretariat Department (SEKPER) and subsequently submitted to the directors. Beriku is a complaint reported in 2016:

Table.5.2.1: Community Complaints for Company Activities

Community	Complaint	Follow-up
Lapuko Village Community	CSR Fund Management, road improvement, street lights and labor recruitment	Coordinate with the local government.
Non-governmental organization	Unlicensed mining	Clarification to related institutions regarding permits

Source: PT Semen Tonasa 2016 Sustainability Report

This fact is evidence of dissatisfaction from the community, which although the company only reported as many as two problems but outside the community were

still very dissatisfied with the company's performance. The sense of community dissatisfaction is certainly very relative in believing the truth because company policy

will certainly not guarantee the satisfaction of all parties. The company may have formally budgeted or factually carried out the distribution of space, but is it really in line with the expectations of the community that is still a problem that still arises. Therefore, good communication between companies and communities needs to be an important concern. This is where the principle of togetherness and kinship is needed to be applied to mutual understanding and mutual trust. As an example of the occurrence of disharmony, mutual suspicion and mutual distrust, a local community figure and traditional leader, Mr. Simpuang Ago, felt that Semen Tonasa was

only claiming what they considered social performance. As he stated:

well, if he took the sample about pollution, he did it himself, it should be invited by the public to see what time it was, later in the day that the name was not good, the tonnage was certainly no ee distribution, yes maybe that. I have never been invited to that.

Comparing between company perceptions and society will always find a cross-productive opinion that is counter-productive. People still have suspicion even though companies with standard operating procedures may have been convinced of implementing environmental controls as in the following table:

Table.5.2.2: Environmental Control

Environmental Parameters	Unit	Quality standards	Measurement results		
			2014	2015	2016
Working environment dust	(Mg/m3)	10	1,08	1,16	0,89
Noise in the work environment	Desibel (Db)	85	72,35	71,93	72,66

Source: PT Semen Tonasa 2016 Sustainability Report

The standard standards used by the company to ensure the safety of dust control for example, from year to year show measurements in accordance with quality standards (QS), even in 2016 claimed to be better than in previous years. If in 2015 the measurement results were 1.16 mg / m3, then in 2016 it decreased to 0.89 mg / m3. This figure shows the level of security according to health standards because it is still far below the quality standard with a tolerance of 10 mg / m3. Noise in the work environment is still safe. In 2016 it was 72.66 Db, this number is still tolerable by the ears because it is still below QS 85 Db (PT Semen Tonasa Sustainability Report 2016). This

measurement is what the ordinary people do not understand. Even so, they really need to be involved so that they feel confident that what is done by the company really provides a sense of security for the community.

Fair distribution will always leave a polemic because the size of each party is very multi-interpretive. Measures of satisfaction cannot be fulfilled by the material possessed. So it is very important to reduce disharmony by the conflict with a relationship that is characterized by a sense of togetherness and kinship. The following is a graph of income distribution made by PT Semen Tonasa for the 2014-2016 period as follows:

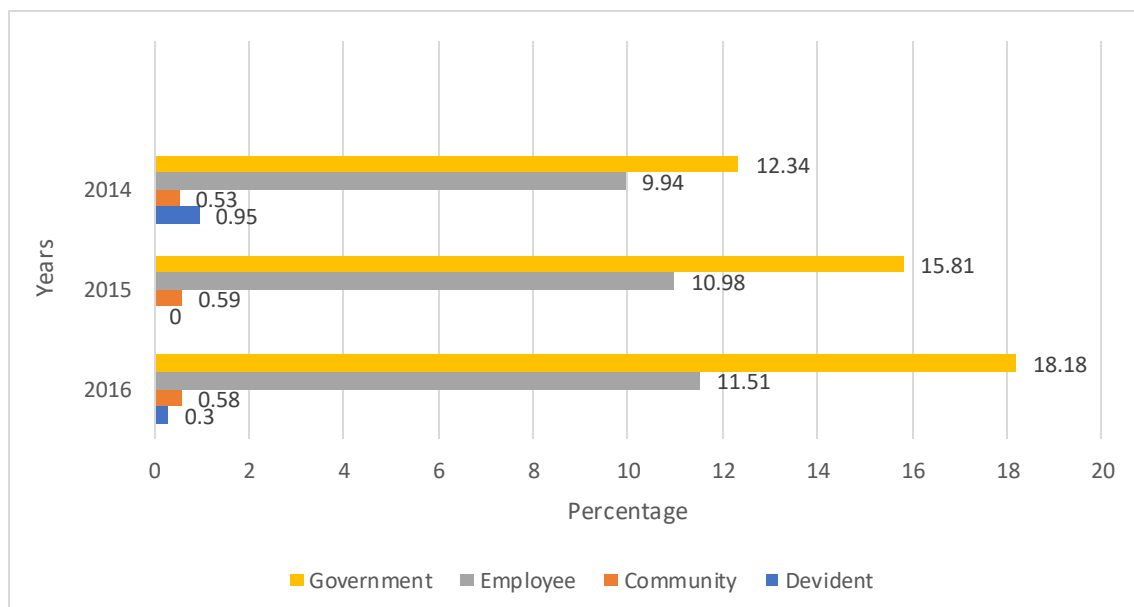


Fig.5.2: Income Distribution Chart (%)

The trend of increasing income distribution to quantitative stakeholders on average experiences a progressive distributive number. Expenditures to the government show the most significant progress. This fact is very relevant to the PEA Tinker concept (1980, 1984) considering that PT Semen Tonasa is a government company so that distribution will be strongly influenced by power. Market considerations in determining the policy direction are not proven by looking at the distribution in the form of dividends that are not a company priority. Communities that include people and the environment are quantitatively consistently experiencing an increase which means they always receive important attention from the company.

Quantification of the value of the distribution can give a picture of the proportional distribution to stakeholders. But in fact the field is still very young found dissatisfaction from several parties. It is also very unfair to feel that the wrong party is addressed to the company. Therefore, the size of the material will not satisfy all parties so that efforts to use non-material values are needed so that harmonious relations between parties can be established well. This principle of togetherness and kinship is needed to foster a symbiotic relationship to understand, love and protect each other.

5.3 Towards Harmony with Fair Distribution

Corporate, natural and community relations are in fact necessary. Harmonization is often a problem in its dynamics. Claims and dissatisfaction color the conflict. The company is the most superior party because of the role and stability of its resources. The power of resources will also be distributed to the owners of capital.

Capital owner recognition is only associated with shareholders, so it is only natural that management acts solely for the benefit of the shareholders and it is also natural that the shareholder's bottom line (profit) is the right measure to measure the company's performance. The general argumentation always holds that shareholders are investing, they are also the ones who bear the risk, and therefore they are also entitled to the benefits. However, the company has other constituencies such as workers, customers, suppliers, surrounding communities, and the wider community. All other stakeholders are also investors (Estes, 1996), and they often bear greater risk than financial investors.

"The kinship" that is built between the owners of the company, employees, the community and the government needs to get its own formulation so that the achievement of the country's aspirations in processing the natural wealth possessed for a just and prosperous society can be realized. Following is the scheme of company and stakeholder relationships:

The mandate of the 1945 Constitution article 33, especially in paragraph 3, requires state control over

natural resources. Strategic resources that affect the survival of many people cannot be delegated to the interests of a handful. The role of state control is carried out by the government to carry out the state constitution which is responsible for the management of natural wealth in order to guarantee the prosperity of the people.

The government, in carrying out the mandate of the 1945 Constitution on the control of natural resources, established SOEs as an extension of the government in the economic field. SOEs as the objective of being formed as one of the actors of economic activities in the national economy based on economic democracy and has an important role in the implementation of the national economy in order to realize public welfare. SOEs as managers of strategic business fields and the implementation of public services are given the responsibility to exploit and explore natural resources. The available natural wealth makes abundant sources of raw materials for company production.

Utilization of natural wealth is not solely to provide benefits to the company but to provide benefits to local communities directly or indirectly through the government to the wider community. Natural wealth cannot be separated from the community therefore the rights of the people are a necessity that must be fulfilled. Fulfillment is not just social assistance but rather a guarantee of their welfare. Society and nature are investors who are entitled to claims for company benefits. They are entitled to get results from the company's production. Social profit is a consequence of the social capital that society has. This is the common thread if the commitment to prospering the community really becomes the main goal (bottom line). The relationship between SOEs, society and nature is a symbiosis of mutualism not a symbiosis of parasitism so that the relationship is a family that is connected in a "kinship" circle. Living together, working together and togetherness that will bring together prosperity: companies and communities and natural sustainability are maintained.

5.4. Building Indonesian Accounting Character

Character is the values that underlie human behavior based on religious, cultural, legal or constitutional norms, customs, and aesthetics (Ministry of National Education, 2010). If it is associated with accounting science, building the Indonesian character of accounting is a planned effort to make the value of accounting values embedded in knowledge, awareness and actions to carry out values, both towards God, oneself, society, and the environment, as well as with the state. Scientific buildings that have the characteristics of Indonesian-ness characteristics are religious, humanistic, social (social), and have a national commitment.

Accounting with Indonesian character is accounting that relies on the value of Godhead. This concept is the basis that needs are not just material but also attach great importance to non-material. Building a sense of justice will be impossible if it only measures it with material abundance but must be supported by spiritual gratification. Thus, Indonesian-Indonesian accounting is very identical to the recording and reporting system that has divine accountability which serves the needs of all stakeholders with the aim of realizing social justice.

Humanity is the basis of practice that is applied as an achievement strategy to always uphold the human limitations of each individual. Accounting alignment proportionally to the interests of humans (investors) without discrediting other people (employees and society). Humanitarian accounting is accounting that in practice recognizes equality, equal rights and obligations proportionally, mutual love for each other, respect and mutual cooperation. This attitude is a reflection of the principle of kinship as in the mandate of Pancasila and the 1945 Constitution.

The planting of these values is expected to shape the character of accounting science and will further influence the behavior of accounting actors. Character-building values that must be developed in each educational institution are basically a form of universal human character. Amid the diversity of nations in the world, Indonesian people must have Indonesian-ness character. This is a marker of the Indonesian nation that has a different identity from other nations.

Formation of Indonesian character, the frame of nationality and patriotism are the spirit towards changing scientific orientation. The value of national spirit is described as a way of thinking, acting and being insightful that places the interests of the nation and state above their self and group interests. The value of love for the homeland is described as a way of thinking, acting, and acting that shows high loyalty, care, and appreciation for the language, physical environment, social, cultural, economic and political nation.

The character of Indonesianness in the accounting context means having to keep away from a system that only serves capital owners and authorities, but must be able to change views from just profit orientation to nationality and patriotism that not only prioritizes profit but also very empathetic, divine, humanity, community and also natural sustainability. This value becomes very important as an Indonesian-ness character that will become a differentiator with other nations as a manifestation of the sovereignty of the nation that stands on its own. That is the self-image of Indonesian-Indonesian accounting. Indonesia with its diversity, namely differences in religion, race, ethnicity, culture, understanding, and level of education, should not be a weakness but a potential that

must be used to make each other happy. Need to be convinced of all national organs that our existence is always bound by a sense of nationality. Even though we are different in religion, race, ethnicity and culture, we have one thing in common. We both come from Indonesia. Naturally religion teaches us that loving the motherland as part of faith.

The character of Indonesianness in accounting practice can be realized by changing the perspective in the function and purpose of the accounting itself. The purpose of the state in managing the country's natural wealth is for the prosperity of the people, so that the management tools must be synergized with the country's goals. Accounting in this case must be based on nationalism which must also serve the state in realizing the prosperity of its people. The production system cannot be separated from the underlying value, the principle of togetherness and kinship must be formed in each accounting entity. If with "bamboo spikes" alone, Indonesia can gain independence from the invaders, so why should we be pessimistic about our own abilities. In the colonial era, where the people were in all limitations, they were able to stand up and fight to expel the invaders bravely. The heroism of the Indonesian people should be a lesson for the nation's elements to always maintain national values which have proven effective in driving Indonesia out of colonialism.

As a nation that has a long history, forms of Indonesian nationalist awareness in the form of a sense of pride as a nation that has independence and courage, honor, awareness against colonialism, awareness of sacrifice for the nation, nationalism awareness and regional awareness towards Indonesianness. Modern colonialism is no longer taking up arms but the stakes of the ability to continue to oppose the undermining of foreign ideologies that hegemony our economic system.

VI. CONCLUSIONS

Processing natural wealth with distribution based on Indonesian values will always reject the monopoly of ownership. Based on the principles of brotherhood, equality, lack of absolute property rights and the mutualism principle, all elements including the community are obliged to make redistribution even though private ownership through zakat, infaq, alms, state taxes, avoiding extravagance, and do not hoard treasure and prohibit concentration of ownership. In the teachings of moeslimit is strictly forbidden to hoard treasure and calculate it as in the Al-Quran (Alhumazah: 2). Wasteful nature will be very detrimental to sustainability and future generations, so it is also strictly prohibited to carry out massive unattended exploitation.

The basics of Indonesian values will be a differentiator in looking at resource distribution systems that will realize social justice. Social justice in question is the concept of

justice contained in the Pancasila and the 1945 Constitution. The concept of justice does not necessarily have to be measured by the fulfillment of material needs, but can be of a sense, a value order that gives a sense of humanity and peace. The Indonesian people describe a society that is aspired as a "social justice" for all Indonesian people, which means that all people, big, small and from any group and group must be able to enjoy a sense of security and peace so that a just and prosperous society can be realized.

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Risk Assessment Process for Construction Projects in Afghanistan

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Abstract— *The construction industry in Afghanistan faces challenges such as cost overruns and delays. To overcome these problems, nowadays, implementing risk management in construction field has shown improvements in the mitigation of risks which have adverse impacts on project objects such as time, cost and quality. Risk assessment process is executed as part of risk management for uncertainties that construction sector confronts in Afghanistan. 21 most significant risks were identified, analyzed and evaluated using 5x5 probability matrix method. It was found that 20 out of 21 risks fell into the unacceptable and unwanted category. These risks require mitigation measures by executing risk treatment policy and need be to registered, monitored and reviewed before and during the construction phase. The findings call for necessary awareness in developing the Afghanistan construction industry's capability and performance to execute risk management for mitigating against further project failure.*

Keywords— *Risk Management, Qualitative Risk Assessment, Risk Analysis, Probability matrix*

I. INTRODUCTION

Afghanistan is a developing country where the construction sector has a significant influence on the country's development and infrastructure. According to the Afghanistan Investment Support Agency (AISA) [1], in the recent years, the statistics show that the construction sector has a share of 7-10% in GDP of the country. The construction sector has been rated third in the county's economic development after agriculture and mining [2]. Although the construction industry represents a significant share of Afghanistan economy, over the past years the efficiency and enhancement of the construction industry have been undervalued. In the delivery of essential infrastructure projects such as power plants and roads, there are unnecessary cost overruns, delays, and less productivity [3].

Nowadays, implementing risk management in construction has gained more attention globally. Risk management overcomes many risks which have adverse effects on project objects such as time, cost and quality

[4]. ISO 31000 [5] defines risk management as “coordinated activities to direct and control an organization with regard to risk”. For the sustainability of an organization, the risk management framework, policy and plan is an essential requirement to deal with uncertain events in the changing world. Risk management process encompasses activities of communicating, consulting, establishing the context, and identifying, analyzing, evaluating, treating, monitoring and reviewing risk [5]. Among these activities, the risk assessment is a vital part of the risk management process. Risk assessment comprises risk identification, risk analysis, and risk evaluation [6]. Risk identification is the first stage of risk assessment by which potential risks are recognized by surveys, expert advice, brainstorming, previous data analyzing, etc. Next, these identified risks are assessed by different techniques that can be qualitative, semi-qualitative or quantitative [7]. Finally, the risks are categorized based on their severity and impacts.

Despite the vital role of risk management in the improvement of quality in the construction projects, limited researches have been conducted in Afghanistan, and rarely addressed in academia. In order to prevent the cost overruns and delays of projects in Afghanistan, a risk assessment will be carried out as part of the risk management process for the risks that construction industry faces.

II. RESEARCH METHODOLOGY

In this study, the risk assessment is performed for the risks that construction industry confronts in Afghanistan. Risk management process is summarized in Figure 1. As can be seen in the figure risk assessment has three stages, namely, identification, analysis, and evaluation.

2.1. Risk Identification

To identify the risks that cause cost overruns and delays in the construction project in Afghanistan, a literature survey is conducted with particular emphasis on the standards, guidelines, codes of practices, published articles and other documents issued by accredited institutions and national legislation related to the subject.

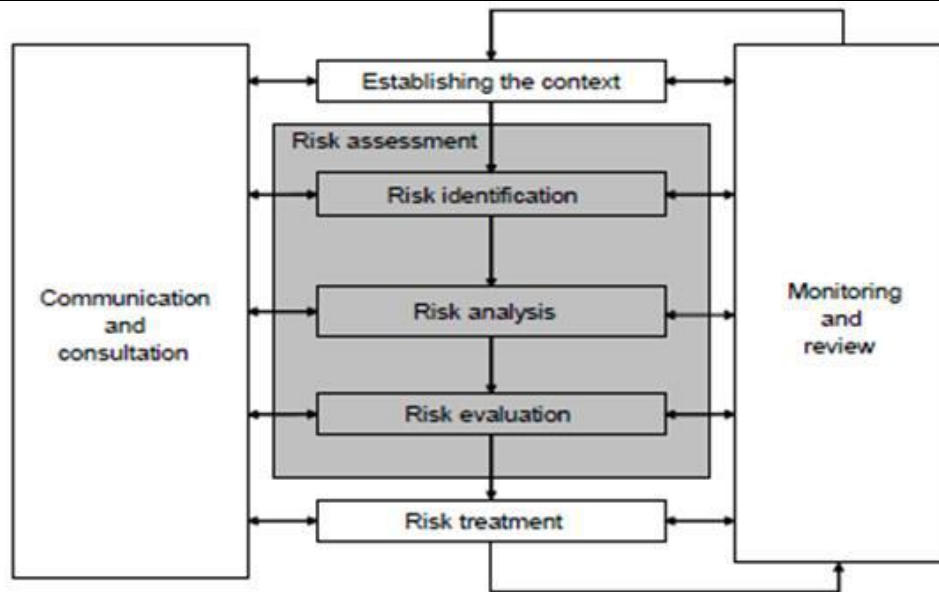


Fig. 1: The contribution of risk assessment to the risk management process [6].

As the result of the literature survey, three relevant published articles have been selected for the risk identification process. Niazi and Painting [8] with Ahady et al. [9] searched for the factors that cause cost overruns in the construction industry in Afghanistan. Also, Niazi and Gidado [10] explored the circumstances of project delays. The mentioned researchers have sorted the most influential factors for cost overruns and delays in the construction sector. In this study, these factors were identified as potential risks that should be analyzed and evaluated.

2.2. Risk Analysis

5x5 risk matrix methodology was developed in the risk analysis stage. After identification of risks, the

Very likely	(quantitative value	: 5)
Likely	(“ “	: 4)
Occasional	(“ “	: 3)
Unlikely	(“ “	: 2)
Very unlikely	(“ “	: 1)

frequency (likelihood) of the uncertain event, and its severity of consequence were estimated in the five categories defined by 5x5 risk matrix methodology, and identical quantitative values have been designated [6]. The value of risk was estimated by multiplication of likelihood and severity of the risk. The risk value can be formulated as:

$$R = P \times S$$

Where: P = Likelihood of occurrence and
 S = Potential severity of risk.

2.2.1. Categories for likelihood of risks (Frequency classification)

Five categories described by risk matrix methodology are:

- Very Unlikely: Infrequent risks, with about no probability of happening.
- Unlikely: Risks that are comparatively rare, but have a little chance of exposing.
- Occasional: Risks that are more common, with approximately a 50/50 probability of taking place.
- Likely: Risks that are extremely likely to happen.
- Very likely: Risks that are almost certain to reveal. Address these risks first.

2.2.2. Categories for severity of risks (Consequence classification)

Defined five harm categories are:

Disastrous	(quantitative value	: 5)
Severe	(“ “	: 4)
Serious	(“ “	: 3)
Considerable	(“ “	: 2)
Insignificant	(“ “	: 1)

- Insignificant: Risks that make no substantial negative consequences, or pose no notable threat to the organization or project.
- Minor: Risks that hold a little potential for adverse outcomes, but will not significantly influence overall success.
- Moderate: Risks that could induce negative consequences, posing a consistent threat to the project or organization.
- Critical: Risks with substantial unfavorable effects that will severely impact the accomplishment of the organization or project.

- Disastrous: Risks with extremely negative results that could make the entire project to fail or severely affect the daily operations of the organization.

2.3. Categories of risk on the basis of risk level

Risk categories were established by building a risk matrix using levels for likelihood of risk and classes for severity of risk as its variables shown in Table 1. In this matrix risks are grouped as:

Table.2.1: Risk matrix and risk categories on the basis of risk level [11; 12].

Probability of Occurrence (P)		Severity of Consequence (S)				
		Disastrous	Severe	Serious	Considerable	Insignificant
		5	4	3	2	1
Very likely	5	25 Very high	20 Very high	15 Very high	10 High	5 Low
Likely	4	20 Very high	16 Very high	12 High	8 Medium	4 Very low
Occasional	3	15 Very high	12 High	9 Medium	6 Low	3 Very low
Unlikely	2	10 High	8 Medium	6 Low	4 Very low	2 Very low
Very unlikely	1	5 Low	4 Very low	3 Very low	2 Very low	1 Very low

2.4. Risk Evaluation

At this stage, the results of risk analysis have been compared with risk criteria to decide whether the risk or its magnitude is acceptable or tolerable. The actions to be taken for each risk depend on whether the relevant risk is categorized as:

Unacceptable	(quantitative value)	: 15, 16, 20, 25)
Unwanted	(“ “	: 9, 10,12)
Acceptable	(“ “	: 3,4)
Negligible	(“ “	: 1,2)

Table 3.1 shows the risk category and acceptance level after estimating the risk value (R = P X S) in risk analysis process.

Table 3: Risk Categorization [12].

Category of risk	Evaluation of tolerability
Very low (Level 1, 2, 3, 4)	Acceptable (or Negligible)
Low (Level 5, 6)	Risks that should be reduced so that they are tolerable or acceptable (Unwanted)
Medium (Level 8, 9)	
High (Level 10, 12)	
Very high (Level 15, 16, 20, 25)	Unacceptable

III. RESULTS AND DISCUSSION

3.1: Identified Risks in Construction projects in Afghanistan

Table 4.1 shows the result of a literature survey of the potential risks that are most influence the cost overruns and delays of projects. These risks were addressed by clients, contractors and consultants [8; 9; 10].

Table 4: Most significant risks faced by construction industry in Afghanistan

NO	Risk	Description
1	Corruption	Corruption creates a severe threat to the Afghanistan Construction Industry being able to improve because it has a critical influence on construction cost growth. This is because of low commitments of Afghan leaders against corruption, lack of technical staff, a weak legal and regulatory regime and poor overseeing mechanism.

2	Security	Security is a significant threat that has limited most projects from being delivered on planned funds in Afghanistan. The bad security condition is a great dare that construction stakeholders face with, thus, most of the projects are delayed which drives to cost rises.
3	Delay in progress payments by client	Delays in progress payments by clients are a crucial factor which makes construction cost overruns not only in Afghanistan but can be one of the common main causes of delays in most countries.
4	Financial difficulties by contractor	Some contractor companies go on bankruptcy due to some political and economic challenges in Afghanistan.
5	Frequent change orders during construction by client	Deficiency of communication between client and contractor during the design stage of the project causes that the customer changes his mind during the construction phase to modify the scope of the project.
6	Market inflation	Raising the prices of goods and services due to the high demand in the market.
7	Mistakes and discrepancies in design documents	Lack of well-documented engineering design and construction standards and qualified design engineers in Afghanistan.
8	Inappropriate type of project bidding and award	The process of project bidding is complicated in Afghanistan and sometimes the project is awarded to an unqualified company.
9	Lengthy bureaucracy in government entities	The inadequate management system in government such that still there are no active online systems to facilitate communication problems and the existence of parallel government institutions that require the same documents repeatedly.
10	Late in approving design documents	Decision-making problems in the top management.
11	Shortage of supply of construction material required	Some essential construction materials are imported from outside of the country, and due to some political and security concerns, the materials cannot arrive on time.
12	Fluctuations in the cost of building and other materials	Fluctuation in prices of raw materials increases the cost of building and construction materials.
13	Delay in sub-contractors work	Financial difficulties and disqualifications of sub-contractors' companies result in project delay.
14	Lack of pre-contract project coordination	The terms and conditions of a project is not clear. While implementing the plan, the contractors recognize some undiscussed points that were not reviewed with the client before the sign of the contract.
15	Lack of skilled labor	Most of the skilled labor in Afghanistan are from Pakistan and India, so there is the inadequacy of local skilled labor.
16	Improvements to standard drawings during construction phase	Lack of communication and interaction in the decision-making process between stakeholders.
17	Poor qualification of the contractor's technical staff	The contracting companies are facing the nonexistence of experienced technical staff to execute complex projects such as applying HVAC systems in buildings.
18	Poor site management and supervision by contractor	Construction management process is not implemented in some of projects.
19	Ineffective planning and scheduling of project by contractor	Poor construction management
20	Poor communication and coordination by contractor with other parties	Proceeding the project without giving a construction progress report to the stakeholders.
21	Frequent change of sub-contractors because of their inefficient work	The disability of sub-contractors to complete the project and meet the needs of main contractors.

The above risks can be classified for further main risk categories as external, project management, organizational, technical, quality and performance [13]. Risk types vary for each country. For example, in the case of Afghanistan, corruption and security are two dominant risk types that can generate other kinds of risk as well. Due to these two risks, construction projects cannot be delivered on time with the estimated budget. However, in Pakistan, as a result of a questionnaire survey, the principal risks in construction projects were payment delays, project funding problems, accidents/safety during construction, defective design, etc. [4].

3.2: Risk Analysis and Evaluation of Identified Risks

The 5x5 risk matrix methodology has been applied to the risk analysis. For each type of risk, the category of likelihood and severity were assigned. As it has been

shown in Table 5, out of 21 potential risks, just one of them fell into the acceptable category. Other ones have been ranked as the unacceptable and unwanted risks. This shows that the risks can cause severe losses to the quality and scheme of the construction projects in Afghanistan. For the risks that are in the category of unacceptable and unwanted requires a risk mitigation or treatment plan to minimize the probability of occurrence. Risk treatment can include; withdrawing the risk by determining not to begin or proceed with the activity that gives rise to the risk, eliminating the risk origin, changing the probability, changing the consequences, assigning the risk with another party, and retaining the risk by informed decision [5].

Table 5: Analysis and Evaluation of Identified Risks

No	Risk	Frequency of Occurrence		Consequence		Risk Class	
		Description	Frequency	Severity		Rating	Accept
1	Corruption	Very likely	5	Critical	4	20	Unacceptable
2	Security	Likely	4	Critical	4	16	Unacceptable
3	Delay in progress payments by client	Occasional	3	Critical	4	12	Unwanted
4	Financial difficulties by contractor	Occasional	3	Moderate	3	9	Unwanted
5	Frequent change orders during construction by client	Occasional	3	Moderate	3	9	Unwanted
6	Market inflation	Occasional	3	Moderate	3	9	Unwanted
7	Mistakes and discrepancies in design documents	Occasional	3	Moderate	3	9	Unwanted
8	Inappropriate type of project bidding and award	Likely	4	Critical	4	16	Unacceptable
9	Lengthy bureaucracy in government entities	Likely	4	Moderate	3	12	Unwanted
10	Late in approving design documents	Occasional	3	Critical	4	12	Unwanted
11	Shortage of supply of construction material required	Likely	4	Moderate	3	12	Unwanted
12	Fluctuations in the cost of building and other materials	Occasional	3	Moderate	3	9	Unwanted
13	Delay in sub-contractors work	Occasional	3	Moderate	3	9	Unwanted
14	Lack of pre-contract project coordination	Unlikely	2	Minor	2	4	Acceptable

15	Lack of skilled labor	Likely	4	Moderate	3	12	Unwanted
16	Improvements to standard drawings during construction phase	Occasional	3	Minor	2	6	Unwanted
17	Poor qualification of the contractor's technical staff	Occasional	3	Critical	4	12	Unwanted
18	Poor site management and supervision by contractor	Occasional	3	Moderate	3	9	Unwanted
19	Ineffective planning and scheduling of project by contractor	Occasional	3	Critical	4	12	Unwanted
20	Poor communication and coordination by contractor with other parties	Occasional	3	Moderate	3	9	Unwanted
21	Frequent change of sub-contractors because of their inefficient work	Occasional	3	Moderate	3	9	Unwanted

IV. CONCLUSION

In this study, the risk assessment process has been implemented for the potential risks that the construction industry confronts. The probable uncertainties of cost overrun and delays in building construction in Afghanistan were reviewed through the literature assessment in which 21 most critical risks were identified. After the analysis and evaluation of identified risks using probability matrix method, it was found that 20 risks fell into the unacceptable and unwanted category. These risks need mitigation measures by executing risk treatment policy to register, monitor and review the uncertain events. The conclusions call for necessary awareness in developing the Afghanistan construction industry's capability and performance to execute risk management in their projects for mitigating against further project failure.

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PDCA Method for Environmental Management of Pollutants Generated in a Battery Industry in an Amazonian City

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Abstract—The automotive battery industry is a fixed emission source of high pollution potential arising from secondary lead smelting processes pollutants. The management, the quality control standards of air, air pollutant emission limits as well as the allocation and disposal of waste and effluents are provided by legal norms. The objective is to identify management practices and management of atmospheric emissions and the allocation and disposal of waste and effluents in a battery industry that manufactures and reuses materials from reverse logistics to propose a management model based on PDCA- Plan, Do, Check and Act. The specific objectives are: (1) Identify the management and environmental management practices in the industry and relates them with economic development and innovation in industrial processes; (2) Check the procedures adopted for the reverse logistics management and allocation and disposal of wastes, effluents and emissions to mitigate the generation of pollutants; (3) propose management actions

and environmental management, according to the PDCA method. It is a descriptive exploratory survey of bibliographical studies and field research with observations of practices in the industry and using the interview questionnaire, to present qualitative and quantitative data. The sample was randomly chosen to focus an industry that generates wastes, effluents and emissions of high polluting potential. Employing the task is intended to answer the question: An environmental management plan based on the PDCA method is able to systematize sustainable actions in an industry that generates highly toxic pollutants? The result is of interest to managers of enterprises that manufacture and reuse of waste battery. This study is important considering the locus of research, the Amazonian City, which deserves special attention.

Keywords— *Environmental Management. PDCA Method. Waste and Pollutant. Battery Industry. Reverse Logistic.*

I. INTRODUCTION

This work has focused on the business environmental management plan, reverse logistics activities, generation, disposal and disposal of waste and effluents and control of air emissions in a battery manufacturing and reuses materials industry. According to the legal regulations the main pollutants from the batteries are those generated in the secondary lead industry merger process. Considering the toxicity of the materials processed in the battery industry, the studies for the environmental management are shown important for the sustainable development of the planet.

The objective is to identify management practices and management of atmospheric emissions and the allocation and disposal of waste and effluents in a battery industry that manufactures and reuses materials from reverse logistics to propose a management model based on PDCA - Plan, Do, Check, Act. The specific objectives are: (1) identify the environmental management practices in the industry and relate them with economic development and innovation in industrial processes; (2) Check the procedures adopted for the reverse logistics management and allocation and disposal of wastes, effluents and emissions to mitigate the generation of pollutants; (3) Propose environmental management actions, according to the PDCA approach set out in ISO 14001 of December 31, 2004 taking into account the provisions of ISO 9001 2000. This is a descriptive exploratory survey of bibliographical studies and field research with observations practices in the industry and using the interview questionnaire, to present qualitative and quantitative data. The sample was chosen randomly, focused in an industry that generates high potential pollutants toxic to the environment and health. The need and obligation of an environmental management system, with appropriate standards in manufacturing processes, reverse logistics, destination and disposal of waste, effluents and emissions control in a battery industry, leads the research question: An environmental management plan based on the PDCA-Plan, Do, Check and Act are able to systematize sustainable actions in an industry that generates highly toxic pollutants? To answer the question we identified practices and management actions and environmental management adopted in the industry. This research consolidates theoretical and practical knowledge of the subject under study. With the result, it was possible to guide managers, the legal rules and procedures, environmentally sound, for a battery industry, which generates highly toxic pollutants that demand attention, thinking about the environmental, social and economic sustainability for present and future generations.

II. OBJECTIVE

The general objective of this work is to study environmental management and management practices, focusing on atmospheric emissions to the disposal and disposal of waste and effluents. The research was conducted in a battery industry that manufactures and reuses materials from reverse logistics to propose a management model based on the PDCA - Plan, Do (or Execute), Check (or Verify) and Act. The specific objectives are: (1) identify the environmental management practices in the industry and relate them with economic development and innovation in industrial processes; (2) Check the procedures adopted for the reverse logistics management and allocation and disposal of wastes, effluents and emissions to mitigate the generation of pollutants; (3) Propose environmental management actions.

III. THEORETICAL CONCEPTUAL REVIEW

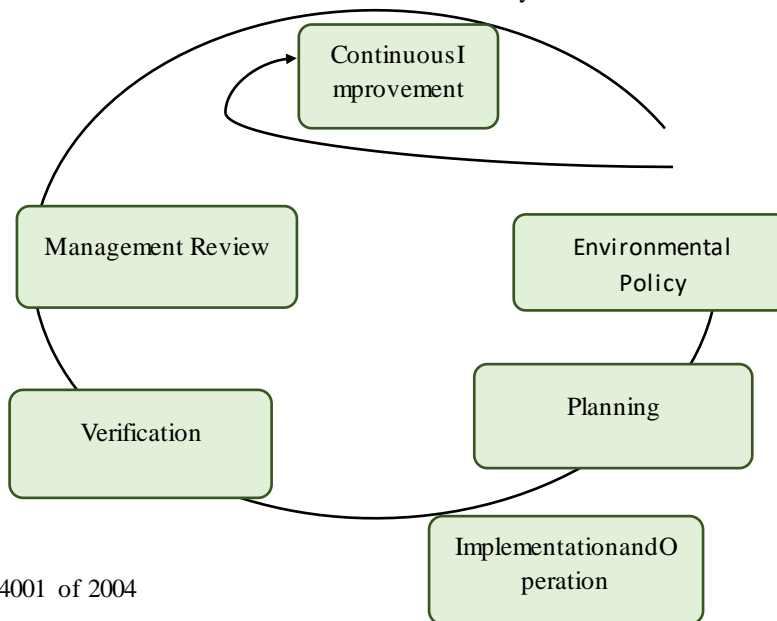
The literature review is based on the PDCA method for environmental management and administration of the relationship theory of economic development and innovation in the environmental management and reverse logistics materials and atmospheric effluents and emissions considered highly toxic. Rummage in scientific studies the effects on the environment and human health from pollutants generated in the industry under study. Based on legal norms for allocation, provision and limitations of air pollutant emissions to establish a relationship with the industry of reality under study.

3.1. PDCA method for the construction of Environmental Management System

According Valle (1995) Environmental Management System, proposed tools for continuous improvement in a structured process, allowing systematically organize a plan to cover all phases of a product from the initial idealization until complete elimination of waste, objectifying adequate environmental performance. The ABNT NBR ISO 14001 of December 31, 2004, provides that the construction of an environmental management plan means implementing policies and objectives to guide and promote the commitment of all the organization for actions that lead to achieving economic, social and environment in accordance with legal regulations, resulting in sustainable development. The same rule clarifies that the implementation of a set of environmental management techniques, may reflect important results for the planet. The management of companies, regardless of the economic activity exercised, must implement environmental management policies through guiding documents, with periodic reviews to continuously keep

the actions to control environmental impacts in accordance with legal and environmental regulations. The CONAMA Resolution 401 of November 04, 2008, determines that the battery manufacturer must present to the competent environmental agency, management plan for the batteries. The same Resolution establishes that, each year, the battery manufacturer must submit to IBAMA - Brazilian Institute of Environment and Renewable Natural Resources, an award on the physico-chemical composition, issued by a laboratory of the National Institute of Metrology and Standardization - INMETRO.

The process to implement an Environmental Management System - EMS proposed in the ISO 14001 series of 31 December 2004, it is based on the PDCA methodology (Plan, Do, Check, Act). To Mariani (2005). PDCA method directs the actions of management of internal processes, is used to achieve goals set for the organization, using the information to direct actions. Based on the ISO 14001 series of 2004, phases of the PDCA are represented in Figure 1 and establish a roadmap for actions in the company in search of the implementation of an EMS- Environmental Management System.



Fonte: Norm ISO 14001 of 2004

Fig.1: Model of the environmental management system according to ISO 14001

Based on Figure 1 the Environmental Management System is an integrated process that, according to ISO 14001 of December 31, 2004, can be called process

approach. Table 1 shows the phases of the PDCA process approach to environmental management.

Table.1: Phases of approach to environmental and process management

Processes	Integrating processes	Result
Environmental Policy	Based on legal norms define the company's environmental policies	Continuous Improvement
Plan	Establish the objectives and processes necessary for the desired results in accordance with the organization's environmental policy	
Do	Implement the processes	
Check	Monitor and measure processes in accordance with the environmental policy, objectives, targets, legal and other requirements, and report the results.	
Act	Act to continuously improve the performance of the environmental management system.	

Source: Adapted ISO 14001 2004

3.2 The interface of the theory of economic development, innovation and environmental management

Mitcham (1995) states that since the sixties occur debates on relationship between economic growth and quality of life on earth in search of balance between development,

economic stability in industrial nations and ecological maintenance and environmental safety of the planet.

According to Adams (2006) and Quental *et al.* (2011) the society and the economy are governed by man and the available natural resources represent a finite limit which means that the supply of natural resources and energy is limited in space and time.

For Schumpeter (1985) the agent of transformation of the economy is the entrepreneur who, through innovation destroys creatively old habits, establishing a new relationship with the market. The thought of Schumpeter (1985) propose to focus on innovation as a fundamental phenomenon of economic development, it highlights the entrepreneur's role to put into practical innovations and trigger endogenous changes that generate economic growth with changing habits of consumers. Defends innovation to change the way the current static production company conceptualizes and innovation as the development of new internal combinations seeking innovative alternatives to market a new way of making new products and meeting profitability and development.

For Porter and Van der Linde (1999) compliance innovation for the environmental adaptation is carried in response to regulatory mechanisms. The same author points out that the legal standards drive innovation to the environment and become important to ensure that companies do not create competitive advantage with actions that harm the environment. As for Weber (1999) in the contemporary world government through the imposition of stricter laws shall establish commitment and environmental responsibility to stakeholders, to reduce the environmental impact in the production process, trade and consumption of goods and services. And clarifies that the industries and trade started to use environmental management to establish a competitive business strategy. According to Bessant and Tidd (2009) innovation plays a central role in helping to create sustainable future by conventional means, such as new processes, products and services, but also by promoting changes in behavior. The concern about the issue of sustainability is increasing on the agenda of innovation. Innovation connected to sustainability factors, usually has greater systemic implications and emphasizes the need for integrated management.

The report of the United Nations Environment Program - UNEP (2011), points out that the industry through innovative actions should take a proactive role in the green economy with efficient use of resources and increased productivity throughout the supply chain and distribution products and services.

3.3 Reverse logistics in environmental management actions of waste, effluents and emissions in industry that generate toxic pollutants

For Leite (2009) the reverse logistics deals with the return of various types of products after use and end of that lifetime back to the manufacturer for recycling, adding value to return to the production process to form new products.

Xavier and Correia (2013) say that reverse logistics is important for society because it reduces the extraction of raw materials through reuse of waste in the production process, environmentally intended materials thus protecting the environment for the benefit of sustainability.

About this, Souza and Rodrigues (2014) affirm that the practice of reverse logistics in the battery industry is to reduce the environmental impact and the reuse of materials, effluents and waste establishes an operational competitive advantage by reducing the cost of raw materials, adding value to the company.

Reverse logistics action in Brazil is foreseen in CONAMA Resolution No. 401 of November 4, 2008, which requires manufacturers, importers and retailers to deploy operating mechanisms for the collection, transport and storage as well as establishing criteria for marketing in the national territory.

The Law 12.305 of 2 August, 2010 establishing the National Policy on Solid Waste, establishes standards for the management of hazardous wastes and reverse logistics, as an economic and social development tool, characterized by a set of actions, procedures and means designed to facilitate the return of waste for reuse in the productive cycle or for the environmentally acceptable disposal.

3.3.1 Air emissions, effluents and waste generated in the process of recycling the batteries industries

Important to note that the CONAMA Resolution 3 June 28, 1990 conceptualized air pollution as any form of pollution that is not in accordance with the established levels considering matter or energy, intensity and quantity, concentration, time or characteristics that makes the offensive air health, that interfere with the public welfare, cause damage to the materials, flora and fauna or compromising the security in the normal activities of the people. Already CONAMA Resolution 436 of December 22, 2011 sets limits of air pollutants emissions, points out that this is the main pollutant generated in the battery industry and results from secondary lead melting process. Santos *et al.* (2011) affirm that the industrial process for recycling batteries for reuse of materials is potentially polluting, there is no emission of gases and particles and battery scrap residues contain lead oxide, lead sulfate, and plastics, acidic components and other heavy metals, slag residue resulting from the recycling of lead finally to waste acid solution. According to studies by Baird (1995)

lead is a metal with a high toxicity and a tendency to accumulate in the human organism.

Baenas (2008) that focuses the contamination in the battery case by processing industries for reuse of scrap of components of used batteries. Affirm that the environmental contamination happens through the emission of pollutants causing pollution of air, soil and water contaminants emphasizes that when in contact with the skin are carried by the blood circulation affecting kidneys, bone marrow, liver and brain.

3.3.2 Environmental management of air emissions, waste and effluents generated in the process of recycling in the batteries industries

According to Francalanza (2000), the lead recycling is an environmental point of view, the most correct procedure. But this does not mean that recycling processes adopted, can not come cause serious problems to the environment and to human health, especially the workers in this industrial segment.

To Nunes (2004) lead is highly toxic and accumulative and can be removed from industrial effluents with good efficiency with sodium sulphide. This process must occur prior to biological treatment to avoid inhibition of the microorganisms responsible for the oxidation of organic matter.

For Pacheco (2002) in the battery recycling industry, failure to comply with the rules for changing the filter sleeve may lead to lead contamination by atmospheric emissions, noting that the time of exchanging the filter sleeve containing particulate lead, must be established pursuant to its life. It states that a filter sleeve failure when there is an excessive clogging or emission. The issue should be checked weekly using a particulate detection equipment, while the clogging must be checked daily by measuring pressure loss of the filter with specific apparatus. It states that the pressure drop of the sleeve filter is the pressure difference between the dirty and clean cameras

Especialmente Francalanza (2000), states that industries can use well-known procedures, correct and adequate control and minimization of potential problems with the pollutants generated in the battery industry such as: 1- neutralization of the acid and lead recovery him contained; 2- filtering job for retention of gases and particulates; 3-treatment to neutralize the slag; 4- disposal of slag in suitable landfill; 5-monitoring of emissions and particulates into the environment; 6. Monitoring of soil and groundwater conditions and; 7 periodic medical examinations of employees.

IV. METHODOLOGY

As argued by Creswell (2010), the choice of method will depend on the intent of the search to specify the type of

procedure. Regarding the approach to the problem, the studies of Marconi and Lakatos (2011) are employed in search of qualitative and quantitative data capable of answering the research question and using the Economic Development Theory prescribed in Schumpeter (1985) and the Environmental Management System - EMS proposed in the ISO 14001 series of 31 December 2004 and takes into account the provisions of ISO 9001 2000 is based on the PDCA methodology (Plan, Do, Check, Act) to meet the objectives of this research and propose management actions and management for an industry that generates highly toxic pollutants.

4.2 The method used in this research.

The research assumes exploratory and descriptive character that according to Gil (2010) and Marconi and Lakatos (2011) allows to explain the problem management of pollutants generated in a high pollution potential industry. Through literature review is established familiarity with the subject and based on the proposals of legal regulations and scientific studies propose an environmental management system in an industry that generates toxic pollutants.

With support in the studies of Gil (2010) opted for the field research to increase knowledge about the object under study. We used observation and interview questionnaire with industry managers, to check *in loco* and capture the explanations and interpretations of the actions taken to manage and management there generated pollutants.

The selection of the sample is in the studies of Marconi and Lakatos (2011) that suggests for the field research to select respondents who have practical experiences with the problem researched providing the analysis that stimulates the understanding and propose to know and to interpret the reality, without interfering in it for be able to modify it. The sample non-probabilistic, intentionally incorporated, selected by random sample criterion has support in studies of Cooper and Schindler (2003), the initial selection of sampling is of the investigator. The choice of the sample is focused on the actors that is directly related to the management of generated pollutants. The choice of location was strategic to engage industry studies that processes highly toxic material.

4.3 Procedures and techniques adopted

The strategic to meet the objectives raises technical procedures to systematize the actions of pollution management in an industry that processes lead to emissions of air pollutants, waste and highly toxic and important effluent is made to establish a relationship with the theory of economic innovation and the ecological balance. Figure 2 shows the flow of the procedures adopted to incorporate the results the main knowledge acquired with this task.

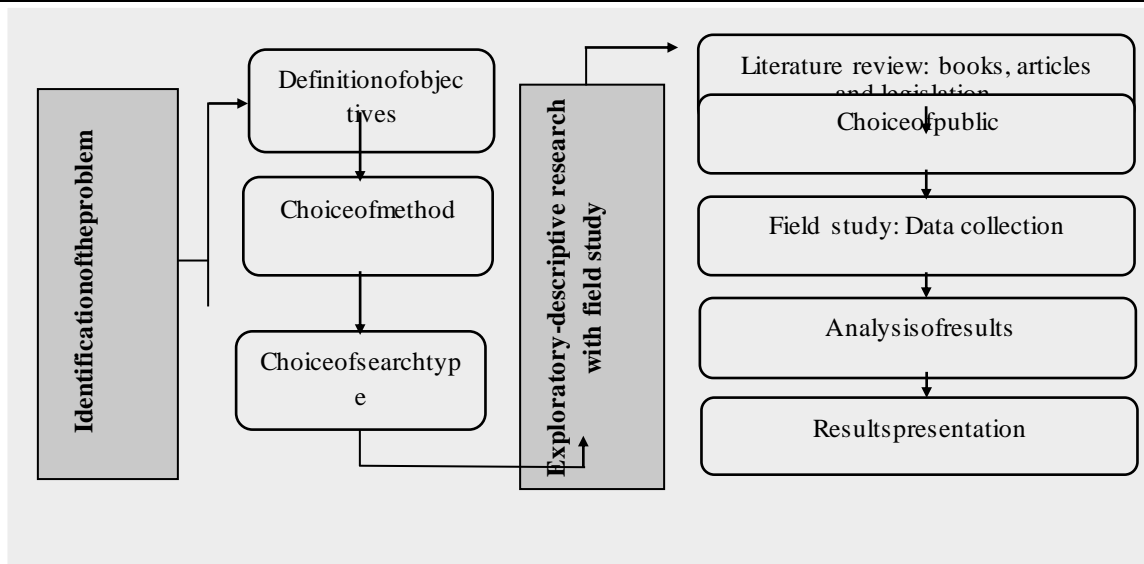


Fig.2: Table procedures adopted for research

Source: The Authors

The preparation of this task begins with the definition of objectives to choose the best method and type of research to substantiate knowledge and answer the research question. The literature review allowed prepare a questionnaire interviews and structuring expertise to the research note that was held in April 2018. In the data collection procedure we tried to maintain discipline provided in the Gil recommendations (2010) and Marconi and Lakatos (2011). Data collection was through interviews with industry managers and observing all environments following processing in the industrial plant relating theory and practice. For the analysis established a relationship between the proposals on legal standards and the theoretical framework with the reality found.

V. RESEARCH RESULTS

This research was conducted in an automotive battery industry, located in a municipality in the region of the Brazilian Amazon in operation for over twenty years. The reverse logistics industry promotes the allocation and disposal of waste and effluent and used in the secondary smelting pyrometallurgical process for the recycling of lead. The source of heat for the processing furnace is moved wood and uses polyester filter sleeve for filtering emissions from the lead secondary fusing process. It has semi-artesian well that provides water for the industry. According to the research result in the main pollutants generated industry study are: particulate material of lead, acid solution, plastic and iron slag.

The company serves in part the legal standards of control and supervisory bodies considering that holds ISO 9001 certification and the certification of INMETRO-National Institute of Metrology, Quality and Technology and

employees circulating in the industry environment, are with EPI - Personal Protective equipment, noting the expected in NR Regulatory Standard No. 6 of the Ministry of Labor. The company also serves Regulatory Norm NR-7 of 1994 which determines the exams every six months in specialized laboratory to identify the lead content in the body of the industry's employees. According to managers until the date of the survey, did not identify lead content above the permitted in any examination conducted.

5.1 The Environmental Management System - EMS, economic development and innovation in the processes and procedures in the industry under study

The scope of the review is possible to identify which industries batteries have general legal standards and specific forecasted to pollutant emissions, the degree of toxicities of waste generated when processing the lead in order to avoid contamination of the soil, water and air.

It was identified that the industry does not have a management plan that meets the Environmental Management System (EMS) provided for in Brazilian legal norms coordinated actions for the allocation and disposal of waste and effluents and air emissions. Imperative to meet the legal framework as Resolution 401 of 2008 which provides for the preparation of the plan and presentation to inspection and environmental control agencies for the operation of the industry. Law 12.305 of August 2, 2010, establishes standards for the waste management and effluent especially dangerous. It is worth highlighting the importance of considering the concepts of CONAMA Resolution 3 of 28 June 1990 and CONAMA Resolution 436 of December 22, 2011 which sets limits for air pollutant emissions for the industry study.

You can see that managers have concerns about air emissions, waste and effluents generated there, however, actions to avoid contamination, need to better focus on the environment and the surroundings, the air, soil and water with global environmental vision, social and economic short-term and then for the benefit of current and future generations.

Note that it is possible to innovate in the process and procedures through planning of adequate environmental actions using the template provided for environmental management in ABNT NBR ISO 14001 2004 based on the PDCA (Plan, Do, Check, Act) recommended for the industry. Thoughts currents raise the innovation part of endogenous entrepreneur actions to change market paradigms and the environment favorable actions are competitive strategies for sustainability or economic, social and environmental.

Based on the results it can be stated that the actions taken there demanding guidelines based on scientific studies and legal norms about the dangers of the procedures adopted in the company, together with the need to mitigate the pollutants to prevent imminent harm to the environment. The systematization and implementation of an environmental management plan with clear reasons and continuous and coordinated actions can improve the

environmental vision and yet the image of the company. In this way, it is important to carry out the planning for execution, verification of the results and mitigation actions proposed by the PDCA method in order to innovate processes and procedures with a view to environmental certification, establishing competitiveness in the market mainly with the big industries.

5.2 Environmental management of reverse logistics of waste and battery waste

The reverse logistics process procedures and requires investments capable of effecting actions from manufacturing through the use of waste generated and return to recycling or reuse, and the manufacturing process or proper disposal in observing the composition of the residue.

The reverse logistics of actions taken by the industry meets the foreseen in CONAMA Resolution No. 401 of 2008 and Law 12.305 of 2010. In the new product sales collect the used battery, action is in partnership with the dealer.

To illustrate, Figure 3 shows the procedures adopted in manufacturing industries of this battery to the generation of wastes, effluents and emissions to reverse logistics procedures.

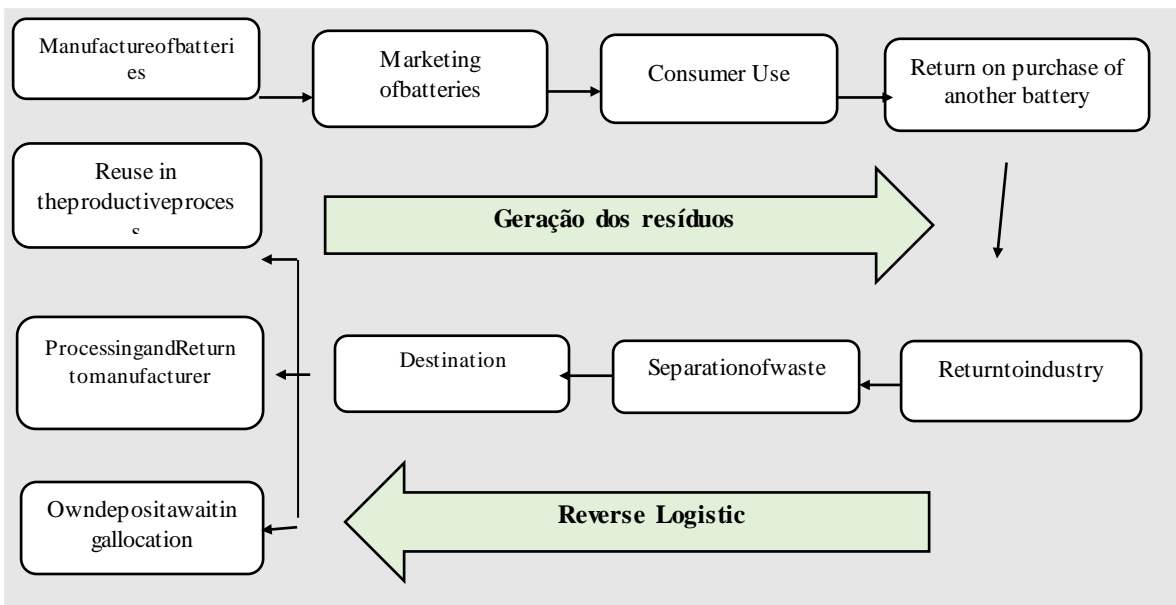


Fig.3: Procedure from manufacture to disposal of the product and disposition

Source: The Authors

The reverse logistics activities, practiced by the industry, meet the Brazilian legal standards return of waste and effluents from batteries. Important to note that the industry makes reuse of the lead taken from the battery, reverse logistics object through the secondary smelting process which generates waste effluents and highly toxic air emissions by means of lead particulate emission, acidic solution, aerosols and the slag iron. The reuse of

the battery cases also generates waste plastic containing particles of lead.

5.2.1 Destination and disposition of air emissions, waste and waste battery

The batteries, reverse logistics object, industry arrive and are stored in a warehouse, subsequently sawn to separate the waste plastic grid of lead acid, and other composing the battery of the structure. Table 2 represents the interview survey results and observation of practices in

the company as atmospheric emissions the allocation and process and associated legal norms.
 disposal of waste and effluents arising from industrial

Table.2: pollutant Classification actions in the industry and associated legal norms

RANKING	WASTE / POLLUTANTS	SEARCH RESULT	LEGAL NORMS
Particulate Material	Aerosols	Smoke from the chimneys is thrown into the atmosphere. Analyzes indicate acceptable limits of particulate matter.	CONAMA Resolution 436of 2011
		Dispersion of particulate material in the air by rupturing the conductive sleeves.	
		Likely suspension of lead particles in exchange for conductive sleeves.	
Liquid	Effluents from acid solution	The industry neutralizes the acid solution and returns to the industry / manufacturer.	CONAMA Resolution n° 401 of 2008 and Law12.305 of 2010
Solid	Lead particulate material	Directed by means of sleeper conductors for the collection and reuse of lead.	CONAMA Resolution 436 of 2011
	Plastic - Batteries cover	Manually crushed and then in the dry crusher and returned to the manufacturer.	CONAMA Resolution n° 401 de 2008 and Law 12.305 of 2010
	Cleaning cloths	They are incinerated in the kiln in the industry.	Law 12.305 of 2010
	Filter sleeve conducting particulate lead	Overdue the lead time is collected for reuse and the sleeves are incinerated in the industry.	CONAMA Resolution 436 of 2011
		There was no information regarding cleaning and use of control and monitoring equipment for the exchange.	Law 12.305 of 2010
Iron Slag	Crushed and deposited in a place in the company awaiting disposal, (around 500 tons in the warehouse)	Law 12.305 of 2010	

Source: The Authors - based search result.

It should be noted that the pollutants generated in the most disturbing industrial process is the particulate material, which dissipates into the air by the smoke and can result in serious problems to the environment and human health through contamination of the atmosphere by the roundness and even in places more distant. The industry presented environmental research reports, conducted in 2012, indicating limits laid down in legal regulations.

It is worth reflecting on the provisions of CONAMA Resolution 436 of 2011 which limits emissions for industries batteries that are considered fixed sources that generate air pollutants in the secondary lead fusion process, highly toxic to health and the environment. Legal regulations indicate that atmospheric emissions contain particulates of lead that contaminate the atmosphere to a greater or lesser degree. The planning and emission control becomes essential to avoid and prevent

environmental disasters that can cause long-term damage, irreparable human health and the environment.

It was identified that lead particulate material is filtered through a polyester filter and collected into sleeve bags for processing and reuse in the company. The filter sleeve used when replaced with new and cleaning cloths are incinerated in the company's furnace. It is suggested that the exchange of the filter sleeve should be carefully practiced, avoiding to disperse particles of lead in the environment. Given the important need to avoid the emission of lead-containing air pollutants, the legal norms and the theoretical framework give rise to the periodic exchange of the manhole filter and daily monitoring of the filtration capacity of the particles to identify the filter clogging. This process can be carried out by checking the pressure drop of the filter and controlling the emissions can be by means of devices that detect the lead

particulates in the aerosols emitted in the chimneys, however, avoiding the contamination of the environment. The acid solution effluent is neutralized and it returns to the manufacturer, in the same transport that brings new products, thus meeting the legal rules of destination through return. The theoretical framework that emphasizes the acidic solution used in manufacturing results in highly polluting effluent. There was the need for the industry to promote management actions acid solution effluent generated when disassembling the batteries, reverse logistics object, considering the contact with the ground in inappropriate location for the job. It is suggested waterproof floor with channels and capture the effluent for neutralization and return to the manufacturer. It was observed that the residue of the plastic battery cases is triturated dry manual process shredder and then, return to the manufacturer for disposal. It was observed that the manual process of disassembling the battery boxes, there is the generation of residues and effluents which probably contains acid and particulate lead. This effluent containing lead runs the floor and observed cracks in the floor which suggests that pollutants have contact with the ground. Based on theoretical framework that indicates the degree of toxicity of the effluent is suggested that where the carcasses are crushed there is a

structure with a waterproof floor to prevent contamination of soil and water, and channels with a thickness capable of collecting solution. It is worth highlighting the importance of a secure process to prevent soil contamination,

It was found that iron slag waste generated in the furnace after the lead is intended for processing a deposit in the industry, open place without protection. According to the search result in the city or proximity has no landfills for disposal in accordance with ABNT 10004 2004 classifies hazardous waste in Class I. According to the managers in the industry under study there is about 500 tons of slag in the tank that demands urgent allocation. Important to note the study Nunes (2004) on the toxicity of lead in industrial wastewater. It is imperative that the company studies to engage the allocation or arrangement of iron slag, waste accumulated in this company.

5.4 Proposal management using the PDCA method

Table 3 is a parallel between the actions in the industry, legal regulations, proposals for action and implementation of PDCA for management of waste and effluents and air emissions. Are processes that integrate and demand an approach to establish a systematic form a plan to consolidate the management in the battery industry.

Table.3: Actions in the industry, legal regulations and interventions based on the PDCA

INDUSTRY ACTIONS	LEGALS NORMS	PROPOSED INTERVENTION	PDCA
Management plan	1. ABNT NBR ISO 14.001 of 2004. 2. Resolution 401 de 4 de novembro de 2008.	Provide a participatory management plan with the PDCA method	Plan Do Check Act
Reverse logistic	CONAMA Resolution 401/2008 and Law 12.305 of 2010	- Establish sales and return controls to consolidate reverse logistics, software is suggested.	Plan Do Check Act
Generation of air pollutants smoke / aerosols Dispersion of lead particulates, collection in bags.	CONAMA Resolution 436 of december of 2011	-Provide filter in the chimneys to monitor particulate emissions and monitor the filtration capacity of the sleeve filter to plan the exchange before they are damaged. -Provide closed site for the collection of lead particulates from the sleeves	Plan Do Check Act
Sulfuric acid - the company promotes reverse logistics for the industry /	CONAMA Resolution n° 401/2008 and Law 12.305 of 2010	- Provide the waterproofing of the floor where the batteries are disassembled, object of the reverse logistics. -Provide channels capable of conducting the liquid waste from the place where the	Plan Do Check Act

manufacturer after neutralization. Plastic cover of the batteries, crushed manually and then in the dry crusher and returned to the manufacturer.		batteries are disassembled for safe collection.	
		-Provide mechanical crusher avoiding human contact with the battery casings.	
		- Treat the liquid waste and lead in the soluble form generated at the time of disassembling the batteries.	
Cloths are cremated Filter sleeves are incinerated in the industry itself.	Law 12.305 of 2010	-Environmentally sound disposal.	Acttocontinuously improve
		-Filter sleeve contains lead if incinerated particles return to the process as particulate residues and again to the filter.	
Iron slag: Crushed and deposited at the company's own site awaiting disposal, (around 500 tons in the warehouse)	Law 12.305 of 2010 and ABNT 10.004 of 2004	- Treatment and neutralization	Plan Do Check Act
		- Waste Class I - hazardous, demands environmentally adequate disposal in Industrial landfill.	
Worker's health	NR 06 and 07	-Provide the management plan and participatory for coordinated actions within the industry.	Plan Do Check Act
		-Monitoring the worker's health continuously.	
		-Monitoring the use of PPE - Personal Protective Equipment.	
		-Monitor the environment of the industrial	

Source: The Authors - Search Results

It highlights the importance of a EMP - Environmental Management Plan, based on rules and procedures validated by the PDCA method - Plan, Do, Check, Act

depicted in Figure 4, in order to direct actions environmentally sound in an industry with highly toxic pollutant emissions.

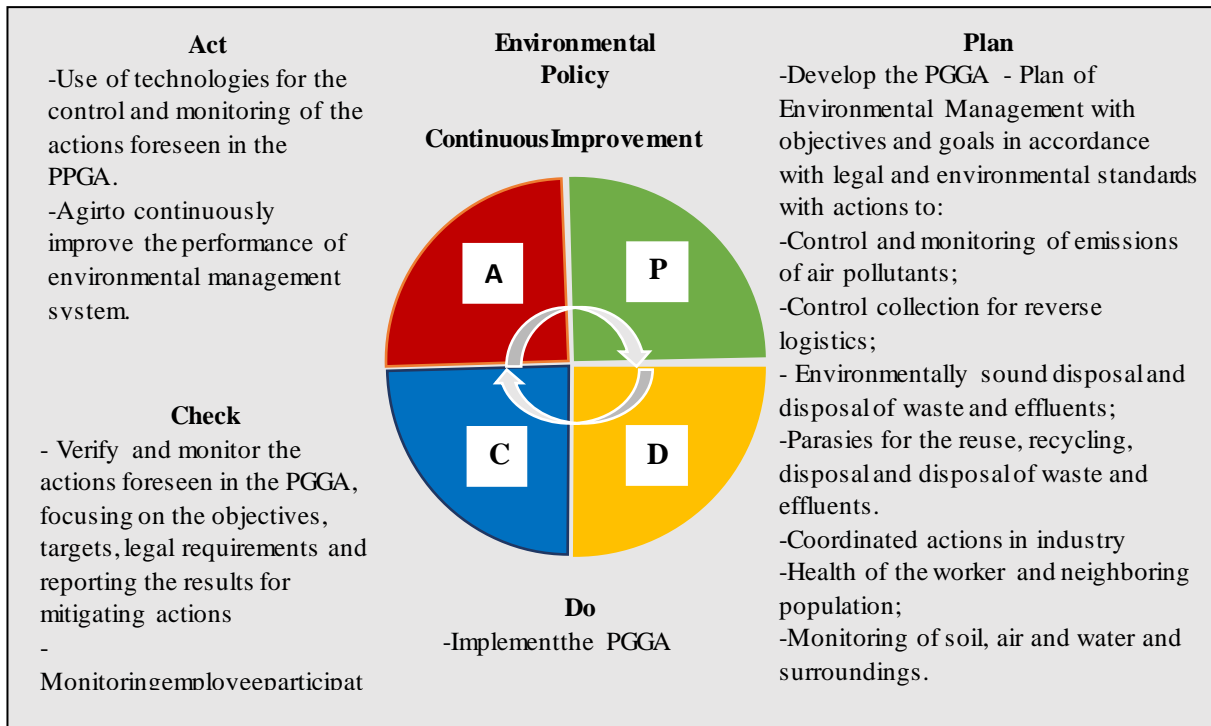


Fig.4: Method for PDCA Environmental Management System EMS in the battery industry

Source: Adapted ISO 14001 2004

The rules establish the need for management plan to direct actions in the battery industry, aimed at environmental protection with the allocation and provision of environmentally sound waste.

VI CONCLUSION

The company does not have an environmental management plan and suggests to design and implement immediately to outline actions, objective and targets for the industry, able to contribute to sustainable development and environmental security of the planet. Noting that a management plan will be able to direct actions, brings security as the rules and procedures in the company and meets the legal and environmental standards.

The high pollution potential is important to implement a participative environmental management, with the involvement of all those who are in the process, so the housekeeper task answers the research question, a environmental management plan based on the PDCA method - Plan, Do, Check and Act are able to systematize sustainable actions in an industry that generates highly toxic pollutants as shown in the task.

It's concluded that a participative EMS - Environmental Management System is important because it promotes continuous improvement with coordinated actions innovating processes and procedures focusing on economic, social and environmental sustainability to establish competitiveness in the consumer market.

According to the theoretical framework of this task emissions of air pollutants, waste and effluent in the battery industry that are highly toxic can reach people living in the surrounding region and it is suggested that studies with the surrounding people water, air and ground.

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Stable Coastline between Two Groins Equation

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Abstract— In this research an equation of static equilibrium geometry shoreline on coastal segment between two groins with quadratic polynomial equations is developed. Equation coefficients were formulated based on the characteristic of stable coastline geometry of the previous study and conservation law of mass, where volume of erosion and sedimentation are identical. The equation is capable of predicting erosion and accretion for coastline between two groin. Furthermore, with the predicted erosion and sedimentation, the groins gap and the length of groin can be planned using maximum permitted erosion criteria.

Keywords—Coastline between two groin, stable coastline.

I. INTRODUCTION

Groin is a type of massive construction as coastal protection against erosion. This construction is constructed perpendicular to the coast to withstand littoral drift. At the coastal segment located between two groins (Fig.1.), erosion and sedimentation will still occur until the formation of a stable coast, i.e. a condition where net sediment transportation is zero.

There are two conditions of stability, i.e. dynamic equilibrium and static equilibrium. At static equilibrium condition, there is no sediment transportation parallel with the coast or resultant of the long shore drift is zero. For a quite long time span, this static equilibrium condition exists if the evolution observed is the result of dominant wave. At static equilibrium condition, even sediment transportation still happened, the coastline will not change due to balance of sediment transportation..

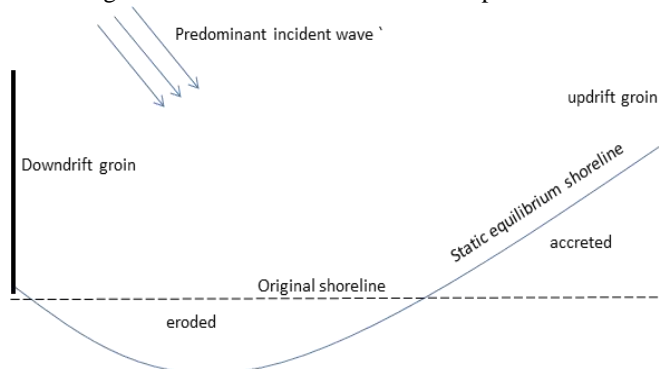


Fig.1 Evolution of Shoreline At The coast Between Two Groins

The aim of this research is to obtain coastline equation between two groins at static equilibrium condition. The equation is obtained by studying the shape of stable coastal geometry from previous researches, such as Haligan [1], half-heart bay, Silverster [2], crenulate shaped bays, Silverster and Hso [3], Hsu and Evans [4] and some other researchers.

The prediction of erosion and sedimentation at coastal segment between two groins can be done using GENESIS software or similar model. However, the analysis requires a long time. If the equation of stable coastline between two groins is obtained, the calculation can be done more practical with shorter time. Then, using the equation, the planning of the length of groin and the distance between groin can be done using the permitted erosion criteria.

II. STABLE COASTAL GEOMETRY

In this section the characteristic of stable coastal geometry will be studied. Based on the geometry characteristic, the approximation equation for stable coastal geometry between two groins will be formulated.

It has been recognized that in the nature there is stable coastal geometry in static equilibrium condition which many researches have studied to this form of stable coast. There are varieties of terminologies for the form of stable coast, i.e. Haligan [1] called it zeta bays, half-heart bay (Silverster [2]), crenulate shaped bays (Silverster dan Hso [3]) and some more. Whereas the shape and theory of the stable shoreline is as follows:

a. Parabolic Model

Hsu and Evans [4] stated a parabolic equation for distance R from point O to every point along the shoreline, whereas the shape of the equation is,

$$\frac{R_{\theta}}{R_{\theta_0}} = C_0 + C_1 \left(\frac{\theta_0}{\theta} \right) + C_2 \left(\frac{\theta_0}{\theta} \right)^2$$

$$C_0 = 0.0707 - 0.0047\theta + 0.000349\theta^2 - 0.0000087\theta^3 + 0.0000000476\theta^4$$

$$C_1 = 0.9536 + 0.0078\theta - 0.00004879\theta^2 + 0.000018\theta^3 - 0.00000128\theta^4$$

$$C_2 = 0.0214 - 0.0078\theta + 0.0003004\theta^2 - 0.0000183\theta^3 + 0.0000000934\theta^4$$

R_{θ_0} = control line (line \overline{OC}), where the length is known

θ_0 = angle between crestline and control line (known)

R_{θ} = length of \overline{OB} line, with θ angle toward crestline

The stable shoreline consists of two parts (Fig.2), i.e. curve part, which is shaped by diffracted wave, and the straight part which is shaped by incident wave and is parallel to it. It is known that littoral drift that is parallel to the coast is a sine function of the angle between the wave and the shoreline. Therefore, the tangent of this linear part must be parallel with the wave crestline where littoral drift is minimal or zero.

b. Logarithmic spiral model

Yasso [5] also discovered that stable coastal geometry has similar shape like the one in parabolic theory. However, he used the logarithmic spiral model equation for the

stable coastal geometry, i.e. $\frac{R_2}{R_1} = e^{\theta \cot \alpha}$

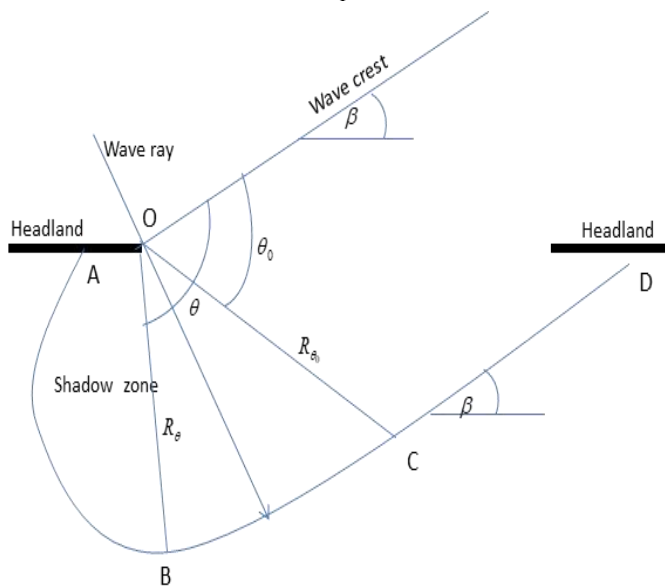


Fig.2: The Shape of Parabolic Stable Shoreline Between Two Headlands

Where (Fig.3), θ is the angle between R_2 and R_1 , α is a logarithmic parameter. One thing that should be taken into account is that either parabolic model or logarithmic spiral model is equation in the diffracted wave area. Therefore, it can be stated that the curve shape of the stable coast is the result of diffracted wave.

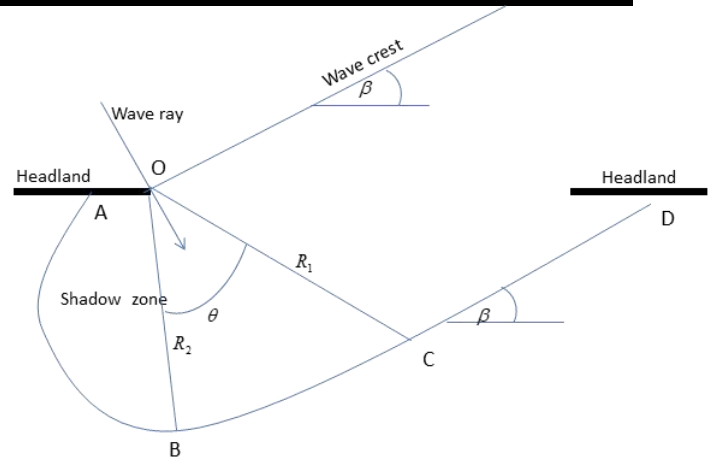


Fig.3: Logarithmic Spiral Model.

c. Shoreline Change Model

Some of the above theories on stable coastal geometry are stable coastal geometry between two headlands, whereas on stable coastal geometry between two groins, no research has been done, where at the down drift groin, coastal geometry is shaped by diffracted wave. Changes in coastline around the groin can be modeled with shoreline change model. The first shoreline change model was developed by Pelnard-Consideré [6], which then was called one line model. The equation was formulated based on conservation law of mass, i.e. the volume of eroded sediment is similar to the volume of the deposited sediment, based on the main assumption that bathymetry moves parallel with the shoreline. The form of the equation is as follows:

$$\frac{\partial y}{\partial t} + \alpha \frac{\partial^2 y}{\partial x^2} = 0 \quad \dots\dots\dots(1)$$

Where $y(x, t)$ is the ordinate of a point on the shoreline or the distance of a point on the shoreline toward x axis which originally is parallel to the shoreline, whereas α is a coefficient which is a function of an angle of the incoming wave and wave height (Fig.4).

Furthermore, many researchers have made analytical method, both analytic and numeric, based on that one line equation to analyze shoreline evolution. Among others are GENESIS which was developed by Hanson and Krauss [7] and ONELINE (Dabees and Kamphuis [8],[9]).

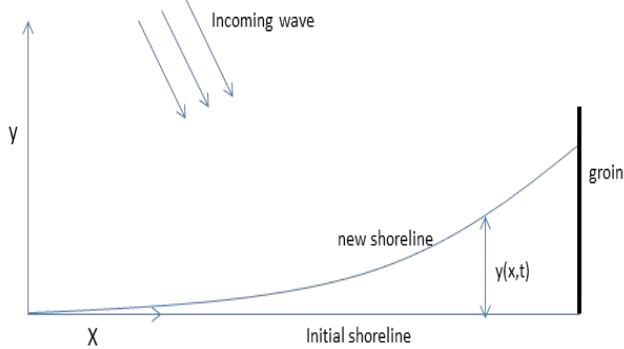


Fig.4: Definition of $y(x,t)$ on OneLine Model Equation

At static equilibrium condition (1), becomes $\frac{\partial^2 y}{\partial x^2} = 0$.

The solution of this equation is, $y(x) = c_0 + c_1 x$ which is a linear line equation. Therefore, according to one line model, shoreline geometry in static equilibrium condition is a straight line. This line should oriented parallel to crestline or perpendicular to wave direction, to avoid littoral drift. However, due to diffracted wave, shoreline in shadow zone is a curve line.

d. Diffraction at Groin

Kamphuis [10] has conducted a study on the condition of diffracted wave around groin since 1962. The diffracted wave coefficient according to Kamphuis [10] is

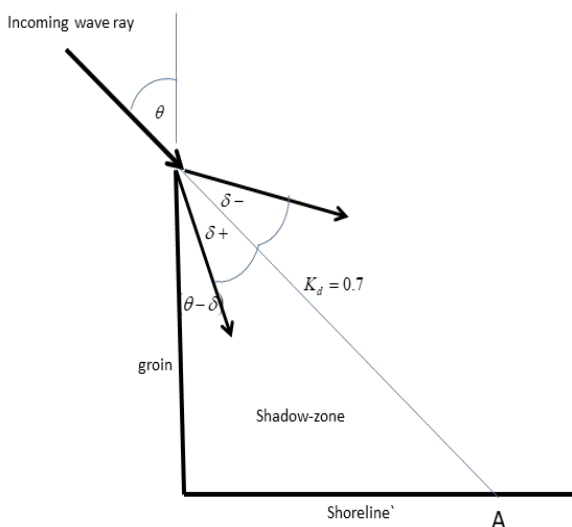


Fig.5: Diffracted Wave Around Groin.

$$K_d = 0.7 - 0.0077\delta \quad \text{for } 0 \leq \delta \leq 90^\circ$$

$$K_d = 0.7 - 0.37 \sin \delta \quad \text{for } 0 \leq \delta \leq -40^\circ$$

$$K_d = 0.83 - 0.17 \sin \delta \quad \text{for } -40 \leq \delta \leq -90^\circ$$

With this distribution pattern of the diffracted coefficient, it is estimated that maximum erosion at the left side of point A (Fig.5), i.e. at the end of shadow zone, whereas

the point where shoreline is linear line is located at a quite far distance from point A.



Fig.6: Secondary Circulate Longshore-current Due to Diffracted Wave

In addition, the difference in wave height as a result of diffraction, triggers longshore secondary current toward downdrift groin. As a result of the longshore current (Fig.6), there could be sedimentation or at least reducing erosion at the downstream groin (Van Rijn [11]). The volume of longshore transport is

$$Q = 0.0006 \rho_s (\tan \beta)^{0.4} d_{50}^{-0.6} (H_{s,br})^{2.6} V_{wave} \dots\dots\dots(2)$$

$$V_{wave} = 0.3 (g H_{s,br})^{0.5} \sin(2\theta_{br})$$

Q = longshore sediment transport (kg/sec), ρ_s = sediment density (kg/m³); d_{50} = median sediment grain size (m), $\tan(\beta)$ = slope of beach surf zone V_{wave} = wave induced longshore current vel. (m/sec), θ_{br} = wave angle at breakerline (°).

It should be noticed that at the longshore equation of the transport sediment, the volume of transport sediment longshore is determined by the angle of the incoming wave, and the higher the angle of the incoming wave the higher the velocity of the secondary longshore current and the bigger the littoral drift will be. Therefore, this secondary longshore current is a protector for part of the beach around down drift groin against erosion. The longer the groin, the larger the shadow zone area will be, and the bigger the secondary longshore current, the smaller the erosion or even the presence of sedimentation.

III. STATIC EQUILIBRIUM SHORELINE EQUATION BETWEEN TWO GROINS

The result of the study on section II. is that stable coastal geometry, between two headlands and also between two groins, consists of two parts, i.e. curve part and linear part. The curve part is formed by diffracted wave, whereas the linear part is formed by incident wave, where the linear part is perpendicular to wave direction or parallel with coastline.

In addition, based on a study conducted by Van Rijn [1], sedimentation could occur at the downstream groin, where the higher the angle of the incoming wave, the larger the sedimentation will be (2).

From the result of the study on part II, a hypothesis line for the static equilibrium shoreline geometry between two groins is made as presented in Fig.7, where there is linear part (straight line) and curve line. This is in accordance with parabolic theory. The straight part (BD line) is perpendicular to incident wave, which is the requirement for stable coastal line so that there will be no littoral drift, whereas the curve part is formed by diffracted wave.

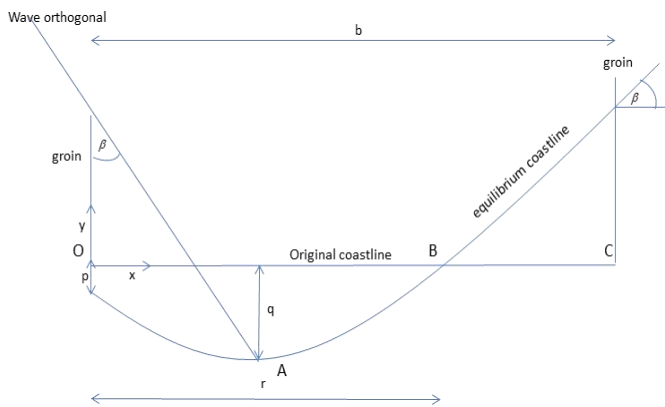


Fig.7: The Sketch of Static Equilibrium Shoreline

With an assumption that shoreline geometry is stable as shown in Fig.7, then it can be approximated with the parabolic equation, i.e.

$$y(x) = c_0 + c_1x + c_2x^2 \dots\dots\dots(3)$$

Need to be determined in that equation are constant values of c_0, c_1 and c_2 and erosion at down drift groin p , the maximum erosion q , length s , with an input of incident wave direction β , length of groin L_g and distance between groin b . Sedimentation at the up drift groin side is calculated after coefficient values of c_0, c_1 and c_2 is obtained. To calculate the values of c_0, c_1, c_2, p, q and s , the following conditions are used:

A. Point Coordinate

1. $O(0, -p)$. At point O , where $x = 0, y = -p$, then $c_0 = -p$, coastal line equation becomes

$$y(x) = -p + c_1x + c_2x^2 \dots\dots\dots(4)$$

2. $A(r, -q)$. At point A , i.e. at $x = r, y = -q$. From experiment, the approximation equation for r is $r = (L_g - q)\tan \beta$. The equation at this point is an effort to include length of groin L_g as one planning factor.

$$-p + c_1r + c_2r^2 = -q \dots\dots\dots(5)$$

3. $B(s, 0)$. At point B , i.e. at $x = s, y = 0$. Equation at this point is needed to determine the length of s or erosion area.

$$-p + c_1s + c_2s^2 = 0 \dots\dots\dots(6)$$

B. The direction of line $\frac{dy}{dx} = c_1 + 2c_2x$

1. At $x = x_B = b$; $\frac{dy}{dx} = \tan \beta$, this equation is also used as a requirement of limit at updrift groin at numeric completion of One Line model equation, i.e. as surface boundary of solid surface that no sediment goes through the groin, then

$$c_1 + 2c_2 = \tan \beta \dots\dots\dots(7)$$

2. At $x = x_A = r$ at maximum erosion location, $\frac{dy}{dx} = 0$, this equation together with equation at point $A(r, -q)$, i.e. equation (5), is used to insert the influence of the length of groin.

$$c_1 + 2c_2r = 0 \dots\dots\dots(8)$$

C. Conservation law of mass

In this section the conservation law of mass is done where the volume of erosion is similar to the volume of sedimentation, i.e.

$$\int_0^b y(x)dx = 0$$

Considering that the volume of erosion material can increase when it is submerged under water, then the relation between volume of erosion (V_e) and sedimentation (V_s) is $V_e = (1 + \lambda)V_s$ where λ is sand porosity with a value of 0.2 - 0.3. The integration is divided into two parts.

$$\int_0^s y(x)dx + \left(1 + \lambda \int_s^b y(x)dx\right) = 0$$

where the first term is the volume of erosion and the second term is the volume of sedimentation. By completing the integration, and by dividing the equation with $(1 + \lambda)b$, the following equation is obtained,

$$-\frac{\lambda}{(1 + \lambda)b} \left(-ps + \frac{c_1}{2}s^2 + \frac{c_2}{3}s^3\right) + \left(-p + \frac{c_1}{2}b + \frac{c_2}{3}b^2\right) = 0 \dots\dots\dots(9)$$

For $\lambda = 0$

$$-p + \frac{c_1}{2}b + \frac{c_2}{3}b^2 = 0 \dots\dots\dots(10)$$

Equation (4) until equation (9) and or (10) can be solved simultaneously using Newton-Rhapson iteration method for non-linear system equation, where variables to be calculated are c_1, c_2, p, q and s . To avoid the

formation of an equation with zero diagonal, those five equations are arranged as follow

1. Equation for c_1 , $x = x_B = b$, $\frac{dy}{dx} = \tan \beta$

$$f_1(c_1, c_2, q, r, s) = c_1 + 2c_2b - \tan \beta$$

2. Equation for c_2 , $\int_0^b y(x)dx = 0$

$$f_2(c_1, c_2, q, r, s) = \left(-ps + \frac{c_1}{2}s^2 + \frac{c_2}{3}s^3\right)\left(-\frac{\lambda}{b}\right) + \left(-p + \frac{c_1}{2}b + \frac{c_2}{3}b^2\right)$$

3. Equation for p , at point $A(r, -q)$

$$f_3(c_1, c_2, q, r, s) = -p + c_1r + c_2r^2 + q$$

4. Equation for q , $x = x_A = r$, $\frac{dy}{dx} = 0$

$$f_4(c_1, c_2, q, r, s) = c_1 + 2c_2(L_g - q)\tan \beta$$

5. Equation for s , $x = s$, $y = 0$

$$f_6(c_1, c_2, p, q, r, s) = -p + c_1s + c_2s^2$$

The Newton-Rhapton Iteration Method requires initial value. As initial value, the values on table (1) can be used.

Table.1: Initial Value for Iteration

c_1	c_2	p	q	s
$-\tan \beta$	$\frac{\tan \beta}{s}$	Any value	$\frac{\tan \beta}{s}$	$\frac{2}{3}b$

IV. MODEL RESULT

This section presents the result of equation for various cases. In this example, sand void ratio was not considered or $\lambda = 0$. Fig.8 shows the result of the model for wave angle incident $\beta = 15^0, 30^0, 45^0$, length of groin 40 m, distance between groin $b = 100m$. As shown on figure 8, the bigger the angle of the incoming wave, the bigger the erosion and sedimentation will be. At a big angle of incoming wave, ($\beta = 45^0$), erosion at the down drift groin is smaller, which represents secondary effect of longshore current from Van Rijn [11], as mentioned in chapter 2.

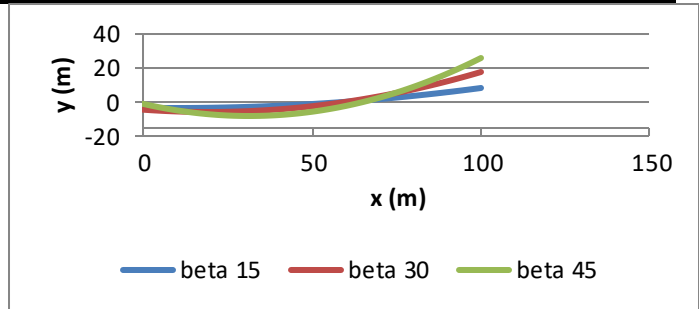


Fig.8: Example of Equation Result, for $\beta = 15^0, 30^0, 45^0$, Length of Groin $L_g = 40 m$. Distance Between Groin $b = 100m$.

Next is the presentation of model result for varied b , L_g and β as shown on table (2). At varied b with L_g and β constant, erosion and sedimentation are bigger with the expansion of distance between groins. At varied L_g with b and β constant, the longer the groin, the smaller the erosion and sedimentation will be. There is p negative at $\beta = 40^0$ and 45^0 which shows that accretion occurs at the downdrift groin. This represents the effect of secondary longshore current as stated by Van Rijn [11].

In Fig. 8, there is no sedimentation at the downdrift groin although $\beta = 45^0$ is used, because the length of groin is 40 m, whereas the result on Table 2 groin length 50 m. The effect of the length of groin is also showed in table 2, i.e. reduces of the erosion. So, the length of groin and the angle of incoming wave provide secondary longshore current effect which reduces erosion at the down drift groin.

Table.2: The result of equation with varied L_g, b and β

Varied Distance between groin (b)							
b (m)	L_g (m)	β (0)	p (m)	q (m)	r (m)	s (m)	t (m)
100	50	25	3,63	4,94	21,01	61,92	13,47
110	50	25	4,59	5,71	20,65	67,43	15,12
120	50	25	5,53	6,49	20,28	72,98	16,75
130	50	25	6,44	7,28	19,91	78,57	18,37
140	50	25	7,35	8,08	19,54	84,19	19,99
150	50	25	8,24	8,89	19,16	89,82	21,60
Varied Length of groin (L_g)							
100	30	25	5,82	6,15	11,12	59,54	14,57
100	35	25	5,32	5,82	13,60	60,05	14,32
100	40	25	4,79	5,51	16,08	60,62	14,05

100	45	25	4,23	5,21	18,55	61,24	13,77
100	50	25	3,63	4,94	21,01	61,92	13,47
100	55	25	3,00	4,68	23,46	62,67	13,16
100	60	25	2,33	4,44	25,90	63,50	12,82
100	65	25	1,62	4,23	28,33	64,42	12,47
Varied angle of incoming wave (β)							
100	50	15	3,19	3,43	12,47	59,82	8,29
100	50	20	3,64	4,24	16,65	60,75	10,92
100	50	25	3,63	4,94	21,01	61,92	13,47
100	50	30	2,97	5,535	25,67	63,42	15,92
100	50	35	1,30	6,08	30,74	65,44	18,15
100	50	40	-1,96	6,72	36,31	68,26	19,99
100	50	45	-7,73	7,73	42,26	72,15	21,13

Note : The negative value of p shows the presence of accretion

V. APPLICATION FOR THE GROIN PLANNING

The aim of shore protection using groin is to prevent erosion at coastal segment between two groins, where the actual erosion is still happening. Therefore, as the parameter for the planning of groin is the permitted maximum of the erosion.

Erosion can be limited by arranging the distance between groin and the length of groin so that the erosion that happens does not exceed the permitted erosion. For example, with the calculation on table (2) with the permitted erosion of 5 m, for angle of incoming wave of 25° , then distance between groin that can be used is 100 m, with the length of groin 40m, and with this length the sand bypassing at the updrift groin will not happen since the sedimentation is only 14.0 m.

VI CONCLUSION

At the method that is developed, there are the effects of the length of groin and the distance between groins on erosion as well as sedimentation. In addition, this method can also represent the effect of secondary longshore current from Van Rijn [1], so it can be said that this method can predict erosion and sedimentation at the coastal segment between two groins and the geometry static equilibrium condition of its shoreline.

The method that is developed in this research can also be used to conduct initial estimation on the length of groin and the distance between groins, for preliminary study at a planning of coastal protection using groin.

For further development, a research should be done by comparing the equation with the result of physical model.

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Fuzzy Method for in Control Acetaldehyde Generation in Resin Pet in the Process of Packaging Pre-Forms of Plastic Injection

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Abstract—In order to control the drying temperature of the PET resin in the silo of the plastic injection molding machine, during the plastic injection process in the industries producing preforms for the manufacture of beverage bottles, care is taken in the ideal temperature regulation for the better performance in controlling the generation of Acetaldehyde (AA), which alters the taste of carbonated or non-carbonated drinks, providing a citrus nuance to the palate and questioning the quality of the packaged products. The objective of this work is to develop a tool based on Fuzzy logic to support the control of the drying temperature of PET resin, allowing specialists to make the ideal temperature control decisions necessary to control the generation of Acetaldehyde (AA). For the development of the proposed Fuzzy inference model, we used the Matlab Fuzzy toolbox tool, where the input variables, the fuzzyfication rules and the output variable were implemented based on the data collected from the preform injection process. From the inference model, we obtained a more precise management of the variables that influence the generation of AA, estimating a reduction of \$ 240,044.00 in annual costs in the production of preforms.

Keywords— Packaging, Fuzzy Logic, Inference Rules, Computational Intelligence, PET, Acetaldehyde.

I. INTRODUCTION

With the advent of modern life, the search for convenience and better quality of life, have enabled the

increase of research and development of new technologies and raw materials generate new products.

In this context, processes that evolve the manufacture of plastic products have shown a considerable increase (PIRA, 2017).

Regarding the technology used glass as a raw material in the packaging of soft drinks and water. Polyethylene terephthalate (PET) in its bioriented form is the most popular plastic materials to replace glass containers of drinking water, mineral water and carbonated beverages. The resin properties and has some advantages, such as cheaper cost, packaging Lightweight, high mechanical and chemical resistance, versatility of shapes and colors, high barriers to gases, excellent transparency and gloss (ÖZLEM, 2008).

PET or poly (ethylene terephthalate) PET is known worldwide as classified chemically as a semi crystalline polyester polymer belonging to the family, suitable thermoplastic for many applications, particularly in the packaging industry, and particularly in bottles for carbonated beverages. The packaging for this type drinks require special properties, mainly carbon dioxide permeability, PET application come prove their acceptance by the market as a fully recyclable material, is aligned to global trends of economy, energy and environmental protection (GHISOLFI, 2009).

Recent research shows that PET packaging in the world market should reach levels of 21.2 million tons by 2021. In 2015 the PET bottles totaled 16.7 million tons,

representing an increase of about 3, 8% compared with the previous year 2014. In the year 2016 the growth of packaging was around 17.5 million tons, achieved an increase of 4.8%. This growth was due to the development of new products for application in various areas of the canning industry, juices and other functional drinks, forecast the drop in PET resin prices will benefit the consumer market (PIRA, 2017).

The PET bottle is produced in the injection process originally in the preform of the bottle, and during this process the polymers soften with temperature, normally pass through several stages of heating the material, followed by mechanical forming, there are several methods that are used in production of plastic parts as extrusion, injection molding, blow molding, etc. (ROSATO, DONALD, & MATTHEWS, 2004).

They are produced through two processes, injection and blow, depending on the final part application during the process of injection molding, which consists essentially in heating and softening of the material grain in a heated cylinder and its subsequent injection at high pressure to the mold, where it cools and takes final shape (GHISOLFI, 2009).

The entire injection process for obtaining molded parts is divided into five stages: drying (bin), feed, plasticization, injection and extraction of the parts (GHISOLFI, 2009).

PET is a hygroscopic material absorbs environmental water during storage (storage), careful drying is controlled in the PET resin and is an essential operation prior to processing to obtain required levels of drying are required peripherals such as bin (store), drying with desiccants, typically with molecular sieves where the air used for drying of the resin is previously dehumidified, polymers and PET are no exception where the temperature range at the recommended drying, should be between 4 to 6 hours otherwise occurs excessive temperatures can damage the raw material, the temperature of the dry air used for drying should be between 160 ° C - 180 ° C (measured at the dryer outlet) when the dry air temperature must not exceed 190 ° C (GHISOLFI, 2009).

A problem came up and the formation of acetaldehyde during polymerization of the PET resin, typically a polymer produced by a polymerization process in liquid phase followed by solid phase polymerization to provide characteristics appropriate for use in the manufacture of blown containers for various applications. It is a colorless, volatile substance citrus odor is generated at high temperatures (ANJOS, 2007).

This problem is compounded during the injection process of the preform of PET, PET generated when the polymer is exposed to high temperatures normally used

during the injection molding process. When the polymer is heated above the melting temperature, and may generate the AA altering the flavor of the carbonated drink packaged and not aerated (BACH, Dauchy, Chagnon, & Etienne, 2012).

But it is possible to keep the formation of acetaldehyde in PET bottles at low levels during the production process, controlling the critical steps of the injection process. The concern with the specifications required by the packaging quality control, processing conditions to have a bottle with low AA content during processing of PET resin are low-temperature molten resin, low shear rate, low time residence (ÖZLEM, 2008).

Artificial Intelligence (AI) techniques applied in the field of plastic injection process aimed at helping in the decision to select values for the process parameters deducted a qualitative inspection of injection defects. Also aiming at optimizing the process conditions to obtain a specific level of quality.

The development of systems for operations in the injection molding process suggests optimal conditions of control parameters based on IA which is a great degree of relationship in process conditions (CHAVES, Márquez, Pérez, Sánchez, & Vizán, 2018).

The AI in injection molding machines may have an important contribution in the production of plastic parts quality, due to the action of the sensors that monitor variations in the temperature of the grains subject to factors that may come to disqualify the results obtained in injection (LABATI et al., 2016).

This work has as main objective the use of a fuzzy inference model for control of acetaldehyde formation in the plastic injection process of the preform for the production of bottles.

II. LITERATURE REVISION

2.1 The Injection Mold

The injection molding is the most widely used method in the manufacture of plastic products, due to the high efficiency and manufacturability. The molding process includes three stages: filling, cooling and extraction. The first stage begins by filling the mold cavity with the molten polymer in an injection temperature, the polymer melt is packed into the cavity at a higher pressure to compensate for the anticipated shrinkage as the polymer cools (solidifies) in this cooling phase, when the part is sufficiently rigid to be extracted from the mold, care is redoubled because this phase directly affect and especially productivity and quality molding (CHEN, LAM, & LI, 2000).

The injection molding process is a controllable process in the specified limits. The injection molding can be manufactured with a single cavity or a larger number

of similar or dissimilar cavities, the cavities are interconnected through flow channels or runners, which direct the flow of molten plastic material into the cavities.

The manufacturing process of molded parts has five steps: drying, food, lamination, injection and extraction of the product. The cooling time in the manufacturing process, it is important that the injection cycle is from the start of injection until opening the mold for extracting the work piece, this time is associated with the solidification temperature (GHISOLFI, 2009).

The cycle of injection of the preform is performed as follows: mold closing; injection unit of advancement; Injection; Repression; Retreat (machine gun); Dosage; Opening the mold and extraction of the piece. Other processes for the production of PET containers can be made by three methods (GHISOLFI, 2009):

- Injection stretch blow: the preform produced is then reheated and stretched and molded into final packaging. This process is called ISBM (Injection Stretch Blow Molding) - Injection molding, stretching and blowing process of a stage;
- Injection blow: the preform is produced, then reheated and blown to stay in the shape of the final package. This process is called IBM (Injection Blow Molding) injection and blow-molding by.
- Injection: a preform is produced and stored and then forwarded to the area for blowing production of the package.

The injection molding machines meet different quality requirements for specific mold parts such as dry cycle, injection rate and injection pressure (ROSATO et al., 2004). The types of injection molding machines can be identified by their three most popular methods of operation are: hydraulic, electric and hybrid.

It is observed laminating two basic systems, the first is the molding of a single stage system (Figure 1) and the second of two stages (Figure 2). There are also molding units in three stages, etc. This is known as single-stage reciprocating screw injection molding machine. The double stage is the piggyback, which may partially be related more to a continuous extruder (ROSATO et al., 2004).

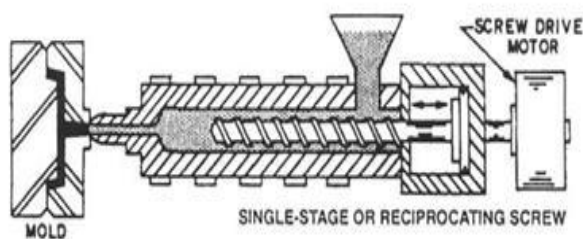


Fig.1: Cannon simple plasticizing injection molding machine.

Source: (ROSATO et al., 2004).

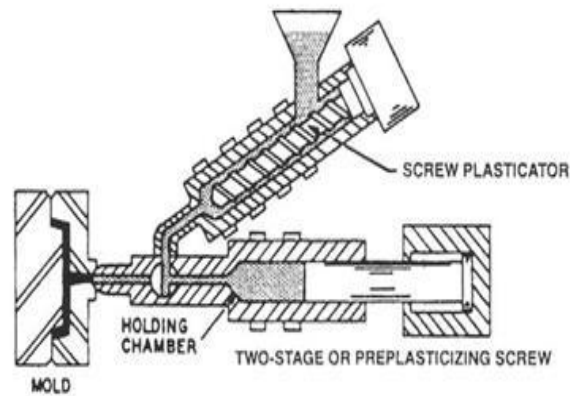


Fig.2: Cannon plasticizer double injection molding machine.

Source: (ROSATO et al., 2004).

One of the important and significant processes of this step is the drying of PET polymer. In solid form PET polymer to be hygroscopic, it absorbs moisture until the equilibrium value with the local relative humidity and high relative humidities in environments can reach up to 0.6% (w / w) by weight if exposed without any protection and weathering for long periods. In practice the polymer is stored indoors, properly packaged and for short periods of time, the humidity value is less may be less than 0.1% (w / w) or less of the weight before entering the polymer melt because it will hydrolyze, reducing the molecular weight and thus the physical properties, chemical and physico-chemical as (BACH et al., 2012).

If the resin is subjected to fusion with these levels of moisture, undergoes rapid degradation (hydrolysis), thereby reducing its molecular weight (Figure 3), which is reflected in the loss of intrinsic viscosity (IV) and consequent loss of its physical properties. To maintain the maximum performance of the PET polymers should reduce its moisture content to below 0.003% (30 ppm) (GHISOLFI, 2009).

The careful and controlled drying of PET resins is an essential operation before processing.

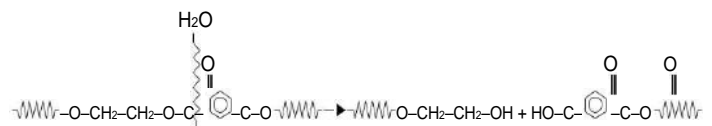


Fig.3: Reaction hydrolytic degradation (hydrolysis) of PET resins.

Source: (GHISOLFI, 2009).

2.2 Acetaldehyde

The (AA) is a colorless volatile liquid substance and pungent odor, non-toxic, with odor and taste typical of fruit, low limit of human perception. AA large quantities are found naturally in many foods such as fruits, butter,

cheese, vegetables and beverages (EWENDER & WELLE, 2008).

The AA is miscible in water and various solvents, which being in diluted concentrations presents citrus fruit aroma. The most common synonyms are ethanol acetaldehyde, acetic aldehyde, acetaldehyde, etilaldeído, and diethyl 1,1 - dietioxiétano, whose molecular structure (Figure 4) (NIJSSEN, KAMPERMAN, & JETTEN, 1996).

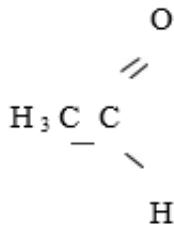


Fig.4: Structural formula of acetaldehyde.

Source:(GHISOLFI, 2009).

2.3 Generation of acetaldehyde in manufacturing the resin

In the production of PET resin, AA is formed during the polymerization stage, which takes place in the melt phase. The amorphous grain obtained at this point may be between 50 ppm and 100 ppm AA as temperatures and residence times used in the process. This resin is post-condensed in the solid state up to a molecular weight suitable for manufacturing bottles. During this step, the AA diffuses out of the grain along with the glycol being driven by process N2. Thus, the AA in PET bottle out of the solid post-condensation step achieves lower residual AA levels of 3-4 ppm, depending on the desired specification for the beverage manufacturer and could reach levels below 1 ppm (GHISOLFI, 2009).

The resin is intended for transformers, which is mainly subjected to injection blow molding process. In this process, the resin is remelted in the injection phase, then taking place again degradation of the resin, thus generating AA (NIJSSEN et al., 1996).

2.4 Generation of acetaldehyde in the molding process

In the resin molding process (PET) the melting temperature is a key control the generation of variable formation of acetaldehyde (AA) is in the process consisting essentially of softening the material in a heated cylinder (ROSATO et al., 2004).

In the production of PET resin for packaging can be produced with low levels of residual acetaldehyde (AA), this waste is generated during melting of the polymer in the injection molding of the preform. Therefore, it is important to control the injection process in which the

polymer is subjected to high temperatures for prolonged periods fusion (EWENDER & WELLE, 2008).

Besides the residence of the fusion temperature, we have to consider other relevant factors which are responsible for acetaldehyde levels found in PET containers as type and formulation of the resin, type of equipment, thread profile design of the barrel of the injection machine and processing conditions (ANJOS, 2007).

Initially only the glass kept this property as required to properly package the carbonated and meet the manufacturer's requirements for packaging these products while maintaining the desired transparency. PET bottles obtained in injection and blowing process, allowed to gather optical properties, mechanical and permeability required for preparation of these carbonated beverages or non- (GHISOLFI, 2009).

The flavors and aromas in beverages groups may be altered by the presence of (AA) from the environment may be, the product itself and / or the packaging material used. From the point of environmental contamination arising view, can be diverse sources such as combustion of wood, coffee roasting, acetic acid and vinyl acetate production from ethylene, among others. The synthesis or the formation in the food itself comes also in different ways, mainly by oxidation of the primary alcohol ethanol or ethyl and fermentation processes for the production of foods and beverages (GHISOLFI, 2009).

Concern about the presence of acetaldehyde in PET packaging is due to the taste change that may cause the packaged product. For example, colas and mineral water in which its flavor is directly affected by the presence of AA. The non-carbonated mineral waters are more sensitive, resulting in a low perception threshold to the taste in the range of 20 ppm to 40 ppm AA, depending on the water composition (EWENDER & WELLE, 2008).

Acetaldehyde is a byproduct of PET degradation, formed when PET polymer is subjected to high temperatures, typically used in manufacturing and processing, when the polymer is heated above the melting temperature and maintained its high residence time (NIJSSEN et al., 1996).

Two mechanisms are proposed for AA formation by thermal decomposition of PET. The first is the thermal decomposition of hydroxyethyl end group (Figure 5), the second considers that degradation occurs preferably by random scission of the molecular chain of the PET with breaking of ester bonds. This degradation chains are formed with acids and vinyl terminal groups that can react in various ways, eliminating AA (Figure 5) (GHISOLFI, 2009).

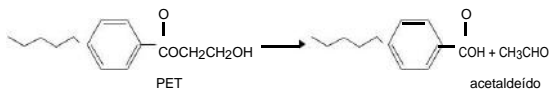


Fig.5: Thermal Degradation of hydroxyethyl end groups.
Source:(GHISOLFI, 2009).

The thermal decomposition of PET (Figure 6) is significant when the polymer is melted (temperature above 245 ° C). Therefore, AA is formed so as to manufacture the resin during processing.

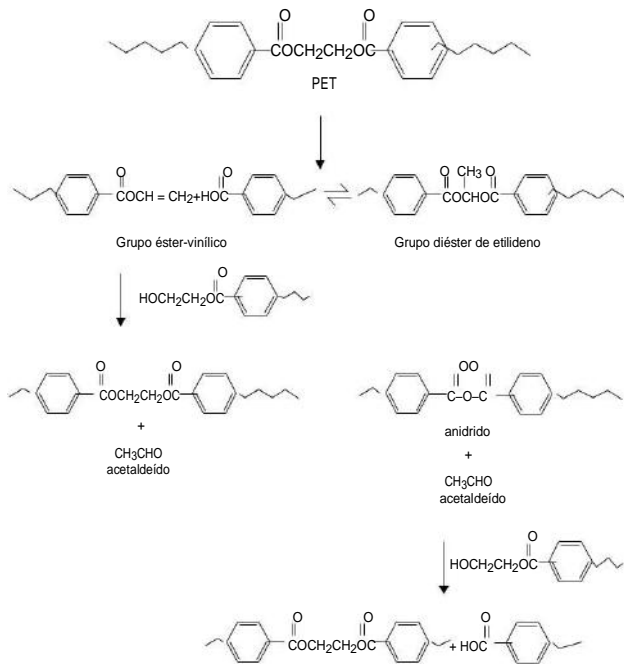


Fig.6: Mechanism of thermal degradation of PET.
Source:(GHISOLFI, 2009).

AA Measurements made in various phases of the injection blow molding process for preforms of bottles, confirm that the major source of AA generation on PET resin transformation process occurs during injection of the preform due to reflow of resin (GHISOLFI, 2009).

AA generated during injection blow the PET is held in the bottle wall between the polymer molecules, spreading slowly to the contents thereof.(EWENDER & WELLE, 2008)

AA generation control in the manufacture of bottles, the AA formed in the bottle depends on(GHISOLFI, 2009):

- Resin Formulation - Aiming at the highest quality grade resins, formulations were developed and process conditions that result in lower residual AA content in the grains.
- Processing Conditions - The general processing conditions for a bottle with low AA content during the processing of PET are: Low temperature molten

resin, low shear rates and short residence times (very long injection times corresponding to increased exposure heat).

AA is generated at significantly elevated temperatures. Thus, control of the injection process is critical to control the AA generation in the production of bottles. On the other hand, the blowing stage has virtually no effect on the formation of AA, since it works at warmer temperatures.

Thus, to reduce the generation of AA from the resin during the injection of the preform, it is advisable to keep the polymer melt in the lowest temperature possible for the minimum time, with minimum shear.

The concentration of AA in the preform increases in proportion to the drying temperature, the barrel and the mold. But only adjust the barrel temperatures and mold channels does not guarantee that the temperature of the molten polyester go stay fit. The viscous melt is also heated by friction with the barrel, the screw and the distribution channels. This friction is much depending on the viscosity of the molten resin as the type and speed of the thread. Besides the heat generated by friction, shear mechanically break the polymer molecules, thereby forming more hydroxyethyl end groups, which, in turn, make more AA (Figure 5)(GHISOLFI, 2009).

Parameters to be controlled to minimize exposure to heat are:

- a) cylinder temperature (decrease).
- b) Temperatures of hot runner nozzles and manifold (lessen).
- c) residence time in the barrel, and hot runner manifold (keep as short as possible).
- d) Residence time of the polymer melt in the process.

A parameter of almost equal importance to the temperature of the molten polymer to minimize the formation of AA in the preform is the residence time thereof. Put simply note that the AA generated is almost directly proportional to the residence time of the melt in the process. Thus, it is a good rule to minimize the cycle time to decrease the generation of AA. Parameters that depend on the machine used: Dimensions of injection channels, the thread profile.

Since low AA concentrations already affecting the organoleptic properties of the mineral waters and colas manufacturing bottles with low AA is essential for the rigid packaging industry. Therefore, it is leading the AA analysis in quality control resins and bottles (EWENDER & WELLE, 2008).

2.5 Fuzzy theory

The fuzzy set theory was developed in 1965, with the work of Lotfi Zadeh, professor at the University of California at Berkeley (Nogueira & Nascimento, 2017).

The theory of fuzzy sets has emerged as a tool to address problems related to information vague, imprecise or ambiguous, often described in natural language - qualitative terms - to be transcribed into numerical language (Nogueira & Nascimento, 2017).

The use of fuzzy theory allows us to model mathematically variables vague and imprecise, provided by knowledgeable people of the study process (BOBILLO & STRACCIA, 2017).

Are many different applications of the theory of fuzzy sets, the further fuzzy control, has been applied in the automation of various areas of production in the industry.

A fuzzy set is a class of objects with a continuum of association notes. This set is characterized by a membership function (feature) that assigns each object a varying degree of association in a numerical range [0, 1] (BOBILLO & STRACCIA, 2017).

The inclusion notions, union intersection, complement, relation, convexity, etc., are extended to these and various properties of these notions in the context of fuzzy sets and are established. In particular, a separation theorem for convex fuzzy sets is proved without requiring fuzzy sets are disjoint (ZADEH, 1965) (Nogueira & Nascimento, 2017).

2.5.1 System Mamdani

In 1975, Mamdani represented one of the first fuzzy systems which applied a set of fuzzy rules provided by experienced human operators to control a combination of the steam engine and boiler (POURJAVAD & MAYORGA, 2017).

The main idea of Mamdani method is to describe the process of states through linguistic variables and use these variables as inputs to control rules; the rules connect the input variables to the output variables and are based on the description of the diffuse state which is obtained by definition of linguistic variables. It is expected that each crisp input (real or n-tuple of real numbers) do match a crisp output and overall system Fuzzy match the each input an output. In this case, a fuzzy system is a function $R_n \rightarrow R$, constructed by a method according to specify modules 3 (Figure 7) (MUÑOS & MIRANDA, 2016).

Fuzzification module: mathematically modeling the information of the input variables by means of fuzzy sets. It is the module that shows the great importance of the skilled process to be examined, every input variable must be assigned linguistic terms that represent the states of this variable and for each linguistic term relevance. The universe of discourse of each variable was determined by the linguistic components "Low", "Medium", "High" and "Low", "Medium", "High" for input and output. It is in this module that stores the variables and their language ratings (LEE, 1990);

Inference module: is which defines the logical connectives used to establish the relationship modeling fuzzy rules base. It is this module that depends on the success of the Fuzzy system as it will provide the output (control) to be adopted by the fuzzy controller from each fuzzy input (ROBLES, Vazquez, Castro, & Castillo, 2016);

Defuzzification module: which reflects the state of the fuzzy output variable to a numeric value.

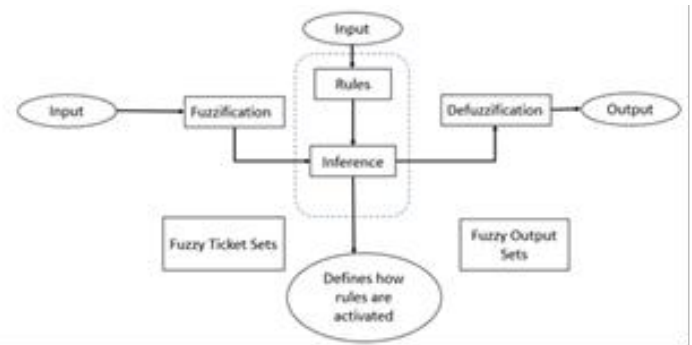


Fig.7: Structure of the fuzzy logic controller.

Source: Adapted from (Nogueira & Nascimento, 2017).

III. MATERIALS AND METHODS

3.1 Data

The data used for this study corresponds to information collected on an industrial hub company Manaus during production by injection preforms PET polymer to be used in its entirety for the manufacture of carbonated beverage containers or not, that process the preform is stored and then delivered to the beverage manufacturer, where the final package for the bottling of the beverage is produced by the blowing process.

All data relating to low linguistic terms, medium and high, fuzzy set and the universe of discourse, where the fuzzy rule-based system is generally derived from the knowledge possessed by an operator or an expert on the functioning of the system (ARIF, Anoraga, Handoyo, & Nasir, 2016).

Data were collected in the quality control sector in packaged preforms in lots of 500 pieces. The Intelligent System was developed as a solution of the injection molding process, which is a complex process with a high number of parameters and variables involved in the process. The only reference to set the appropriate parameters based on certain qualitative characteristics of the produced parts.

The software used to develop this intelligent system was MATLAB R2013a® by enabling management of variables and fuzzy operators, and adapt them to any application without restrictions (CHAVES et al., 2018).

The work took place in two phases, the first characterized by the literature of computational intelligence applications industries processes, and the second occurred with the survey and analysis of control requirements to be used by the proposed fuzzy inference model.

3.2 Applied Methodology Fuzzy Model

The proposed fuzzy model (Figure 8) shows the representation scenery inference system Silo temperature control of the injection molding machine where the expert daily controls the resin drying process, process done manually, in accordance with the information and feedback from inspections of batches produced and analyzed by the quality control department.

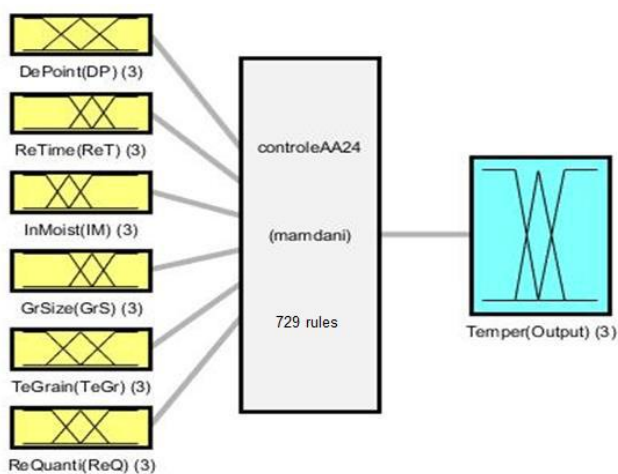


Fig.8: input and output variables of the proposed system.
 Source: Authors (2017).

3.2.1 Misty Variables

The input and output data representing the schematic forms of the fuzzy system, through the amount of data in kilos PET polymer grains, dew point, air flow, residence time in the silo, initial moisture content, grain size, temperature grain and outlet temperature.

Table 1 presents the linguistic variables, as well as linguistic labels defined for all variables, the universe of discourse and its description.

Table.1: Description and results of the linguistic variables.

VARIABLE language	CLOUD Y SET	UNIVER SE OF SPEECH	DESCRIPTI ON
Input Dew point	Low (B)	[10:50]	The lower the dew point of the higher speed air drying, where the drying air
	Medium(M)		
	High (A)		

Residence Time	Low (B)	[12:10]	is greater absorption capacity.
	Ideal (I)		It is time that the PET bead is inside the dryer. To PET should be four to six hours. It depends on the size of the dryer and the resin consumption.
	High (A)		
Initial moisture	Low (B)	[1000: 6000]	The absorption of water by the PET resin occurs until an equilibrium concentration depends on various factors such as time and storage temperature, relative humidity of atmosphere, crystallinity, grain size and shape.
	Ideal (I)		
	High (A)		
Grain size	Low (B)	[12:10]	The smaller the grain size, the higher the equilibrium moisture of the resin. This effect is attributed to the greater surface area to adsorption (for a same amount of sample, the smaller the grain, the greater the total surface area).
	Ideal (I)		
	High (A)		

	Temperature Grain	Low (B)	[12:45]	All polymers have a suggested drying temperature range. A long drying time and extreme temperatures can damage the material.
		Ideal (I)		
		High (A)		
	Resin Quantity	Low (B)	[450: 550]	PET polymer in the silo count should not exceed the consumer PET which the machine produces in 1 hour.
		Medium (M)		
		High (A)		
Output	Temperature	Low (B)	[155: 190]	Maintain the effective temperature of grains between 160 ° C - 180 ° C (measured at the dryer outlet);
		Ideal (I)		
		High (A)		

Source: Authors (2017).

Descriptions of the variables of the proposed system are: Low, Medium and High.

Variables Inputs:

The Amount of PET Resin - the amount of PET resin in the dryer silo consumption must not exceed the machine continuously produces in 1 hour, 500 Kg / h (Figure 9).

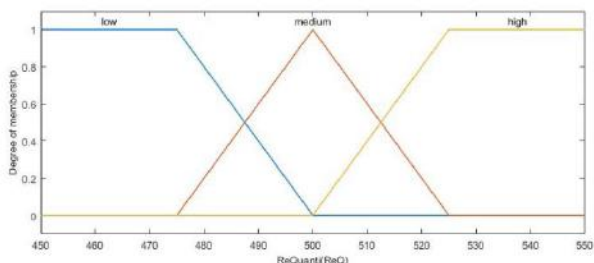


Figure 9: Changeable Amount of resin.
 Source: Authors (2017).

Grain dew point - the lower the dew point of the air, the greater the rate of drying, where the drying air is greater absorption capacity (Figure 10).

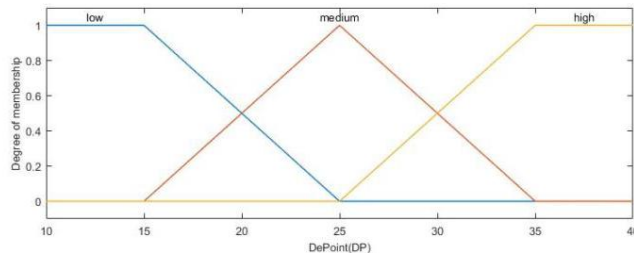


Fig.10: Variable Dew Point.
 Source: Authors (2017).

Residence time of matter- the residence time of the raw material in the silo is the time that the PET resin is inside the dryer silo. For PET, must be four to six hours (Figure 11).

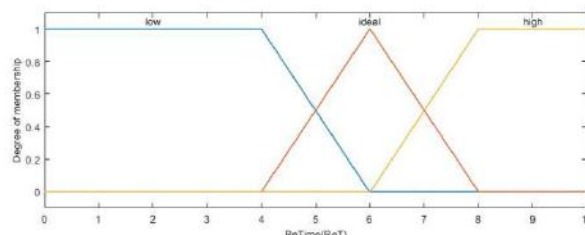


Fig.11: Variable Residence Time.
 Source: Authors (2017).

The Initial Moisture of the grains- should not exceed 3.000ppm (0.3%) prior to fusion. PET resin by water absorption occurs until an equilibrium concentration depends on various factors such as storage temperature and time, so it is recommended careful storage in cool environments and covered (Figure 12).

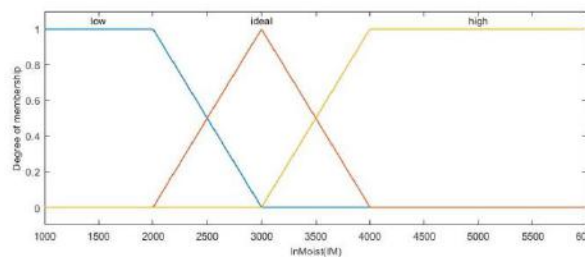


Fig.12: Changeable Initial moisture.
 Source: Authors (2017).

Grain Size- the smaller the grain size, the higher the equilibrium moisture of the resin. This effect is attributed to the greater surface area to adsorption (for a same amount of sample, the smaller the grain, the greater the total surface area), this hypothesis is supported by the equilibrium moisture results obtained by PET resin (Figure 13).

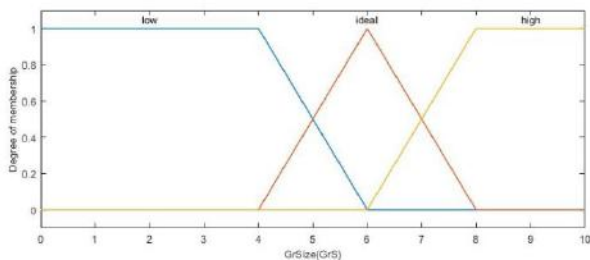


Fig.13: Variable Size grains.

Source: Authors (2017).

Temperature Grain- water absorption resin, should keep in storage the resin at 25 ° C ambient temperature, with temperatures controlled in the manufacturing areas. (Figure 14).

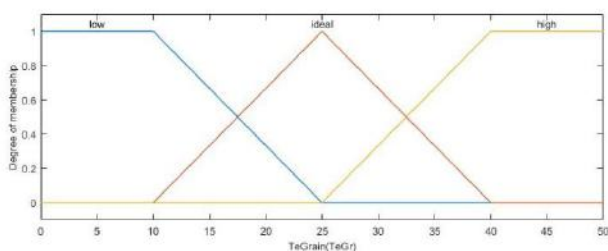


Fig.14: Variable Temperature Grain.

Source: Authors (2017).

Output:

Temperature Control in bin - corresponds to the effective temperature of grains between 160 ° C - 180 ° C (measured at the dryer outlet), if correct change in acetaldehyde content (Figure 15).

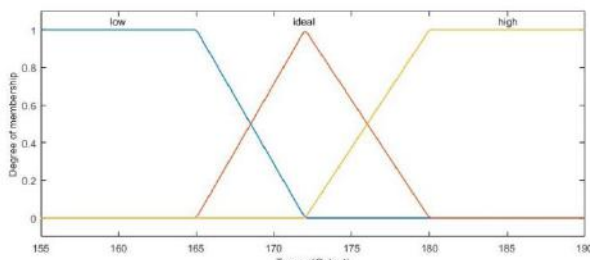


Fig.15: Variable Temperature out.

Source: Authors (2017).

3.2.2 Rule Base

Through the knowledge of experts were obtained the information necessary to create the consistency of the rule base.

To answer the problem posed were created major Inference Rules Bases of linguistic variables resulting in 729 combinations, applied in this fuzzy solution, where part of it is shown in Figure 16, the construction of a fuzzy rule system also should check out no unnecessary rules and which can be removed from the system.

1. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is low) and (GrSize(GrS) is low) and (TeGrain(TeGr) is low) and (InMoist(M) is ideal) and (ReTime(ReT) is ideal) and (GrSize(GrS) is ideal) and (TeGrain(TeGr) is ideal) and (DePoint(DP) is low) and (ReTime(ReT) is high) and (InMoist(M) is high) and (GrSize(GrS) is high) and (TeGrain(TeGr) is high)
2. If (DePoint(DP) is low) and (ReTime(ReT) is ideal) and (InMoist(M) is ideal) and (GrSize(GrS) is low) and (TeGrain(TeGr) is ideal)
3. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is ideal) and (GrSize(GrS) is low) and (TeGrain(TeGr) is ideal)
4. If (DePoint(DP) is low) and (ReTime(ReT) is ideal) and (InMoist(M) is low) and (GrSize(GrS) is ideal) and (TeGrain(TeGr) is low)
5. If (DePoint(DP) is low) and (ReTime(ReT) is high) and (InMoist(M) is low) and (GrSize(GrS) is low) and (TeGrain(TeGr) is low)
6. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is ideal) and (GrSize(GrS) is high) and (TeGrain(TeGr) is low)
7. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is ideal) and (GrSize(GrS) is high) and (TeGrain(TeGr) is low)
8. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is high) and (GrSize(GrS) is low) and (TeGrain(TeGr) is high)
9. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is low) and (GrSize(GrS) is ideal) and (TeGrain(TeGr) is low)
10. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is low) and (GrSize(GrS) is low) and (TeGrain(TeGr) is ideal)
11. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is low) and (GrSize(GrS) is low) and (TeGrain(TeGr) is low)
12. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is ideal) and (GrSize(GrS) is ideal) and (TeGrain(TeGr) is ideal)
13. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is high) and (GrSize(GrS) is high) and (TeGrain(TeGr) is high)
14. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is low) and (GrSize(GrS) is high) and (TeGrain(TeGr) is high)
15. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is low) and (GrSize(GrS) is low) and (TeGrain(TeGr) is high)
16. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is low) and (GrSize(GrS) is low) and (TeGrain(TeGr) is low)
17. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is ideal) and (GrSize(GrS) is low) and (TeGrain(TeGr) is low)
18. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is low) and (GrSize(GrS) is ideal) and (TeGrain(TeGr) is low)
19. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is low) and (GrSize(GrS) is low) and (TeGrain(TeGr) is ideal)
20. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is low) and (GrSize(GrS) is low) and (TeGrain(TeGr) is low)
21. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is high) and (GrSize(GrS) is ideal) and (TeGrain(TeGr) is low)
22. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is high) and (GrSize(GrS) is low) and (TeGrain(TeGr) is low)
23. If (DePoint(DP) is low) and (ReTime(ReT) is ideal) and (InMoist(M) is high) and (GrSize(GrS) is low) and (TeGrain(TeGr) is ideal)
24. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is low) and (GrSize(GrS) is ideal) and (TeGrain(TeGr) is ideal)
25. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is low) and (GrSize(GrS) is high) and (TeGrain(TeGr) is high)
26. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is low) and (GrSize(GrS) is low) and (TeGrain(TeGr) is ideal)
27. If (DePoint(DP) is low) and (ReTime(ReT) is low) and (InMoist(M) is low) and (GrSize(GrS) is low) and (TeGrain(TeGr) is high)

Fig.16. Inference rules of linguistic variables.

Source: Authors (2017)

3.2.3 System Parameters

To perform system controls was used R2013a® MATLAB tool that used the Fuzzy Logic Toolbox and Table 2 shows the summary of system parameters on the use of this tool.

Table.2: Summary of system parameters.

TYPE	"Mamdani"	The response of the process is a fuzzy set for each rule.
METHOD	'Min'	Used to be the connector system rules.
DEFUZZYMET HOD	'Centroid'	Being adherent and computationally simple.
INPUT:	[Strut 1x6]	6 input variables
OUTPUT:	[Strut 1x1]	One output variable
RULE	[Strut 36]	729 rules in total

Source: Authors (2017).

In the literature appear several Fuzzy numbers, the most common are triangular, trapezoidal and bell-shaped. Among them, the best fit to the proposed model was the triangular and trapezoidal, since it works the averages centered on a given range, whose extreme values are related to the mean and standard deviation functions.

IV. RESULTS AND DISCUSSIONS

After inspection of a sample of the produced batches are considered failed lots whose Acetaldehyde indices have up to 4 ppm values as specified in the standard for the

beverage manufacturer, this information is passed on to technical production which thereafter alter the adjusting the polymer drying silo temperature.

A simulation with use of real situations of arguments where the model can evaluate the linguistic variables of predefined input generating information to support the expert decision in controlling the optimum temperature of the silo during the manufacturing process of the preform was held. Table 3 shows an example of results of the proposed fuzzy inference model.

Table.3: Simulation of the proposed fuzzy inference model.

D.P.	R.T.	LM	G.S.	Te.Gr.	Qt.Rs.	Output
10	3	1000	1	9.5	450	161
45	9	4500	9.0	40	545	161
50	10	5000	10.0	45	550	161
15	4.5	1500	2.5	10	470	162
40	8	4000	8.5	35	540	167
20	4.0	1700	3	15	490	168
35	6	2500	6	25	520	172
25	5.5	2000	4	20	510	173
30	5	3500	5	22.5	500	173
35.5	7	3000	7.5	30	530	173

Source: Authors (2017).

In Table 3, it is seen that the output values are within the limits silo temperature tolerance for non-generation of acetaldehyde in order to evaluate the appropriate values of the input variables, which result in the drying process of PET resin. And allowing the specialist on better regulation of temperature.

By varying the input values is possible to assess the outputs by the proposed system, obtaining a value that allows support in decision-making with respect to the silo temperature control, there is the following situation for example, if the dew point is -35°C , the residence time is 6 hours, initial moisture content is 2500ppm (0.25%), 6mm^2 the grain size, grain temperature is 25°C and the amount of resin is $520\text{kg} / \text{h.}$, then the result will be the 172°C temperature, as shown in simulation performed and observed in Figure 17.

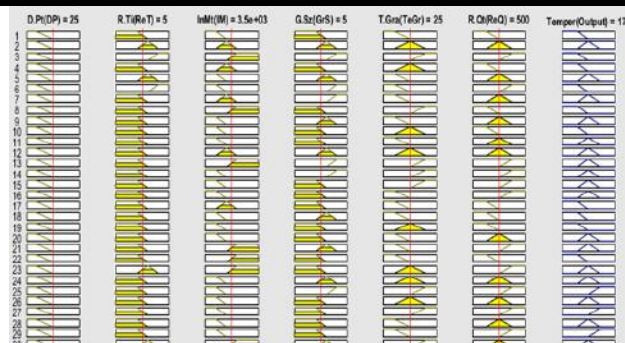


Fig.17: Results shown from inferences.

Source: Authors (2017).

In the graph of Figure 18 has the development performance of the outlet temperatures from the values of the input linguistic variables, where the optimal temperature for the non-generation of acetaldehyde, and not affect the degree of crystallization of the packaging, no loss the intrinsic viscosity of the resin and loss of physicochemical and mechanical functions, that are on average 172°C

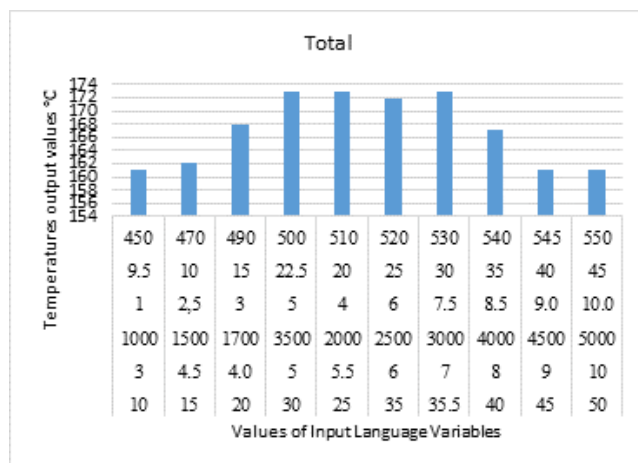


Fig.18: Evolution of the temperature performance.

Source: Authors (2017).

In Figure 19, we note that the residence time of the resin in the injection molding machine-drying silo must not exceed 6 hours and the amount of resin should not exceed 480 kg, approximately.

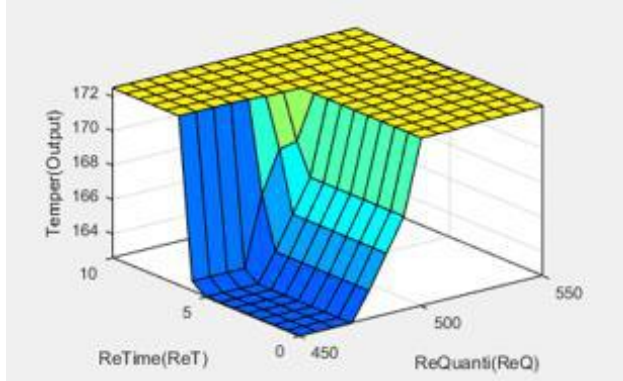


Fig.19: Graph of linguistic variable residence time.

Source: Authors (2017).

Figure 20 shows the optimum temperature of the grain should be maintained between 20 to 25 ° C for a resin amount not exceeding 480 kg, approximately.

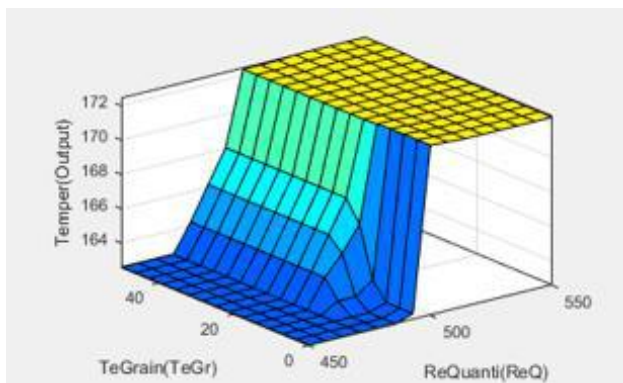


Fig.20: Graph of linguistic variable temperature.

Source: Authors (2017).

V. CONCLUSION

This study presented a method for application of fuzzy drying silo temperature control of the injection molding machine PET polymer. The used model input parameters preset by the resin manufacturers.

The results showed that, in general, the proposed inference model enabled, from the input information, determine ideal temperature of the silo for the production of preforms is carried out within the quality standards required by the beverage manufacturer, ie, with acetaldehyde content below 4ppm. Based on these results, it can be said that the fuzzy inference model proposed, can be considered as an important classification tool temperature control, showing that the Fuzzy method is a promising tool for this classification, it is suggested search Fuzzy an interconnection system controls the injection molding machine so that a synchronized control is carried out with temperature control sensors, being a fully automatic system,

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Design and Fabrication of Little gourd cutter

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Abstract— Plywood base was used as a platform to place the entire equipment. Stainless steel blade was attached to the shaft of motor of 240V which acts as cutting unit. Stainless steel cylinder with supporting iron rod is used for feeding little gourds. A rectangular frame made up of metallic stands was used as main frame and supporting main units. A collection tray made up of metal sheet was used for collection of slices.

Moisture content of little gourds was 85%. The dimensions of little gourds were measured using digital Vernier callipers and weight of each little gourd was measured using electronic weighing balance. Average length and diameter of little gourds were found to be 17.93mm and 18.88mm respectively. The other parameters like Sphericity, roundness, cylindrical and elliptical were found to be 0.14cm, 3.73cm², 19.87cm³ and 0.89cm⁻³ respectively. Average weight of the little gourds were found to be 16.5g. The surface area and bulk density of little gourds were found to be 180.6 sq.cm and 500 kg/m³. Performance evaluation of little gourd cutter was performed where slicing operation was performed at different motor speeds and voltages. High motor speed with voltage of 240V gave slices of 0.75mm which were suitable for household consumption.

Keywords— gourd cutter, Plywood, *Coccinia grandis*.

I. INTRODUCTION

Coccinia grandis, the little gourd is popularly known as scarlet gourd, ivy gourd, baby watermelon and kowai. It is a tropical vine belonging to the family of Cucurbitaceae. It prevents kidney stones, fatigue and protects the nervous system. It maintains healthy metabolism and the fiber present in the little gourd keeps the digestive tract healthy. Little gourd is widely used for medicinal and anti-oxidant properties. It is used in Ayurvedic formulation for centuries as an immunity defender and anti-triglyceride agent. It acts as a medicine to cure bronchitis, asthma, jaundice, leprosy, etc. It is a strong

source of carbohydrates, proteins, fiber, calcium, potassium and iron.

The little gourd plant is a native plant in Asia and Africa. It grows naturally in many areas such as India, Philippines, Myanmar, and Thailand etc. In India, the little gourd has been mostly consumed as a curry, by deep-frying it along with spices, stuffing it with *masala* and sauteing it, or boiling in a pressure cooker followed by frying. They are best when cooked, and are often compared to bitter melon. In Thai cuisine, it is one of the ingredients of the very popular clear soup dish *kaeng jued tum lueng* and *kaeng lieng* curry.

Little gourd is featured with the ability of detoxification and it acts as ideal in cleaning human blood. Little gourd has the anti-bacterial properties but also the pain killing and anti-ulcer properties. The plant of this vegetable is used to control high fever and bowel problems. People suffering with high cholesterol levels are suggested to take the little gourd along with their diet in order to hold it in control.

As the little gourds are small in size, it is difficult for cutting in short time. Mostly little gourds are processed by manual cutting which is common in hostels, educational institutions, catering services and in restaurants. For small scale production, a household and user-friendly cutter is required.

The existing vegetable cutting machines in market are automatic, which operates on the concept of rotating grid which are not specific for little gourd and costs nearly about 1.5-5 lakh. For a middle-level business like catering services, hotels, it is a high investment.

Considering the size and shape of the little gourd, it is difficult to cut through vegetable cutters. There is a need to design a model for easing the work load, which minimize the cost of equipment and suit for cutting little gourd. In this connection an attempt was made to design a medium size little gourd cutter to cut little gourd into pre-defined size and make it semi-automatic with following objectives:

1. Design a semi-automatic little gourd cutter for medium sized little gourds
2. Performance evaluation of design to assess its suitability for small scale industries
3. Cost estimation of little gourd cutter

The proposed development of a little gourd cutter could alleviate the problems faced by manual cutting. The machine will be reducing the time of cutting of little gourd.

II. MATERIALS AND METHODS

Materials used were medium sized little gourd, stainless steel cylinder for feeding, blades for cutting, motor and belt driven pulleys, iron angular rods for making stands (shaft holding and tray holding), plywood for base, metal sheet for design of collection tray, variable voltage transformer. These materials were procured from local hardware shop of Bapatla and developed in local workshop.

Fresh little gourds of medium size were procured from vegetable market of Bapatla, Guntur dist., A.P. Little Gourds procured were graded and thoroughly washed and preserved in cool dry place to avoid pest attack.

Moisture content of little gourd slices was measured by hot air oven method. One sample of little gourd slices, 10 g was taken into moisture box and placed in hot air oven (Yorco, Model: YSI-431) at 100-105°C with lid open until constant weights were obtained and then cooled in a desiccator with closed lid for 15 min. weight of the sample was taken when weight remained constant (AOAC, 2000). And calculated by using formula

$$MC = \frac{\text{Initial Weight of Sample} - \text{Final weight of sample}}{\text{Initial weight}} \times 100$$

Dimensions of little gourd were useful in designing cutting machine as size affects the cylinder diameter, design characteristics and knife orientation. These are important properties to describe an object satisfactorily. Size is the measurement of dimensions while shape is the rigid form of the body. The dimensional characteristics of the material are called size. Five little gourds were randomly selected and the two principal dimensions (length and diameter) of little gourds were measured using digital Vernier calipers with an accuracy of 0.1mm (Mitutoyo, Model CD-6''CSX).

The Sphericity, cylindrical, roundness, elliptical shape of little gourd were calculated using the following formulae.

$$\text{Sphericity} = \frac{D_i}{D_c}$$

$$\text{Roundness} = \frac{4\pi r^2}{3}$$

$$\text{Cylindrical, } V = \pi r^2 h$$

$$\text{Elliptical} = \frac{4\pi}{3ab^2}$$

Where,

D_i = diameter of largest inscribed circle

D_c = diameter of smallest circumscribed circle

r = radius i.e., half of the diameter of largest inscribed circle

h = height of the little gourd

a = diameter of the largest inscribed circle,

b = diameter of the smallest circumscribed circle

Weight of little gourd and little gourd slices were measured using electronic weighing balance (Ohaus, PAG213) with an accuracy of 0.001g. The doors of weighing balance were closed, and sample weight was measured.

Surface area was calculated by measuring the weight of little gourd using electronic weighing balance. Surface area was given by the formula (Reference: Physical properties of biological materials by O.P.SINGHAL and D.V.K.SAMUEL). The values obtained were converted into 'm²'

$$\text{Surface area, } S = 4.82W^{0.66}$$

Where,

S = Surface area in sq. m

W = weight, in g

Little gourds were placed in a beaker of known volume and the weight of little gourd that fit into the beaker was taken. Bulk density of little gourd was calculated using the formula:

$$\text{Bulk Density} = \text{Mass (kg)} / \text{Volume (m}^3\text{)}$$

III. MATERIALS USED IN FABRICATION OF LITTLE GOURD CUTTER

Semi-automatic little gourd cutter consists of stainless steel blades for cutting, a hollow stainless-steel pipe for feeding, motor with DC electric source. Motor is attached to a shaft with a belt driven pulley. The blade is fixed to the shaft positioned inside two ball bearings resting on frame. The shaft gets the drive from motor with pulley and V-belt attached to shaft. A stainless-steel tray is used for collection of slices which is placed under the cutting blades with angle iron support. Variable voltage transformer was used to regulate RPM of shaft.

The two types of blades made up of stainless steel are used to cut the vegetables. One type of blade consists of one cutting edge where as another type consists of two cutting edges on either sides. The primary cutting edge of blade is close to the standard circular arc, with an angle 22°C which is helpful in improving the cutting efficiency of machine. The blade is fixed to the shaft placed inside two ball bearings resting on frame, which is beside the feeding pipe. The performance of cutting tool mainly depends on

the geometry of cutting blade, physical properties and the operating conditions (such as speed and thickness).

A stainless steel pipe is used to feed the vegetables. It is horizontal to the plane of base. It is placed exactly at 90° to the cutting blade with the help of iron rod which is at a height of 15cm from the base. The cylinder is formed into semi-circular shape to make feeding convenient to the user. The length of the stainless steel cylinder is 30cm and the diameter is 2.5cm. The cylinder is shaped into semicircle which is of length 25cm and the 5cm is remain as circular shape to avoid outflow of vegetables.

Metallic stands of thickness 2.1cm are used to place the driving mechanism of shaft and to hold the tray.

Dimensions of metallic stand used to place the shaft: Length = 27cm, Height = 20cm, Width = 12.5cm

Dimensions of metallic stands used for holding the tray: Length = 30cm, Height = 5cm

The shaft with length of 15cm and diameter of 2.5cm is placed on metallic stand with the help of two ball bearings. The shaft gets the drive from motor with pulley and V-belt attached to shaft.

A motor capacity of 240V with varied rpm is placed in the corner of the base with DC electric source. The key shaft of length 5cm is connected to the motor to attach the pulley. The pulley rotates through the shaft with the help of belt driven mechanism.

A Variable voltage Transformer is used to control the RPM of motor by regulating the voltage. It is simple to operate and controls are available for automatic adjustment to maintain "constant" (regulated) voltage output.

A metal sheet with length 50cm, width 40cm and thickness 2.2cm was bent at an angle of 90° and at a length and width of 10cm on four sides to make a collection tray. The volume of collection tray was 6000cm^3 .

Dimensions of collection tray: Length = 30cm, Width = 20cm, Thickness = 2.2cm

IV. FABRICATION OF MACHINE

Little gourd cutter consists of four units: platform and main frame, feeding mechanism, blade mechanism, collection mechanism.

A plywood of dimensions $55 \times 55\text{cm}$ and thickness 1.5cm is used as a platform to place the whole equipment. The main frame includes motor, pulley, shaft and bearing. A motor of capacity of 240V is placed at a distance of 18cm from the corner and the key shaft of length 5cm is connected to the motor shaft to attach the pulley. A variable voltage transformer is used to control the RPM of the motor. The shaft of length 15cm and diameter 2.5cm is

placed on rectangular frame made up of metallic stands of length 27cm, height 20cm and width 12.5cm at a distance of 5.5cm from both sides. The shaft gets the drive from motor with pulley and V-belt attached to shaft. A rectangular frame (made up of metallic stands of length 27cm, height 20cm and width 12.5cm) is placed at a distance of 26.5cm from one side and 13 cm from another side of the corner and is used to place the shaft and feeder. One side of shaft is facilitated to hold and give drive for the blade whereas other side of the shaft is to hold the pulley. The pulley of length 30cm rotates through the shaft with the help of belt driven mechanism. Two ball bearings are used to hold the shaft and is placed on the rectangular frame at a distance of 4cm from shaft (both sides).

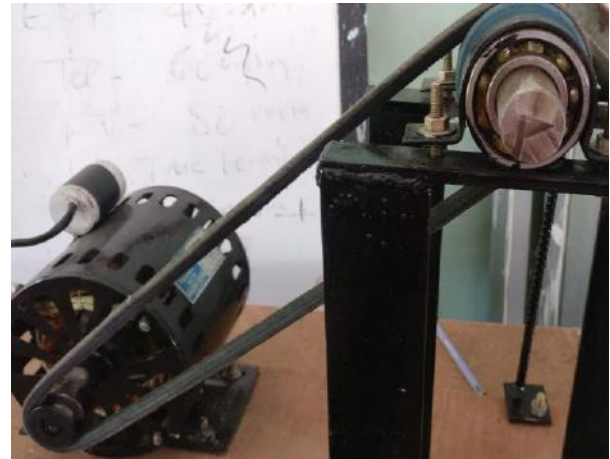


Fig.1: Main Frame

The feeding mechanism consists of a stainless steel pipe of length 30cm and diameter 2.5cm used as a feeder which is horizontal to the plane of base. The feeder is placed on a rectangular frame at a distance of 4cm from the shaft with the help of iron rod at height of 26cm from the base. The feeding pipe is made into a shape of semicircle at the length of 25cm and 5 cm was remained as a circular shape. This provision is made to allow easy flow of vegetables from feeder to the blade.

The blade mechanism consists of two types of blades made up of stainless steel are used to cut the little gourd. One type of blade consists of one cutting edge where as another type consists of two cutting edges. The primary cutting edge of blade is close to the standard circular arc, which is helpful in improving the cutting efficiency of machine. The blade is fixed to a hollow ring and shaft placed inside two ball bearings resting on frame, which is beside the feeding pipe. The performance of cutting tool mainly depends on the geometry of cutting blade, physical

properties and the operating conditions (such as speed and thickness).

The collection tray is made up of metal sheet with length 50cm, width 40cm and thickness 2.2cm was bent at an angle of 90° and at a length and width of 10cm on four sides to make a collection tray of length 30cm, breadth 20cm and height 10cm is placed on metallic stands of length 30cm at height of 5cm from the base and is at a distance of 25.5cm and 11.6cm from either sides of the base. The collection tray is placed under the blades which is at a distance of 7cm from the blade. A provision is made in order to prevent the overflow of slices. A metal sheet of length 20cm and height 8cm is placed at the back side of the blade section on the rectangular frame which is at a distance of 5cm from the blade and the three square shaped fiber sheets of dimensions 15×15cm and thickness of 0.5 cm are placed on front side and on either sides of the blade at a distance of 5cm from either sides of the blade and at a height of 2cm from the collection tray. This provision allows flow of slices directly into the collection tray. It prevents slipping of slices off the collection tray.

Performance evaluation of machine

Fabricated little gourd cutter was run at varied voltage and varied rpm of shaft and different moisture content. The slice thickness and time for each operation was noted which would conclude the needed speed for perfect slice thickness.

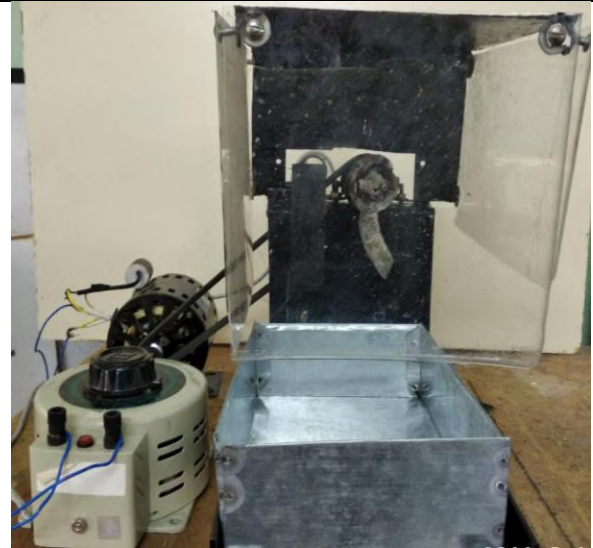


Fig.3: Little gourd cutter (Front view)

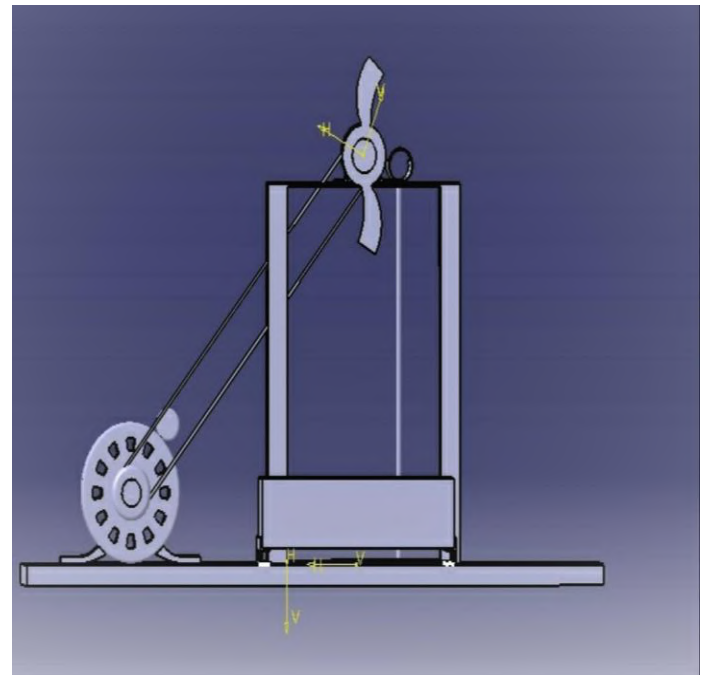


Fig.4: AutoCAD of little gourd cutter (Front view)



Fig.2: Little gourd cutter (Side view)

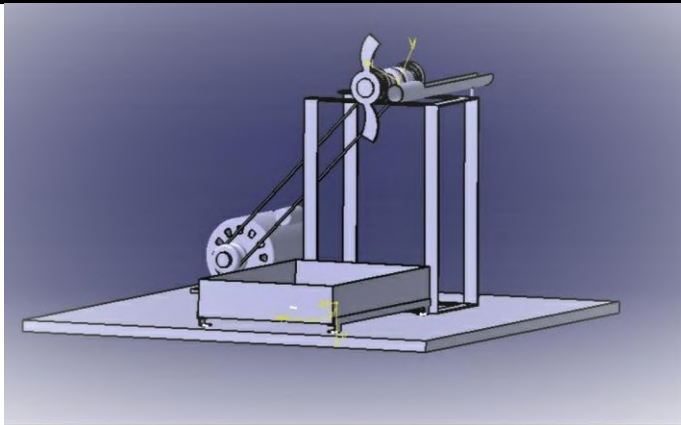


Fig.5: AutoCAD of little gourd cutter (Isometric view)

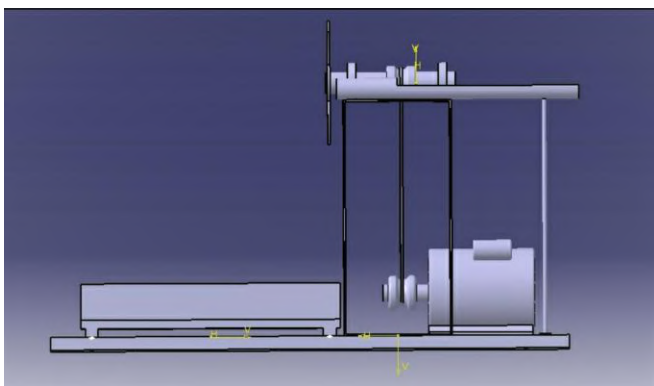


Fig.6: AutoCAD of little gourd cutter (side view)

V. RESULTS AND DISCUSSION

Moisture content of little gourds was 85%. The dimensions of little gourds were measured using digital Vernier calipers and weight of each little gourd was measured using electronic balance. Average length and diameter of little gourds were found to be 17.93mm and 18.88mm respectively.

The other parameters like Sphericity, roundness, cylindrical and elliptical were found to be 0.14cm, 3.73cm², 19.87cm³ and 0.89cm³ respectively. Average weight of the little gourds were found to be 16.5g. The surface area and bulk density of little gourds were found to be 180.6 sq.cm and 500 kg/m³.

Performance evaluation of little gourd cutter

Feed of little gourds in stainless steel cylinder was run at varied motor speeds like high (680rpm), medium (550rpm) and low (450rpm) and varied voltages of 160V, 150V and 140 V and slice thickness. At that particular motor speed triplicates of slice thickness values were taken and average thickness was calculated.

Table.1: Slice thickness at varied voltage and shaft speed

S.no	Voltage (V)	Shaft speed(rpm)	Slice thickness	Mean
1.	160 V	680	a. 3.7 b. 3.6 c. 3.8	3.7
2.	150 V	550	a. 4.9 b. 4.3 c. 4.8	4.3
3.	140 V	450	a. 4.9 b.5.2 c.5.1	5.1

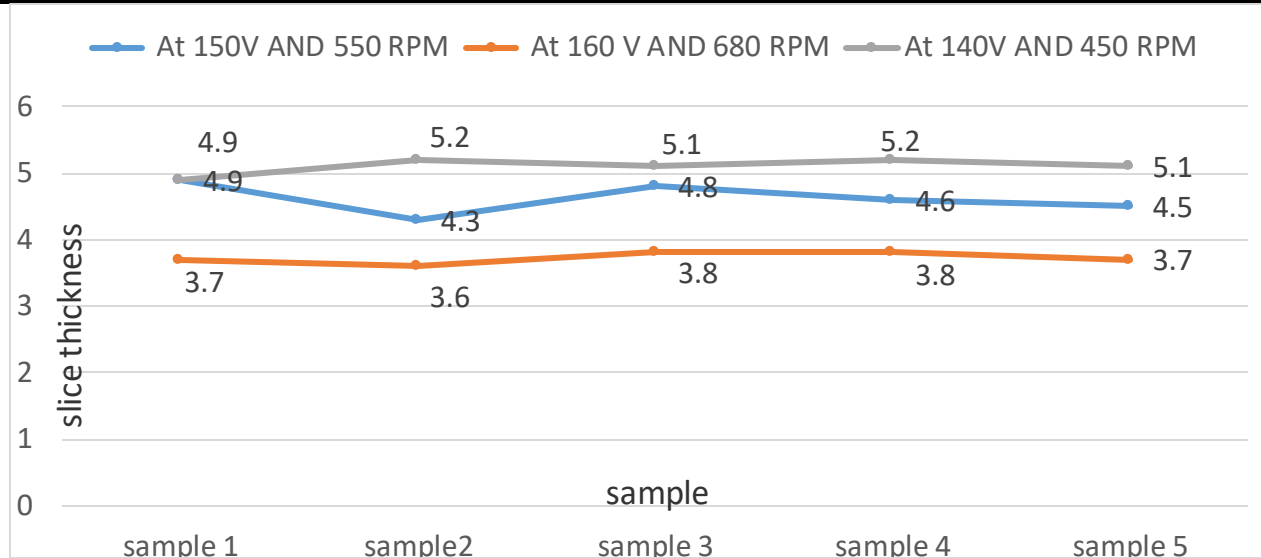


Fig.7: Slice thickness at varied voltage and motor speed

From the fig, it was observed that at a voltage 160 V AND 680 RPM slice thickness is 3.7 and are small when compared to other speeds and voltage. Both 150 V and 140 V yielded slices of thickness 4.3 and 5.1 respectively.



At 160 V

At 150 V

At 140 V

Fig.8: Slices chopped at different voltage

Performance evaluation of cutter at different moisture contents:

Performance evaluation of little gourd cutter at different moisture content of little gourd was done at optimum voltage and thickness. From the above graph we observe optimum and uniform slice thickness is observed at 160 V and 680 RPM. The moisture content was decreased by using hot air oven drying method.

Slice thickness at 160 V and at a moisture content 80%

Little gourds were brought to a moisture content 80% by drying in hot air oven for 30 min. Little gourds with moisture content 80% were fed into the machine and blade was rotated at varied motor speeds of 680 rpm. At that particular motor speed triplicates of slice thickness values were taken and average thickness was calculated.

Table.2: Slice thickness at voltage 160 V and moisture content 80%

S.no	Voltage (V)	Shaft speed(rpm)	Slice thickness	Mean
1.	160 V	680	a. 2.31 b. 1.93 c. 1.29	1.83

Slice thickness at 160 V and at a moisture content 70%

Little gourd were brought to a moisture content 70% by drying in hot air oven for 1hr. Little gourds with moisture content 70% were fed into the machine and blade was rotated at varied motor speeds of 680 rpm. At that particular motor speed triplicates of slice thickness values were taken and average thickness was calculated.

Table.3: Slice thickness at voltage 160 V and moisture content 70%

S.no	Voltage (V)	Shaft speed(rpm)	Slice thickness	Mean
1.	150 V	550	a. 1.84 b. 1.32 c. 1.41	1.52

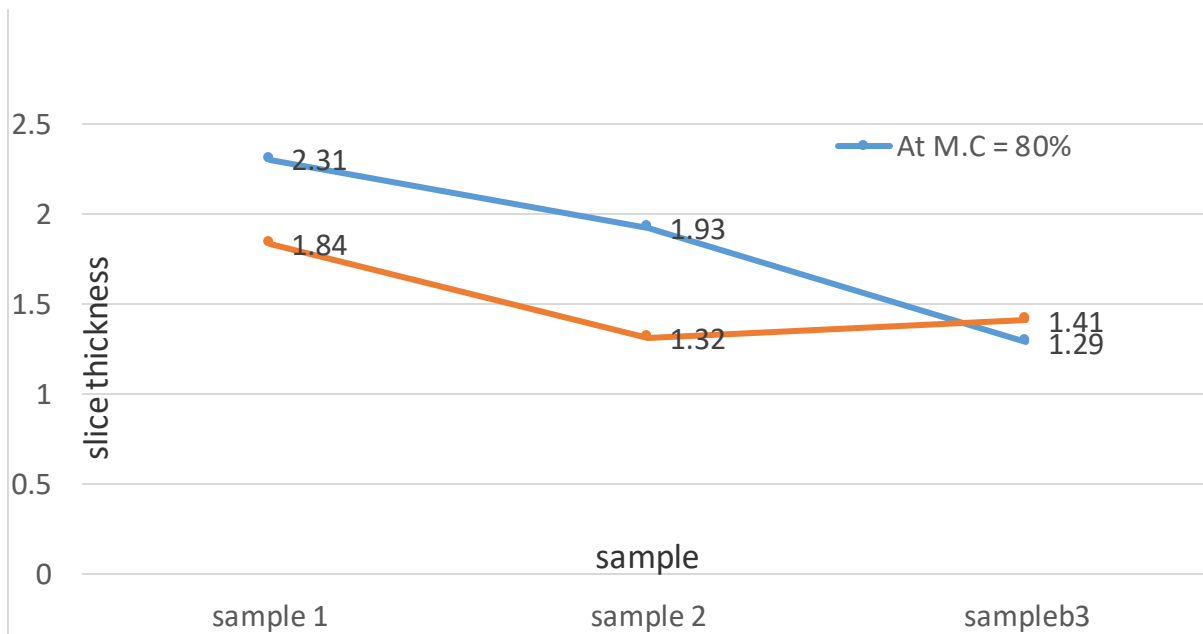


Fig.9: Slice thickness at a voltage 160 V and different moisture content

From the fig, it was observed that as the moisture content decreases slice thickness also decreases

Cost evaluation of little gourd cutter:

Approximate Cost of cutter was ₹ 2,990/-.

The cost of each material was given in the **table 4**

Table.4: Cost of little gourd cutter

Materials	Cost (In Rs)
Motor	1000
Metal rods	200
Stainless steel pipe	120
Pulley	300
Bearings	100
Plywood Base	120

Belt	30
Blade	250
Shaft	160
Collecting tray	150
Workmen	200
Welding and threading charges	300
Total	2,990/-

Cost to run little gourd cutter

Equipment was run for 8 hrs in a day and about 120kg of little gourd was chopped and the power consumption was 2 units per hour and price was Rs. 5/unit. Then the cost incurred for cutting for 1hr is given in the **table 5**

Table.5: Cost for little gourd cutting for 1 hour

Expenses	Cost for 1 day (In Rs.)	Cost for 1 hr. (In Rs.)	Cost for 1 kg (In Rs.)
Workmen	350	43.75	1.75
Power	80	10	0.4
Total	490/-	55.75/-	2.15/-

The capacity of machine is 15 kg/hr when little gourd are fed continuously in the feeding barrel and the cost incurred for cutting 1 kg little gourd is ₹ 2.15/-.

VI. SUMMARY AND CONCLUSIONS

Moisture content of little gourds was 85%. The dimensions of little gourds were measured using digital Vernier callipers and weight of each little gourd was measured using electronic balance. Average length and diameter of little gourds were found to be 17.93mm and 18.88mm respectively. The other parameters like Sphericity, roundness, cylindrical and elliptical were found to be 0.14cm, 3.73cm², 19.87cm³ and 0.89cm³ respectively. Average weight of the little gourds were found to be 16.5g. The surface area and bulk density of little gourds were found to be 180.6 sq.cm and 500 kg/m³. Performance evaluation of little gourd cutter was performed where slicing operation was performed at different shaft speeds and voltages and at different moisture contents. High shaft speed with voltage of 160V at gave slices of 3.7mm which were suitable for household consumption. We observed that as the moisture content decreases the slice thickness also decreased. The capacity of little gourd cutter is 12 kg/hr. Cost of cutter was ₹ 2,990/-.The cost incurred for cutting 1 kg little gourd is ₹ 2.15/-

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Analysis of the Impact of Generation of Housing on the Performance of Soekarno-Hatta Street in Kasongan City

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Abstract— *The purpose of this research is to analyze the effect of housing generation on the performance of Soekarno-Hatta Street in Kasongan City. The independent variable that is used as a factor that influences the generation is the number of family members who work, the number of family members who attend school, the number of family members who do not work and do not attend school, the size of the household, the number of car ownership in the vehicle unit, the number of motorcycle ownership, the number of bicycle ownership, total ownership of vehicles in one house, total income per family per month, and type of house. The research sample was taken at Wengga Housing, Katingan Karya Citra Housing, and Griya Cipta Housing. Analysis is using multiple regression methods. From the results of the research, it was found that the trip generation produced by a housing (pcu/hour) was influenced by the average of total ownership of vehicles in one house and the number of houses occupied in one housing. The form of the generation equation is $y = -165,791 + 41,850 x$ (average of total ownership of vehicles in one house) + $0,321 x$ (number of occupied houses). To maintain the performance of Jalan Soekarno-Hatta is still stable (LOS \square C) with the assumption that the external traffic flow growth is 3.5%, then in the fifth year housing development should not exceed 1.8 times (2350 units) or addition of houses can only be 1002 units.*

Keywords— *effect of trip generation, generation model, traffic performance.*

I. INTRODUCTION

The increasing number of population that is growing rapidly at this time must be able to go hand in hand with an increase in the business of fulfilling life needs. The growing number of requests for housing needs attract investors to build a new residential area that provides comfort, security and affordable prices. Housing location

can be said to have been well arranged if it has been able to meet the requirements including good accessibility and then reach the place of work [1].

Katingan Regency as one of the cities located in the Central Kalimantan Province cannot be separated from urbanization. With urbanization, the need for housing continues to increase. A housing area can be said to be good if it has good and easy accessibility and is safe to reach the destination. This means that the transportation system in the housing area must be properly regulated. Soekarno-Hatta Street is the main road used for traffic from the Wengga Housing area, Katingan Karya Citra Housing, Griya Cipta Housing of Kasongan City. The development of these three housing will certainly cause loading problems on Soekarno-Hatta Street. Therefore, it is necessary to do research on how the trip generation model and its effect on the performance of the main road in the housing area. From the generated generation model, it can be predicted the recommended housing development limits so that the performance of a good main road can still be maintained.

II. THEORETICAL REVIEW

2.1 Transportation Planning

Transportation means moving or transporting something from one place to other place [2]. In a transportation system activity, there are several components that influence. These components can have different functions according to the type and form of the component itself. The component can be in the form of infrastructure and facilities [3].

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Transportation planning is basically to predict transportation needs in the future which are related to economic, social and environmental aspects [4]. Transportation planning is a dynamic and responsive process to changes in land use, economic conditions, and traffic patterns.

The current popular transportation planning concept is the four-stage transportation planning model [5]. This planning model is a combination of several sub-model series, each of which must be conducted separately and sequentially, namely: accessibility, trip generation and trip attraction, trip distribution, modal selection, route selection and traffic flow on the network (dynamic traffic flow).

2.2 Traffic Generation

The traffic generation is the amount of traffic generated by a zone or area per unit of time. The amount of traffic depends on the activities of the city, because the cause of traffic is the human need to carry out activities that relate to and transport goods needed. The generation of the trip is assumed that the generation and attraction of trip as a function of some zone-based socio-economic attributes (x1, x2, ... xn) [6].

$$P = f(x_1, x_2, \dots, x_n)$$

$$A = f(x_1, x_2, \dots, x_n)$$

where:

$$P = \text{Production/Generation}$$

$$A = \text{Attraction}$$

$$x_1, x_2, \dots, x_n = \text{Variable land use}$$

2.3 Performance of the Road Section

Service quality from road sections can be measured using a comparison of the volume of traffic flow to road capacity [7]. According to the Indonesian Highway Capacity Manual (1997), road capacity is defined as the maximum flow through a point on the road that can be maintained per hour at certain condition. For two-way roads (two-way combinations), but for multi-lane roads, the flow is separated by direction and the capacity is determined per lane. Capacity values are observed through field data collection as long as possible, capacity estimated from analysis of traffic conditions, and theoretically assuming mathematical relationship between density, speed and flow [8].

The equation to determine road capacity is as follows [8]; $C = C_0 \times F_{cw} \times F_{csp} \times F_{csf} \times F_{ccs}$. The level of service of a road section is a comparison between traffic volume and road capacity (V/C). Soekarno-Hatta is a type of primary collector road. Characteristics of road service levels on primary collector roads can be seen in Table 1.

Table.1: Road Service Level Characteristics of Primary Collectors [9]

Road service level	Characteristics of traffic	V/C Ratio
A	Free flow conditions with high speed and low traffic flow volume. The driver can have the desired speed without a hitch.	≤ 0,3
B	In a stable flow zone, the driver has enough freedom to make a maneuver	≤ 0,5
C	In this zone, the driver's steady flow is limited in speed	≤ 0,75
D	This zone is an unstable flow, where all drivers are limited in speed, traffic volume is close to road capacity	≤ 0,9
E	This zone of traffic volume close to or is in its capacity, the flow is unstable and often stops	≤ 1
F	This zone of forced flow will cause congestion, or the speed is very low, the queue of the vehicle is very long and many obstacles	>1,00

2.4 Multiple Linear Regression

In trip generation modeling, the Multiple Linear Regression Analysis method is most commonly used. Since 1950, most transportation planning researches have used linear regression analysis to examine trip generation [10]. Multiple linear regression techniques are of interest to transport analysts because they provide convenience in determining the degree of relationship between non-independent variables and independent variables. The concept of multiple linear regression analysis states that the relationship between a dependent variable with several independent variables [11].

This mathematical model has a form:

$$Y = a + b_1X_1 + b_2X_2 + \dots + b_nX_n$$

with:

Y = dependent variable (number of production trips)

a = constants (numbers to look for)

b1, b2, ..., bn = regression coefficients (numbers to look for)

X1, X2, ..., Xn = independent variable (influential factors)

2.5 Classic Assumption Test

Classic assumption tests include multicollinearity, heteroscedasticity, autocorrelation, and normality tests. Multicollinearity classic assumption test is used to measure the level of association (closeness) relationship/influence between the independent variables through the magnitude of the correlation coefficient (r). Multicollinearity occurs when the correlation coefficient

between independent variables is greater than 0.60. It is said that there is no multicollinearity if the correlation coefficient between independent variables is smaller or equal to 0.60 ($r < 0.60$). [12].

Heteroscedasticity test aims to test whether in the regression model there is a variance inequality from residuals of one observation to another observation. If the variance from one observation to another observation remains called homoscedasticity or heteroscedasticity does not occur. Or if the variance is different then it is called heteroscedasticity. A good regression model is homoscedasticity or heteroscedasticity does not occur [13]. If there are certain patterns such as the dots that form a certain regular pattern (wavy, widened and then narrowed) it indicates that heteroscedasticity has occurred. If there is no clear pattern and the points spread above and below the number 0 on the Y axis, heteroscedasticity does not occur. According to [14] heteroscedasticity can lead to inefficient estimation of parameters so that they do not have a minimum range. Parameter estimation is considered efficient because it has a minimum variety, so that the variety of tools is constant or also called that the assumption of homoskedasticity is fulfilled. Heteroscedasticity testing uses a graph test; it can be conducted by comparing the distribution between the predicted values of the dependent variable and the residuals, the output of the detection will be printed in the form of data distribution on a scatter plot.

A good regression equation is not having autocorrelation problems. If there is autocorrelation, the equation becomes not good or not suitable for prediction. The size in determining whether there is an autocorrelation problem with the Durbin-Watson (DW) test. Provisions of test results are if there is a positive autocorrelation if DW is below -2 ($DW < -2$) and autocorrelation does not occur if DW is between -2 and +2 or $-2 < DW < +2$. [15].

Normality test is useful to determine the data that has been obtained is normally distributed. The normality test will be conducted using the chi square formula or chi square. Chi squared techniques are used to test the significance of frequency differences. It means that to interpret whether there are significant differences or not between the frequencies obtained with the expected frequency [16].

III. RESEARCH METHOD

3.1 Data Collection

Primary data from this research are household characteristics (independent variables and characteristics of the population's trip of the Wengga Housing area, Katingan Karya Citra Housing, Griya Cipta Housing of Kasongan City; independent variables (household characteristics) and the dependent variable in this research is total trips per-family per day for activities out of www.ijaers.com

housing. Primary data is obtained by observing questionnaires distributed to each house to be filled in by the respondents. The numbers of respondents in this research were 300 household samples.

3.2 Reviewed Variables

The analysis used in this research is multiple regression analysis. The variables used in the analysis are total trips as the dependent variable (y) with the independent variable (x) including: the number of family members who work in units of people in the family (x_1); number of family members who attend school in units of people in the family (x_2); the number of family members who do not work and do not attend school in units of people in the family (x_3); household size in unit of people in the family (x_4); amount of car ownership in units of vehicles (x_5); the number of motorcycle ownership in units of vehicles (x_6); number of bicycle ownership (x_7); total vehicle ownership in one house (x_8); monthly family income scale (x_9); number of type 36 houses (x_{10}); number of type 45 houses (x_{11}); number of type 60 houses (x_{12}); number of inhabited houses (x_{13}); Housing area in scale (x_{14}).

3.3 Analysis and Interpretation

In this research, the number of generation generated through cross-category analysis and analysis using SPSS (Statistics Product and Service Solution) program [17]. This research is in the form of quantitative descriptive with the relationship test of all variables including regression normality, multicollinearity test, heteroscedasticity test, and autocorrelation test.

Whereas to analyze the load due to access road traffic in the Wengga Housing area, Katingan Karya Citra Housing area, Griya Cipta Housing area, Kasongan City uses the Indonesian Highway Road Capacity Manual approach of 1997.

IV. RESULT AND DISCUSSION

4.1 Generation Model

The generation model is built in two data approaches, namely; 1) household-based generation models, and 2) zone-based generation models. By means of "trial and error" by eliminating the insignificant "x" variable, the equation for the household-based generation model is as follows:

$$y = 0.308 + 0.326x_4 + 0.206x_8 + 2.010x_9$$

where;

y = total trips per family per day

x_4 = household size unit of people in the family

x_8 = the total number of vehicle ownership in one house

x_9 = income scale per family per month

Furthermore, the estimation and classical test results are shown in Table 2, Table 3, Figure 1, and Figure 2.

Table 2. Results of Model Estimation (household-based)

Model	R	Adjusted R Square	Std. Error of the Estimate	Change Statistics			Durbin-Watson
				R Square	F	df	
1	.559 ^a	.313	.311	2,12077	.313	135,770	29,000
2	.615 ^b	.378	.374	2,02149	.065	30,988	17,000
3	.624 ^c	.390	.384	2,00537	.012	5,795	16,017

a. Predictors: (Constant), x9

b. Predictors: (Constant), x9, x4

c. Predictors: (Constant), x9, x4, x8

d. Dependent Variable: y

From Table 2, the correlation value of the equation shows a strong relationship (0.624).

Table.3: Results of coefficients estimation (household-based)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error			
		1	(Constant)			
	x9	2,649	.227	.559	11,652	.000
2	(Constant)	-.205	.588		-.348	.728
	x9	2,331	.224	.492	10,399	.000
	x4	.448	.081	.263	5,567	.000
3	(Constant)	.308	.621		.496	.620
	x9	2,010	.259	.424	7,752	.000
	x4	.326	.095	.191	3,439	.001
	x8	.206	.085	.156	2,407	.017

a. Dependent Variable: y

From Table 3 it can be seen that partially there is a significant influence between X₄, X₈, and X₉ on Y_i. From the Sig value. the three independent variables show a value of <0.05.

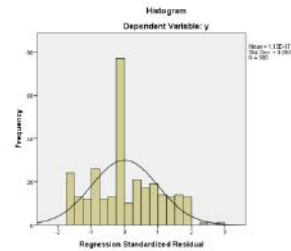


Fig. 1: Normal Curve (household-based)

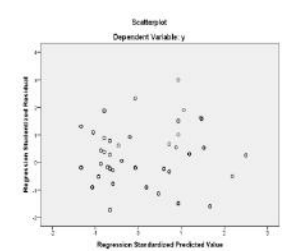


Fig. 2: Distribution Graph (household-based)

The resulting Durbin-Watson (DW) value is 2,285 (Table 2). From DW Table with 0.05 significance and number of data (n) equal to 300, and k by 3 (k is the number of independent variables), the DW value (2,285) is between d_U and 4-d_U, meaning there is no autocorrelation.

The normality test in Figure 1 shows the normal curve line (mean≈0), the points tend to approach the diagonal line, so it can be said to be normally distributed. Figure 2 shows the heteroscedasticity test graphically where the points are not patterned and spread above and below the y axis (number 0), meaning that there is no heteroscedasticity problem in the regression model. Multicollinearity test is that all the coefficient of determination (R²) < R² value model, so it is concluded that there is no multicollinearity problem in the regression model.

In the same way for the equation of the zone-based generation model, the equation of the generation model can be as follows:

$$y = -165.791 + 41.850x_8 + 0.321 x_{13}$$

where;

y = total trips per family per day

x₈ = total vehicle ownership in one house

x₁₃ = number of inhabited houses

Furthermore, the estimation and classical test results are shown in Table 4, Table 5, Figure 3, and Figure 4.

Table.4: Results of Model Estimation (zone-based)

Model	R	Adjusted R Square	Std. Error of the Estimate	Change Statistics			Durbin-Watson
				R Square	F	df	
1	.974 ^e	.948	.913	9,81408	.948	27,192	2,3

a. Predictors: (Constant), x8, x13

b. Dependent Variable: y

From Table 4, the correlation value of the equation shows a strong relationship (0.974).

Table 5. Results of estimated coefficients (zone-based)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error				
	1	(Constant)				-165,791

x13	,321	,052	,828	6,219	,008
x8	41,850	13,313	,418	3,144	,052

From Table 5, it can be seen that partially there is a significant influence between X_{13} and X_8 , on Y_i . From the Sig value. both independent variables show a value of <0.05 .

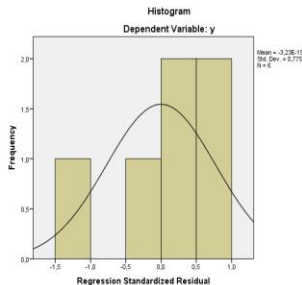


Fig. 3: Normal curve (zone-based)

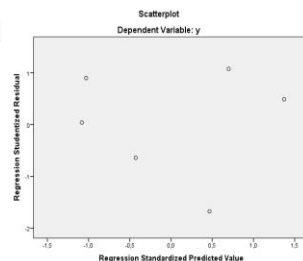


Fig. 4: Distribution Graph (zone-based)

The Durbin-Watson (DW) value generated is 2,522. From Table DW with 0.05 significance and number of data (n) equal to 300, and k by 2 (k is the number of independent variables), DW values (2,522) are between dU and 4-dU, meaning there is no autocorrelation.

The normality test in Figure 3 shows the normal curve line (mean \approx 0), the points tend to approach the diagonal line so it can be said to be normally distributed. Figure 4 shows the heteroscedasticity test graphically where the points are not patterned and scattered above and below the y axis (number 0), meaning there is no heteroscedasticity problem in the regression model. Multicollinearity test that all of value determination coefficient (R^2) $< R^2$ value model, then concluded there was no multicollinearity problem in the regression model. The classic test of the two generation model approaches shows results that have met the requirements. However, when viewed from the correlation value, the zone-based generation model shows a better value than the household-based generation model.

4.2 Analysis of Road Performance in Existing Conditions
 Road performance analysis is carried out at peak hours using the value of degree of saturation (DS) that occurs. From the traffic data taken for 12 hours, the peak hours occur at 06.00 - 07.00 at 676.9 pcu/hour. Fluctuations in traffic flow then can be seen in Figure 5.

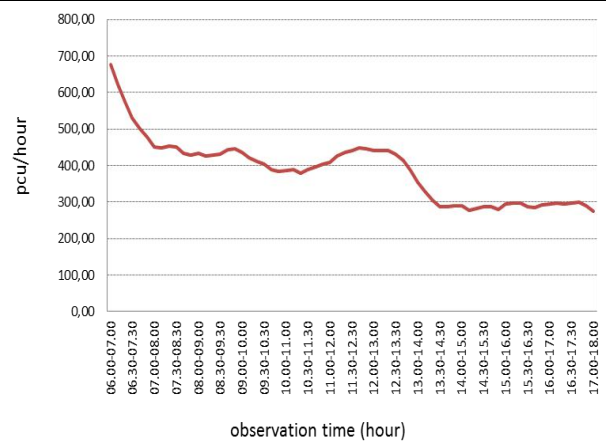


Fig. 5: Fluctuations in Traffic Flows of Soekarno-Hatta Street

The geometric data of Soekarno-Hatta Street are basic capacity (C_0) = 2900 pcu / hour for the undivided two-lane road type, road width adjustment factor (FC_w) = 0.56 for the undivided two-lane road type with effective traffic lane width (W_e) total of two-way 5m, directional separation adjustment factor (FC_{SP}) = 1, side barrier adjustment factor with kerb (FC_{CS}) = 0.97, and city size adjustment factor (FC_{CS}) = 0.9 for undivided two-lane road type with city size = 0.1 - 0.5 million inhabitants.

$$C1 = 2900 \times 0.56 \times 1 \times 0.97 \times 0.9$$

$$C1 = 11417.75 \text{ pcu/hour}$$

By comparing the value of traffic flow and capacity, the value of $DS = 676.9 / 11417.75 = 0.59$ can be obtained, or in other words the LOS of Soekarno-Hatta Street in the existing condition is A.

Furthermore, we can forecast the performance of Soekarno-Hatta Street in the future by paying attention to the development of settlements using the zone-based generation model obtained

4.3 Use of the Generation Model to Estimate the Traffic Flow Charges

Traffic flow on Soekarno-Hatta Street based on the origin of the trip can be divided into two, namely the flow coming from the internal zone (settlement) and the external zone (trajectory/outside the settlement). At the same peak hour, the contribution of traffic loads originating from the reviewed generation zone is as shown in Table 6.

Table 6. Contribution of Traffic Loads from the Generation Zone (pcu / hour)

Location	Zone	Volume (pcu/hour)
Wengga Housing	Strawberry-Soekarno-Hatta	117.3
	Apple-Soekarno-Hatta	51.5
Karya Citra	Avocado-Soekarno-Hatta	101.5

Housing	Pineapple-Soekarno-Hatta	42.5	5-year	2696	867.03	303.57	0.8
Griya Cipta Housing	Durian-Soekarno-Hatta	73	Forecasting				3
	Watermelon-Soekarno-Hatta	35.5	and housing growth of 2 x				
TOTAL		421.3					

Based on the data from Table 6, the contribution of traffic flow burden from the reviewed settlement is 62.24% while the rest comes from the external zone which is 255.6 pcu/hour.

Furthermore, the increase of traffic flow in the future for the internal zone uses the zone-based generation model obtained and the external zone uses the regional traffic growth rate of 3.5%.

Assuming the traffic impact due to settlement development is up to 5 years [18], the value of vehicle ownership for each average house (X₈) is 4, so it can be estimated the addition of the number of occupied housing (X₁₃) by considering the performance of Soekarno-Hatta Street remains in a stable condition (DS ≤ 0.75). For example, in the next 5 years conditions with the addition of occupied housing to 1.5 times, the estimated flow at Soekarno-Hatta Street will be as follows:

Internal Flow:

$$\begin{aligned}
 V_{\text{settlement}} &= -165.791 + 41.850x_8 + 0.321 x_{13} \\
 &= -165.791 + 41.850 (4) + 0.321(1348 \times 1.5) \\
 &= 650.67 \text{ pcu/hour}
 \end{aligned}$$

External Flow:

$$\begin{aligned}
 V_{\text{external}} &= V_{\text{external existing}} \times (1+i)^n \\
 &= 255.6 \times (1+0.035)^5 \\
 &= 303.57 \text{ pcu/hour}
 \end{aligned}$$

So the value of DS of Soekarno-Hatta Street is (650.671 + 303.57) /1417.75=0.67. Furthermore, the estimation with alternative addition of occupied housing can be seen in Table 7.

Table 7. Estimated Addition of Occupied Housing to DS-Value

Condition	Total of Occupied Housing	V _{internal} (pcu/hour)	V _{external} (pcu/hour)	DS
Existing	1348	421.30	225.60	0.48
5-year Forecasting and housing growth of 1.5 x	2022	650.67	303.57	0.67
5-year Forecasting and housing growth of 1.8 x	2350	755.96	303.57	0.75

From Table 7, it can be seen that the performance of Soekarno Hatta Street still can be maintained in a stable traffic flow condition (LOS ≤ C) if the housing development is not more than 1.8 x (2350 units) or an additional of 1002 houses occur.

V. CONCLUSION

several tests on the relationship between total trips on Soekarno-Hatta Street as the dependent variable (y) and as an independent variable (x), the zone-based generation model resulted a better model compared to the household-based generation model. The best form of regression equation obtained is: $y = -165,791 + 41,850x_8 + 0,321x_{13}$ where y is total trips in one zone, x₈ is the total vehicle ownership on average in one house, and x₁₃ is the number of inhabited houses.

Assuming that the rate of regional traffic growth is 3.5%, the average number of vehicle ownership is 4 units, and the traffic flow conditions on Soekarno-Hatta Street are still stable in the next 5 years, the allowable housing development is no more than 1.8 x (2350 units) or the addition allowed is only 1002 housing.

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Management of Technology Focused on the Water Analysis Results in Artesians Wells

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Abstract— *The water is an universal soluble, fundamental to every living being. The main component to the human body and indispensable for any form of life, however, there is an increasing preoccupation within the quality of their providers, which are the rivers, strands and springs, but as the time passes by are threatened by anthropogenic activities, main causer of the contamination and destruction of the local fauna and habitat. The principal objective of this research was to generate necessary information to further make use of this water, specifically located in Porto Velho, Rondônia, in Jamari's River's hidrographic basin sided with Green River's, one affluent and one subfluent of Madeira's River, which is one of the most important hidrographic basins of Amazon's River, yet, lots of physical, chemicals and microbiological parameters were effected, like pH, turbidity, overall alkalinity, overall toughness, iron, chloride, color, fecal coliforms, that are capable of identify the contamination by anthropic action, obtaining the characteristics of the*

containing waters in the studied area, which in turn had favorable results, following the collected results we could confirm that all them were under acceptable and expectable parameters required by legislation in force of bathing, aquatic community preservation and human consumption, being the last one dependable of a simple threatment (chlorination).

Keywords— *Water Quality, Physical Parameters, Chemistry and Environment.*

I. INTRODUCTION

The water is the most important natural resource for the life in earth, having its place as an abundant substance in the whole planet, available in different places and in different quantities making itself irreplaceable. The water domain allowed the human to learn skills such as botanic, animal creation and breeding for its own survival, how to generate energy from it with hydroelectric, and one of the simple habits that shows it

clearly is that the man itself always aimed to live close to rivers and places with rivers to settle in. (Translated from DANTAS, 2002).

To characterize water, some parameters are determined; they represent its physical, chemical and biological characteristics. These parameters indicate the quality of the water and constitute its impurity when it reaches superior value than determined for usage. (Translated from FRACARO, 2005).

As for the importance of the underground waters and the fact that they are virtually the main public supply, related studies regarding its physical, chemical and microbiological parameters turn out to be extremely necessary for these waters. Like this, through analysis, take the right measures to treat the water before the presence of the detected harmful substances.

II. OBJECTIVES

This research main objective is to study the chemical, physical and microbiological characteristics of three wells located in one specific countryside of Porto Velho, capital of Rondônia, in Brazil. And for the results the task at hand brings objectives like obtaining samples from which well to obtain characteristics like depth, temperature, color, turbidity (a), compare themselves among other samples to check their pH, alkalinity, toughness, chloride, free chlorine and ammoniacal nitrogen (b), evaluate the contamination of each sample based on the microbiological parameters of fecal coliforms and total coliforms (c) and at last, but not least, correlate the results of each parameter, physical-chemical and microbiological of each studied area with intent to obtain the true quality of the underground water of the area (d).

III. LITERATURE REVIEW

The quality of water for human consumption is directly linked to the way the present soil was occupied, or by the high deforestation of its riparian forest and the disorderly use of its natural resources, such as livestock and agrochemicals used for agriculture practiced by the present inhabitants and use this water to supply their homes for the consumption of their families.

The main sources of water pollution are liquid and solid discharges from human agglomerations and industrialized regions. Domestic sewage usually consists of a mixture of organic substances and some nutrients, such as detergents and soaps. Industrial sewage generally has a greater diversity of composition, including acids, bases and toxins. However, food industry sewage presents a more heterogeneous mixture due to the type of production and product, usually with a high content of

organic substances (SCHÄFER, 1985; STAMOU et al., 1999).

According to a study carried out by the Water and Sewage Company of Rio Grande do Norte (CAERN) in partnership with the Federal University of Rio Grande do Norte (UFRN), it was possible to identify the main sources of contamination of our surface and underground water sources. They are:

- The cesspools and sinks (consequences of lack of basic sanitation throughout the city).
- Infiltration ponds (resulting from clandestine sewage connections in the rainwater network).
- Old cacimbons transformed into cesspits (directly contaminate groundwater sheets).
- Poorly constructed wells (prepared without adequate technical criteria).
- Dumps (built on the dunes, which are very permeable soils).
- Industrial sewers (transferred to infiltration ponds or dumped directly into the Potengi, Jiqui and Jundiá rivers).
- Gas stations (fuel leaks from tanks buried in the ground and not treatment of wastewater).
- Creations of animals (cattle, pigs and birds) along riverbanks and lagoons.

Waste generated by industries, cities and agricultural activities is solid or liquid, with a very large potential for pollution. Waste generated by cities, such as "garbage", debris and toxic products are carried to the rivers with the help of rains. Liquid waste carries organic pollutants (which are easier to control than inorganic ones, when in small amounts). The industries produce large amounts of waste in their processes, one part being retained by the industry's own treatment facilities, which retain both solid and liquid waste, and the other part dumped into the environment.

In the process of treatment of organic waste is also produced another residue called "slurry", liquid that again needs treatment and control. Finally, water pollution can appear in various ways, including thermal pollution, which is the discharge of effluents at high temperatures, physical pollution, which is the discharge of suspended solid material, biological pollution, which is the discharge of pathogenic microorganisms and viruses, and chemical pollution, which can occur due to oxygen deficiency, toxicity and eutrophication. This is caused by processes of erosion and decomposition that increase nutrient content, increasing biological productivity, allowing periodic proliferation of algae, which in the present study, it was found that the presence of oxygen-deficient water was associated with increased oxygen uptake and increased toxicity to the organisms that live there, such as fish that

appear dead with toxic foams. (ZAMPIERON & VIEIRA, 2006).

It is worth mentioning that the current environmental legislation CONAMA Resolution (National Environmental Council), nº 357/2005 - classifies the waters of the Brazilian territory according to its salinity, as for example; the world water classification, based on its natural characteristics, refers to "fresh water" with a total dissolved solids content (STD) of less than 0,5% mg / l. Waters with STD between 1,000 and 10,000 mg / l are classified as "brackish" and those with more than 10,000 mg / l are considered "salty".

IV. METHODOLOGY

4.1 Characterization of the Area

The experiment will be in 3 (three) points of different situations and activity: 1 (one) industrial area well, 1 (one) well in the commercial area and 1 (one) well in a residential area. All points located in a rural area in the municipality of Porto Velho - Rondônia - Brazil. The points between them have a distance as shown below:

The collections and analyzes were carried out in April 2015, along with the geographical coordinates. After the collections, the tests were carried out in the laboratory of Waters from Rondônia's University (FARO), and were composed of 3 (three) glass bottles, where each flask had an average of 300 ml of sample, the time elapsed between sample collection and the reception for physical - chemical analysis was from 15 to 16 hours, on constant refrigeration. Receipt for physical - chemical analysis was 15 to 16 hours, on constant cooling.

The points studied were identified as follows:

- WELL 1: Commercial area
- WELL 2: Residential area
- WELL 3: Industrial Area

4.2 Collection of Samples

The marking of the points for collecting the samples was obtained by a portable GPS of the Garmin brand, model Gpsmap 76CSx, the geographical coordinates of each point are expressed in the table below number 01:

Table.1: Geographical Coordinates

Sample Collection Points	Geographical Coordinates	
W1	8°47'52.08" S	63°49'47.21" O
W2	8°48'37.10" S	63°48'24.46" O
W3	8°47'42.64" S	63°46'1.76" O

4.3 Colorimetric Tests

The use of colorimetry and the method of quantitative analysis which is based on the comparison of the color produced by a chemical reaction with a standard color according to the intensity of the color produced, infer the concentration of a certain analyte (substance to be analyzed). The safest method to check the color of a reaction is through the use of titrator techniques and an indicator, which compares color intensity to a standard color, called "white". It is the most widely used method in laboratory analysis of the AlfaKit's 2011 potability instruction manual.

4.4 Alkalinity

To perform the alkalinity test, 50 ml of sample with plastic beaker was measured and transferred to the wide mouth flask. Then added 3 (three) drops of Phenolphthalein shaking in circular motions.

After the sample was pink, the total alkalinity reagent was added to the burette and dripped until the color disappeared and then the volume (Vg) as AP was recorded.

In another sample were added 5 drops of mixed and stirred indicator, continuing to drip to the total alkalinity reagent changing from blue to salmon, always stirred in circular motions after the addition of each drop. At the end of this process, the volume spent (Vg) as AT was recorded.

Formula:

$AP \text{ (mg L}^{-1}\text{ CaCO}_3\text{)} = Vg \times 20$ $AT \text{ (mg L}^{-1}\text{ CaCO}_3\text{)} = Vg \times 20$

- AP: Partial Alkalinity
- AT: Total Alkalinity
- Vg: Volume Spent

The alkalinity occurs due to the presence of Hydroxides, Carbonates and Bicarbonates. Table 2 shows the relationship between them:

Ex: If AP is equal to zero the Alkalinity will be due only to Bicarbonates.

Table.2: Reading of Alkalinities

Readings	Alkalinity		
	Hydroxide	Carbonates	Bicarbonates
AP = 0	ND	ND	AT
AP = AT	AT	ND	ND
AP Smaller 1/2 AT	ND	2 AP	AT - (2 AP)
AP = 1/2 AT	ND	2AP	ND
AP Bigger 1/2 AT	2 AP - AT	2 (AT-AP)	ND

4.5 Hardness

To define the hardness, 50 ml of sample was measured with the plastic beaker; and transferred to the wide mouth flask. Added 1.0ml of Buffer Solution and shaker. After this procedure, 02 measurements of Black E.T and stirred were added. Then EDTA was added to the burette and dripped into the sample, shaken with each drop added until the appearance of pure blue color. At the end of this process, the volume spent (Vg) in the titration was recorded.

Formula II:

$$\text{Total Hardness (mg L}^{-1}\text{ CaCO}_3) = Vg \times 20$$

Observations: If the sample shows blue color with E.T. Black before titration, there is no hardness in the sample.

4.6 Iron

The sample was transferred to the cuvette until the 5 ml mark was added, 2 drops of the Tiofer Reagent, closed, shaken and waited 10 minutes. Then open the bucket, positioned on the cartouche and made color comparison.

Formula III:

$$\text{mg L}^{-1}\text{Fe} = \text{Card Read Result}$$

4.7 Turbidity

The sample was placed in the large bucket, to the brim, without spilling. Inserted the turbidimeter into the cuvette and press the "on" button and start the analysis. After the end of this procedure, noting the result that was expressed in UNT.

4.8 Color

A total of 50 ml of sample was transferred to the glass beaker, the lower plastic holder was removed from the beaker and the beaker was placed on the card to make the color comparison, and the colors were visualized above the beaker.

$$\text{mg L}^{-1}\text{Fe} = \text{Card Read Result}$$

4.9 Chloride

After measuring 50 ml of sample with the plastic beaker, transfer to the wide-mouth flask, then add 1 ml of Potassium Chromate and shaken with circular motions. As a result, the sample turned yellow.

Afterwards, the burette was filled with Silver Nitrate. Subsequently, the reagent was dripped into the sample (holder), shaken with each drop added until the

sample turned yellow brick. At the end of this process, the volume spent (Vg) was recorded.

Formula IV:

$$(\text{mg L}^{-1}\text{ Cl}^{-}) = Vg \times 35$$

Vg: Volume spent in titration.

V. MICROBIOLOGICAL TESTS

To carry out the microbiological tests, the Colipaper Kit of the Alpha Kit was used, using the following technique:

It was removed to the microbiological carton and touching just above the pick, then immersed the carton in the sample to be analyzed and waiting to be dampened. After damp, the sample tray and the excess water were removed, replacing the carton in the plastic package and removing the part of the bundle without the rest being touched. Then it was brought to the oven for 15 hours at a temperature of 36-37 ° C.

After 15 hours of incubation, the colonies were counted, always considering the two sides of the chart.

VI. RESULTS AND DISCUSSIONS

With the collection of the local samples, it was possible to carry out the analyzes and with the results, execute the elaboration of several graphs that will be furtherly discussed during the work, the results of the parameters are represented in the graphs below:

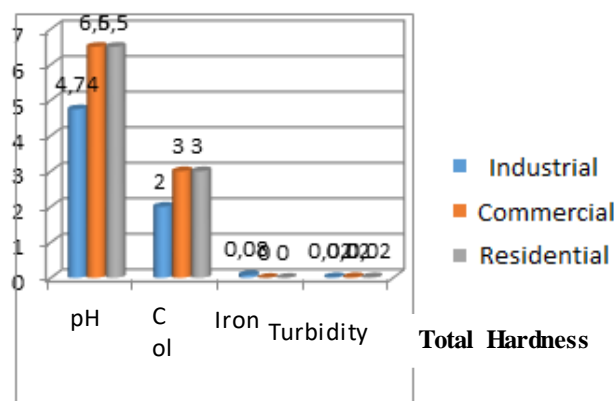


Fig.1: Results of the analysis of Ph, Color, Iron and Turbidity parameters.

According to the results shown in figure 4, we can observe that the pH of the sample related to the industry well is considered to be acid (pH 4.7) and it is necessary to correct the pH in the range of 6.0-9, 0. The other samples presented satisfactory results for these parameters. In contrast, the results of the tests of color, iron and turbidity are very low than the current legislation, as shown in table 01.

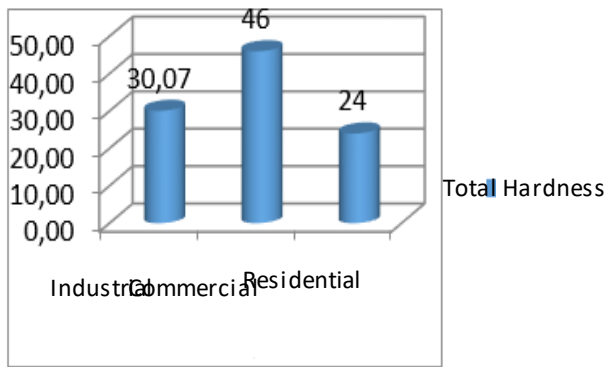


Fig.2: Result of the Total Hardness Analysis

Total hardness is directly related to total alkalinity, both in water and soil. Hardness levels are represented by the amount of CaCo₃ in water and influence on the pH of water. Thus, the water sample in the industrial area presented a lower total hardness index (3.07 mg / l CaCo₃) in relation to the commercial water sample (46 mg / l CaCo₃), justifying the pH of 4.5 and 6.5 of the industrial area and commercial area respectively. The sample of the residence, the CaCo₃ index in the water does not follow the same logic, being able to indicate that the sample belongs to a different underground source.

6.1 Ammonia and Chloride

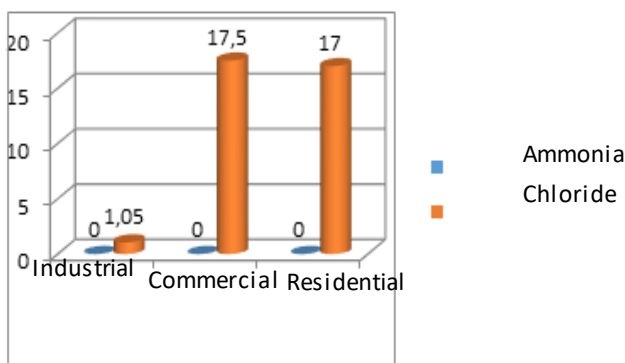


Fig.3: Results of Ammonia and Chloride Analysis

6.2 Escherichia, coliforms and bacteria

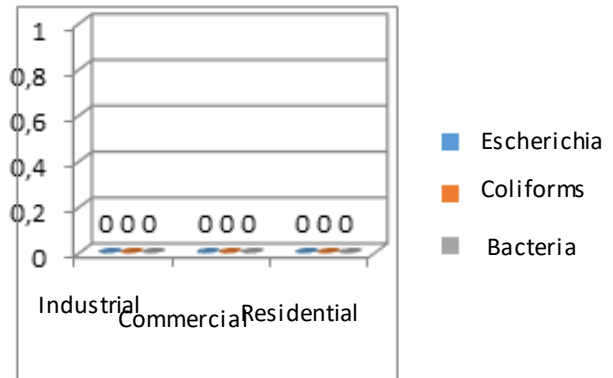


Fig.4: Results of Escherichia, Coliforms and Bacteria Analysis.

6.3 Results x Legislation

Table2: Results compared with in force legislation

Parameters	Unity	Well 1	Well 2	Well 3	Ministry of Health Ordinance No. 2914
pH	-	6,5	6,5	4,74	6,0 - 9,5
Turbidity	NTU	0,02	0,02	0,02	5
Color	UH	>3	>3	2	15
Iron	Mg/L	Absent	Absent	0,08	0,3
Fluorine	Mg/L	1,52	1,17	0,04	1,5
Total Hardness	Mg/L	46	24	30,07	≤500
Partialalkalinity	CaCO ₃	Absent	Absent	Absent	-
Total alkalinity	Mg/L	50	26	34	-
Chloride	Mg/L	17,5	17	1,05	≤250
Ammoniumnitrogen	Mg/L	0,25	0,10	0	1,5

VII CONCLUSION

It is possible to conclude with this research, that according to the results obtained for the studied area, all obtained a final result of respectively favorable analyzes, possessing a good physical - chemical and microbiological quality, for the fauna and flora present in the analyzed rural area, it is important to remember that the results apply to the site studied, both the collection points of the 3 wells, can be an alternative source of supply for the activities present in the areas and without being detrimental to the community in the vicinity. In addition, groundwater is increasingly being contaminated by anthropogenic activities, causing great concern for water quality, so it is important to know that all the results of the analyzes for pH, turbidity, iron, total hardness, alkalinity total, chloride and color of the samples studied here are within the level permitted by Ministry of Health Ordinance No. 2914 and CONAMA Resolution No. 357, which defines the maximum value allowed for human

consumption and protection of aquatic communities, however, only of a chlorination application so that the water is fit for consumption, being aware of such parameters and knowing the quality of the water, to be able to avoid several types of diseases and future complications for the health and well-being of the population.

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Analysis of Mechanical Response during Folding of Creased and Uncreased Paperboard

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Abstract— *Creasing and folding of paperboard are two essential operations to obtain a well-defined shape and strength of a package. Relative Crease Strength, RCS, is specified for process control of creasing and folding and is defined as the ratio between the maximal bending force for a crease and uncreased sample bend to the bending angle of 30 degrees at a rate of 5 degrees/sec. Thus, the present work had as objective to evaluate RCS measured in real industrial samples used for process control of creasing and evaluate the influence of paperboard properties and converting processes creasing and folding. As RCS can be measured only after creasing, the study can give directions to paperboard production process control. Creasing measurements were done on both machine direction (MD) and cross machine direction (CD) samples. The paperboard property that showed the highest correlation to RCS was Scott Bond. Based on this one pilot production with lower Scott Bond was evaluated. Lower values of RCS were obtained, as predicted. X-Ray microtomography revealed higher stratification between fiber layers in the paperboard with lower Scott Bond.*

Keywords— *Bending moment, creasing, folding, paperboard, relative crease strength.*

I. INTRODUCTION

Paperboard is a widely used material for packaging purposes, since it can be easily converted from a flat configuration into a box shaped solid [1, 10]. The final package performance depends on the folding quality which has to produce well defined edges and corners, without damaging the packaging's external surface and providing the formation of a pack of desired shape and functionality [9, 10].

Paperboard creasing is intended to facilitate folding along well-defined lines during the paperboard transformation process from a flat surface into a rigid packaging. The creasing causes a combination of bending and interlaminar shear which reduces its bending stiffness and promotes the folding around the design lines. After

creasing, the paperboard presents a residual indent where the material is delaminated. The delamination extent depends on the creasing severity and on the creasing tool geometry [7, 10].

The quality of creasing of liquid packaging board is controlled by measuring Relative Crease Strength or RCS, which is defined as the ratio between the maximum bending force at or before 30 degrees registered during a standard folding test performed over the creased material, and the maximum bending force which is needed to fold the uncreased material [23]. RCS specifications in the longitudinal direction (MD - Machine Direction) and transverse (CD - Cross Direction) have been defined to ensure uniformity in the creasing process. It is desirable with a RCS-value as low as possible [2, 15, 20].

The problem is that the RCS analysis can only be performed after the creasing of the paperboard, avoiding a direct action during the paperboard production.

This paper attempts to correlate what and how the physical properties and material characteristics that are evaluated during production influence the creasing process and the RCS values, and further rank them according to their influence. In the present work, creasing of liquid packaging paperboard is considered.

To answer these questions a number of investigations were carried out, as bending moment of creased and uncreased paperboard, comparative of bending moment measurements according TAPPI T 556 and RCS method, determination of the maximum bending moment angle, RCS performance evaluation at different crease depths, investigation of physical properties of the paperboard and its influence on the RCS and finally a performance review of the variables in order to select the main feature for a focused industrial testing, with selected samples of best and worst performers for X-ray microtomography analysis.

The packaging paperboard is a layered material. The objective of the creasing process is to produce a permanent delamination damage, promoted by interlaminar shear, in addition to in-plane and

compressive out-of-plane plastic deformation of the plies, whose extent depends on the crease depth [3, 13].

The object of study is the paperboard produced in Paper Machine A (PM-A), that is equipped with two headboxes: the main headbox and secondary box. The main headbox called 'Strataflow' concept receives the flow of bottom and middle layers, going through different chambers in the box and come into contact only to be released by the lip. Secondary inbox is responsible for the white top layer, with his jet received by the dewatering of Bel Liner [7, 8]

The introduction of the paper machine B (PM-B) belonging to the same mill, enabled comparative performance in crease with the PM-A paperboard. The PM-B is equipped with three headboxes. The bottom, middle and top layers are formed individually.

The article is organized as follows; in Section II the main parameters that impact the creasing and folding process are presented. Sections III, IV and V are focused in the method and particularities of RCS analysis. The RCS performance evaluation and the paperboard properties related to RCS behavior are discussed in sections VI and VII. Conclusions and final considerations are presented in section IX and X respectively.

II. PARAMETERS THAT IMPACTS CREASING AND FOLDING

Each ply of the paperboards considered in this study consists of a network of different fibers. The outer plies are stiffer, while the inner plies are softer, with CTMP.

The strategy of forming the plies produces an orientation of the fibers in the machine direction (MD), which thereby is the stiffest direction [5, 9, 10]. The individual plies are glued together, there are interfaces between plies. A combination of low density in the middle ply and high density in the external plies optimizes the bending stiffness. The stiffness and strength of the middle layer are provided by weak bonds mainly due to fiber entanglement. The adhesion between plies is improved using starch. [11, 19]

The paperboard is a non-linear anisotropic material and the crease behavior reflects the crease line orientation with respect to the fiber orientation, especially in shallow creases. The fiber orientation and the longitudinal properties of the fibers are important factors contributing to the in-plane behavior of paper, while the out-of-plane behavior of paper instead is largely dependent on the fiber bending properties. [10, 12, 16]

A creasing sequence is illustrated in Fig. 2.1. The paperboard is pushed by a male die with a rule into a groove of the female die. The geometry of the rule and groove (width, depth, relative clearance, geometry of the indenter) affects the final behavior of the creased material [17, 18].

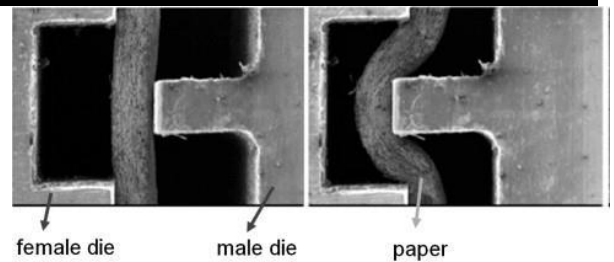


Fig. 2.1 Creasing sequence

When the die is removed, the paperboard presents a residual indent which represents an initial planarity defect for the subsequent folding process. The bending stiffness is decreased in the crease compared to the rest of the paperboard [21, 22]. During folding, the delaminated layers on the compressed side are subjected to compressive forces and undergo large deflections, under combined bending and compression. Delamination occurs not only between the midlayer and the outer layers, but also within the middle layer itself [4, 6, 10].

The bending and axial behavior of the delaminated layer is a consequence of many factors which can influence the creasing operation: the width of the groove and the penetration depth affect not only the length and thickness of the delaminated layers, but also their initial deviation from planarity due to the plastic indent. Thicker boards need a wider die and groove [6, 10, 11].

III. ANALYSIS OF INDIVIDUAL MEASUREMENTS OF THE BENDING MOMENT ON THE PAPERBOARD AND THE CREASE

For a better understanding of data, the individual measurements of the uncreased and creased paperboard were evaluated in the same chart of RCS values. This is the first time that data bending force of the crease and the paperboard are evaluated individually in order to enable the behavior of the data display that generate the final result of RCS.

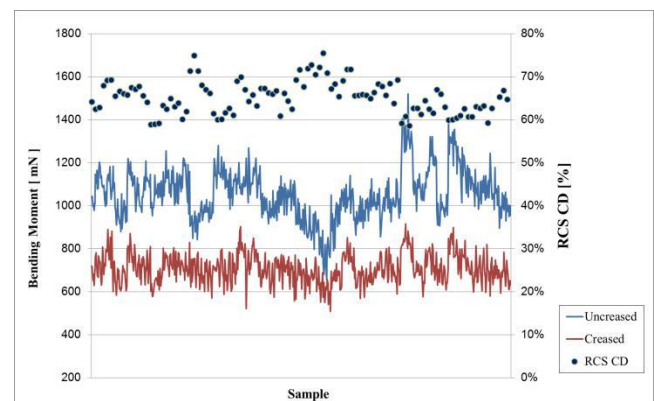


Figure 3.1 – Higher RCS values with reduced bending moment of the uncreased paperboard compared to the bending moment of the creased paperboard.

In Figure 3.1 the individual measurements of uncreased and creased paperboard were inserted in the same chart, with the RCS values. It is observed that the two times when the RCS was higher there was a significant reduction of the bending moment on the paperboard (uncreased area). The bending moment of the crease remained at the same level.

It was expected that the larger RCS values were obtained due to the increased bending moment crease, but the observed behavior was the opposite.

The increase in RCS was due to reduced bending moment of the paperboard. The bending moment of the crease remained almost stable.

IV. COMPARATIVE OF BENDING MOMENT MEASUREMENTS ACCORDING TAPPI T 556 AND RCS METHOD

The comparison of the bending moment analysis according to TAPPI method T 556 (15 degrees and 50 mm) and the method for measuring RCS (30 degrees and 10 mm) conducted in a cross-section of a jumbo roll with 24 sectors is presented in the Figure 4.1.

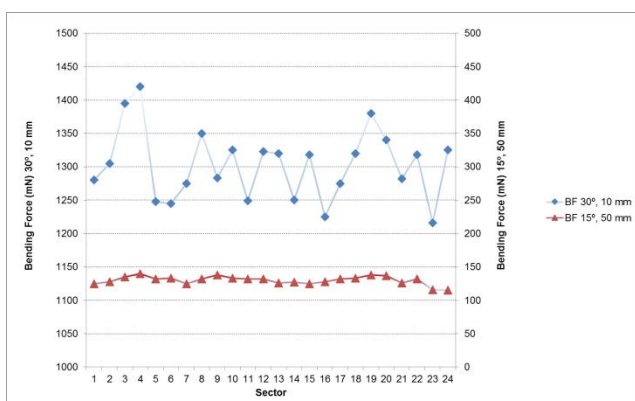


Figure 4.1 – Bending force at 30 degrees, 10 mm on the left side and 15 degrees, 50 mm on the right.

The amplitude of the bending force measurements according TAPPI method T 556 (15 degrees and 50 mm) reached 204 mN while the method for measuring RCS (30 degrees and 10 mm) presented amplitude of 25 mN. The difference was almost ten times greater. This significant difference directly affects the determination of RCS.

V. ASSESSMENT OF THE MAXIMUM BENDING MOMENT ANGLE

A conclusion section must be included and should indicate clearly the advantages, limitations, and possible applications of the paper. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and

extensions.

In order to assess the maximum bending moment angle of the paperboard study, the same equipment for measuring the bending moment till 30 degrees according to the method for RCS calculation was used, programming it for measurements up to 90 degrees.

The moment is recorded during folding process and the data transferred to a spreadsheet for specific software of the equipment.

Paperboard samples from PM-A and PM-B were analyzed.

In Figure 5.1 (a) the maximum bending moment in MD direction occurred at 23.5 degrees, before 30 degrees and therefore the maximum moment obtained up to 90 degrees is the same measured till 30 degrees.

Otherwise in Figure 5.1 (b) the maximum bending moment in CD direction occurred at 45 degrees. Thus the maximum bending moment time achieved is greater that obtained up to 30 degrees.

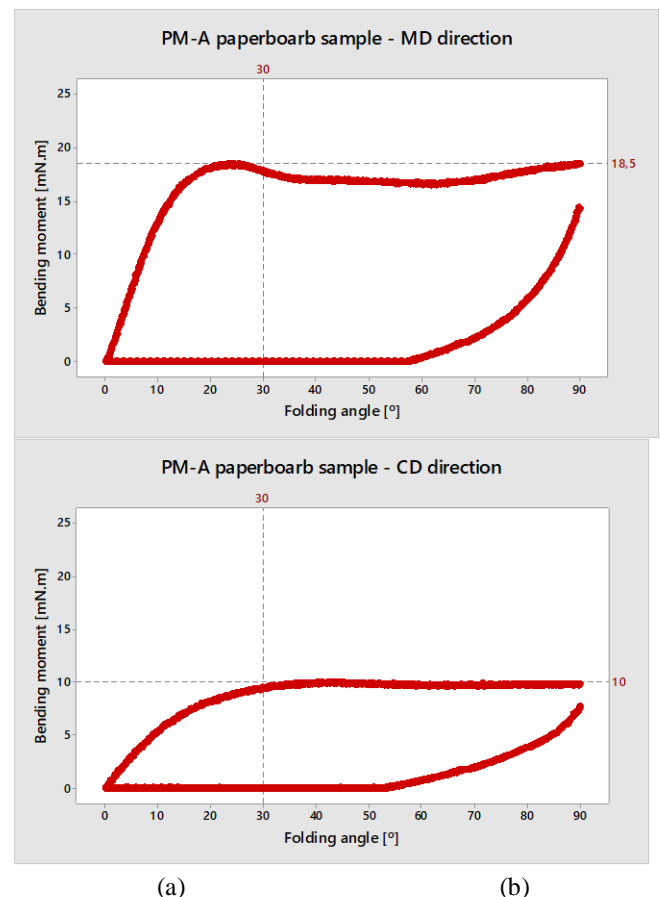


Figure 5.1 – Uncreased paperboard bending moment PM-A. (a) MD direction MD. (b) CD direction.

Do not reach the maximum bending moment until 30 degrees implies impact on RCS, as a smaller denominator will lead to higher values in the calculation of RCS. This behavior may explain why the occurrence of RCS above specification have the bending moment on the lower

paperboard because the maximum moment value has not been reached.

One possible explanation for the difference in the PM-A paperboard is the headbox with 'StrataFlow' concept. The bottom and middle layer are formed in the headbox, which gives unique characteristics to the paperboard produced, such as the inability to delaminate these layers due to the entanglement of the fibers during formation.

VI RCS PERFORMANCE EVALUATION AT DIFFERENT CREASE DEPTHS

The RCS data were organized into webs to allow the verification of possible variations in the cross direction profile, as shown in Figures 6.1 and 6.2.

The webs 1, 4 and 7 show higher variation due to the greater number of measurements in these webs for quality control. Similar variation is observed in the crease depth analysis.

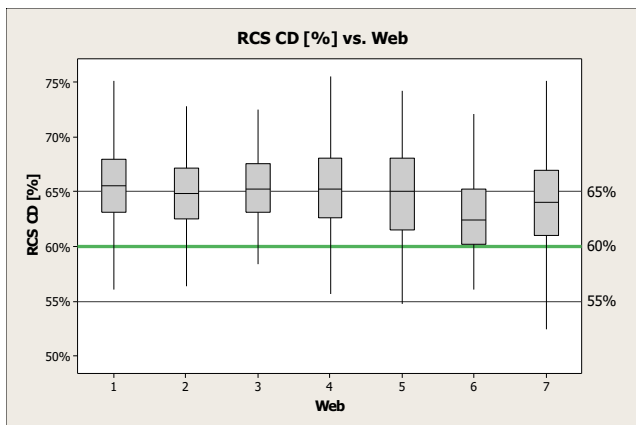


Fig.6.1: RCS CD profile of webs 1 to 7.

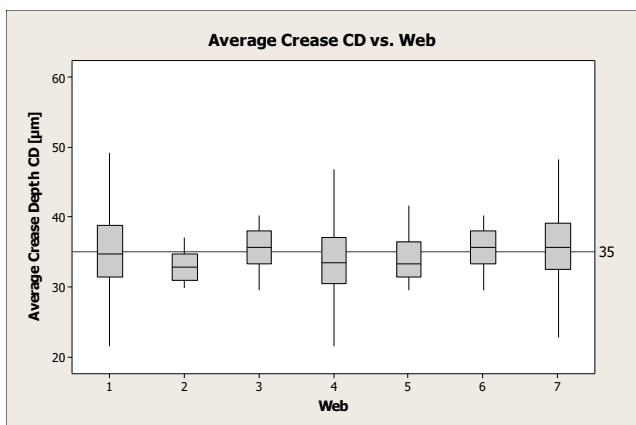


Fig.6.2: Crease depth profile of webs 1 to 7.

VII INVESTIGATION OF PHYSICAL PROPERTIES OF THE PAPERBOARD AND ITS INFLUENCE ON THE RCS BEHAVIOR

The method of ordinary least squares regression (OLS) was applied in order to investigate the relationship

between the RCS and the physical properties of the paperboard.

From the variable strongly correlated with the RCS an industrial test was proposed to validate the model.

In Figure 7.1 there is an indication that lower values of Scott Bond, lower is the RCS. For the range of RCS below 0.60 the median of Scott Bond is 202 J/m² and for RCS above 0.70, the median of Scott Bond is 217 J/m².

In Figure 5.27 the RCS MD presented showed greater reduction than the RCS CD, for lower values of Scott Bond.

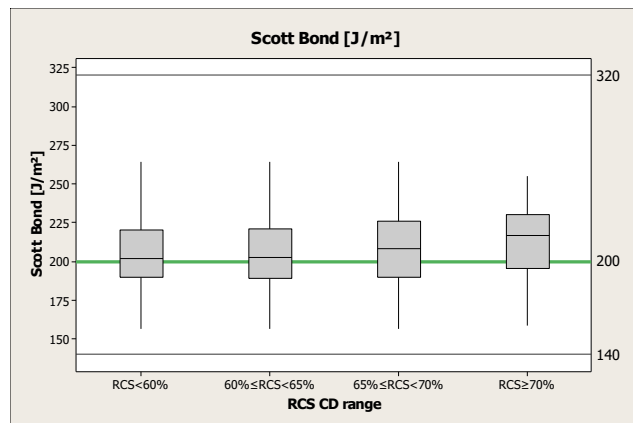


Fig7.1 – Lower Scott Bond values: lower RCS values.

The Scott bond is the most commonly used test method in the paper industry for product control for quantifying the delamination resistance of paper and board [9, 13].

This property depends on the number of fiber bonds, the average area per bond and their specific strength [14].

In the paperboard the interface properties represent the adhesion between the plies. This can be controlled in the manufacturing process by changing the dryness of the different plies before the couching point, the amount of chemicals used to increase or decrease the bonding ability of different plies and pulp properties [12, 14].

[12] observed that the interface strengths had an impact on the bending moment.

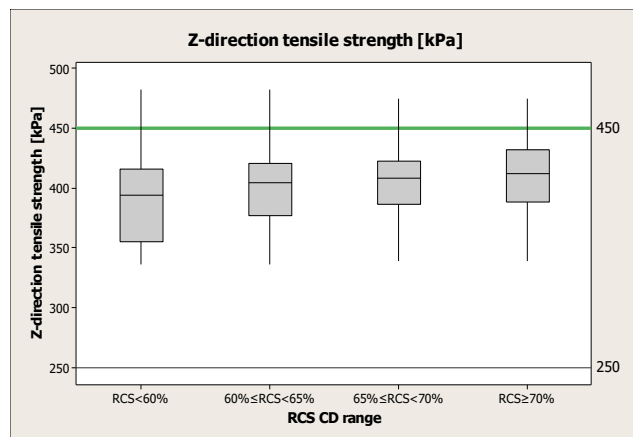


Fig7.2 - Lower values of ZDT: better RCS values range.

Thicker paperboards generally presents lower RCS [20], but this behavior was not observed in the measurements of this study, because it is small variations in only one grade. Figure 7.3.

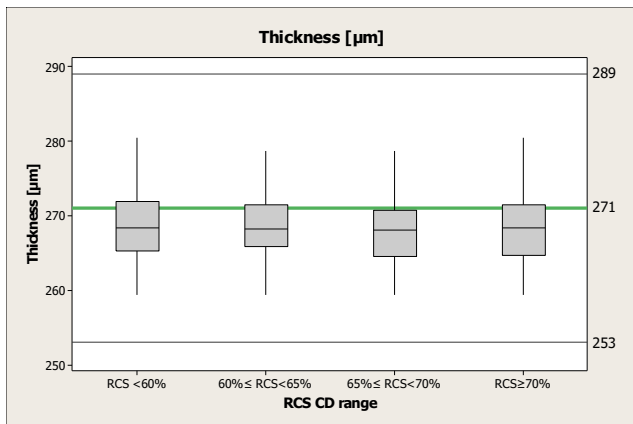


Figure 7.3 - Thickness did not presented correlation with RCS

The impact is evident when comparing products of different thicknesses. A thicker paperboard, presenting the same structure and composition, is easier creased. [24] Short compression test, tensile strength, bending force, grammage and moisture did not presented relevant correlation with RCS in this study.

An industrial test was carried out with paperboard from PM-A with high Scott Bond (271 J/m²) and from PM-B with Scott Bond close to the nominal (211 J/m²). The criterion for selection of these reels was based on the fact that Scott Bond presented the highest correlation with the RCS in the statistical analysis.

VIII. ASSESSMENT OF PM-A AND PM-B SAMPLES USING X-RAY MICROTOMOGRAPHY

Analysis of X-ray microtomography were performed in order to investigate the structure of the creased and folded area for differences that might explain the behavior in relation to the results of RCS.

The use of cutting instruments in paperboard such as scissors, knife or scalpel causes crushing of the inner layers, changing physically the fiber structure and making it impossible to view the area of interest in its original form. Computed X-ray microtomography provides the advantage of dispensing the cut sample, allowing an accurate assessment of the state of delamination of the paperboard at the wrinkle area after folding.

X-ray microtomography analyses were conducted on PM-A and PM-B samples used in the industrial test with the new creasing tool.

Figure 8.1 shows a X-ray microtomography of longitudinal and transverse creases of the paperboard produced in PM-A used in industrial test with the new

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creasing tool. Is it possible to observe a slight delamination between fiber layers. In the Figure 8.2 the X-ray microtomography of longitudinal and transverse creases of the paperboard produced in PM-B shows greater delamination with stratification of the various fibrous layers.

The most severe delamination facilitates the folding process, since there is a reduced strength in the crease area.

Figure 8.3 shows the X-ray microtomography of PM-A paperboard with lower Scott Bond. In this test the RCS MD showed a significant reduction in the reels with lower Scott Bond, evidenced by greater delamination between layers.

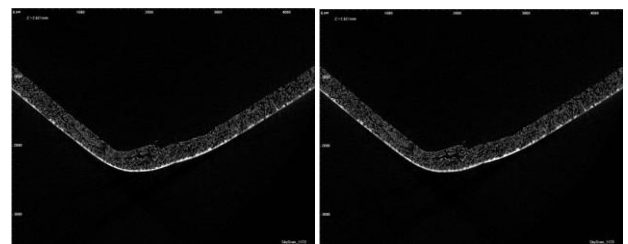


Figure 8.1 - PM-A paperboard - longitudinal crease at left and transverse crease at right.

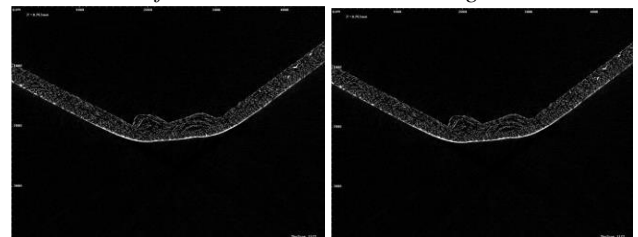


Fig.8.2 - PM-B paperboard - longitudinal crease at left and transverse crease at right

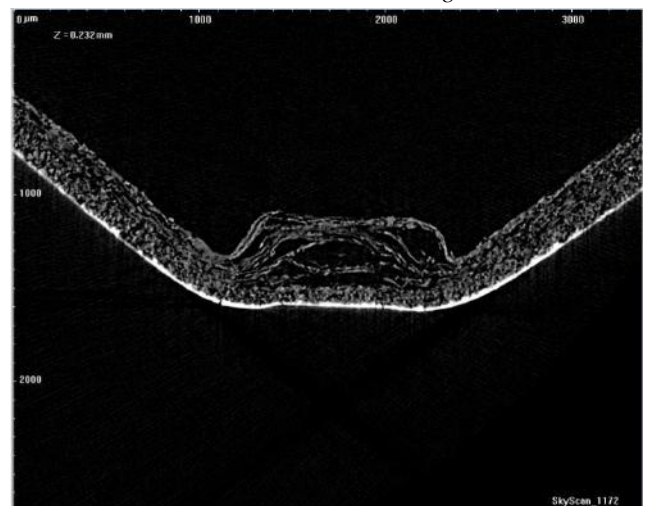


Fig8.3 - PM-A paperboard with lower Scott Bond - longitudinal crease, with significant stratification between the fibrous layers.

IX. CONCLUSION

The individual evaluation of measurements of the bending moment on the crease and uncreased paperboard revealed

a never before observed behavior. Changes in the bending moment determine the RCS value over the crease that remains more stable.

RCS at 30 degrees analysis method cannot be applied to any paperboard for liquid packaging boards. The formation of the paperboard in the Beloit StrataFlow headbox differs from the formation of paperboard with three separated headboxes, thus it was observed that the bending moment measurements for paperboard produced with in PM-A with StrataFlow headbox showed peak after 30 degrees in cross direction creases. The bending moment measurements performed in the paperboard produced in PM-A with StrataFlow headbox showed peak after 30 and thus the analysis of RCS at 30 degrees is not suitable for this type of paperboard formation.

The bending moment of uncreased paperboard at 30 degrees presents high variability and significantly impacts the RCS results.

Regression tools and Best subsets regression of the commercial software Minitab 16 were used to define which properties have the greatest impact on RCS. The Ply Bond property was relevant in both reviews and the property was selected to carry out two industrial tests: paperboard with high and low Scott Bond.

It has been shown in industrial testing the impact of Scott Bond on crease process and RCS values. High Scott Bond values impair the internal delamination necessary for good creasing at the same time should be controlled so that there is no delamination during the conversion process. Based on the industrial test was proposed change of Scott Bond specification, reducing the nominal from 200 J/m² to 180 J/m² for this product.

The X-ray microtomography of PM-A paperboard with higher RCS values confirms the lower delamination between layers compared to PM-B paperboard, which was not observed in samples with lower values of Scott Bond, whose internal delamination is more intense.

The use of X-ray microtomography allowed an evaluation of the internal area of the crease without destroying the through thickness structure and is an interesting option to be exploited in other works such as investigation of cracks in the paperboard, for example.

X. FINAL CONSIDERATIONS

From the results it is possible to suggest for future work:

- To evaluate the effect of moisture from the paperboard during the crease, considering the impact during transport and conversion;
- RCS measuring comparative conduct held in L & W equipment and bending factor in Marbach equipment;
- Assess the applicability of X-ray microtomography analysis of the cracks observed in samples with RCS above the specification.

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Proposal for a Reference Model for Sales & Operations Planning and Aggregate Planning

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Abstract— Companies are increasingly adopting practices aimed at improving the quality of management, with the main purpose of enabling them to act competitively in the present market characterized by high competition and strong organizational changes. Among the improvements developed, we highlight the adoption of Enterprise Resource Planning (ERP) systems. However, the high cost of deploying and maintaining this type of technology can be a barrier for small and medium-sized enterprises (SMEs) that want to achieve such advances. Therefore, it is essential to develop a reference model of typical business planning modules to support ERP implementation, aiming at reducing time and cost in the elaboration of a particular model. In this context, the main objective of this paper is to develop a reference model from the elaboration of the processes related to Sales & Operations Planning (S&OP) and Aggregate Planning (AP), important modules of Production Planning and Control (PPC). The methodology used for the elaboration of this work was divided in eight sequential stages: study of the functions of S&OP and AP, study of process modeling area, definition of reference model processes, choice of modeling notation, choice of modeling tool, development of the reference model, software development and results analysis. The modeling methodology employed in this work was the Business Process Model and Notation (BPMN), through the tool Bizagi Process Modeler version 3.1.0.011. The software was developed through the interface Delphi version 7.0 (Object-Pascal language) in order to apply the reference model in the support to the implementation of a business management tool. As results, from a formal documentation, the reference model proved to be a useful tool in understanding and communicating the business processes raised. It is also concluded that the implemented model is able to support the implementation of production management systems in real situations.

Keywords — Reference model, Sales & Operations Planning, Aggregate Planning, BPMN.

I. INTRODUCTION

The organizations are progressively adopting practices aimed at improving the quality of management, with the main purpose of enabling them to act in a competitive way in the present market. Among the improvements developed by the companies, we highlight the adoption of Enterprise Resource Planning (ERP) systems [1].

A common aspect when adopting an ERP system is that most of these technologies require that the activities, functions, information and resources of the processes that are carried out by the company be surveyed and documented, that is, that the existing Business Processes be mapped in the organization.

In this sense, modeling the processes of a company provides a better understanding of the premises related to the management inherent to its systems and, also, evidences viable alternatives for the existing organizational activities, in order to provide an effective reference for the decision making process [2]. Based on a reference model, it is possible to analyze the best use of its industrial potential, in order to obtain more effective answers to the constant changes that have occurred in the market.

However, the business process modeling activity is not yet a common practice among organizations, which contributes to the increase in cost and time of system implementation or improvement projects, due to the need to develop new models related to their Business Processes [1]. If companies already had a reference model, this activity would not be necessary. Case studies have shown that the use of reference models can reduce the cost and time of implementation of organizational projects by up to 30% [3].

In the business context, one of the Business Processes essential for manufacturing companies is Production Planning and Control (PPC). This process is responsible for the good planning of activities and resources that will directly influence the guarantee of the availability of the final product to customers, as well as the economic aspects for the company, since it covers the purchase of inputs and

the use of capital [4]. Among the basic concepts of the hierarchy of the PPC function, we highlight the Sales & Operations Planning (S&OP) and the Aggregate Planning (AP). These modules are seen as a long-term planning tool not only for production, but also for sales, aggregate demand forecasting and resource capacity planning [5].

Most small and medium-sized enterprises (SME) are aware that they should improve their production planning activities and thus achieve greater operational efficiency [6]. However, for the authors, these organizations simply do not know how to do this, since the vast majority of research and solutions for PPC is focused on large companies. Therefore, it is important to note that there is an academic gap regarding work to support the implementation of production management systems for SME.

Thus, the reference model presents itself as a viable tool for SMEs, allowing users themselves to adjust processes or modules of the system to the reality of their organization, comparing their activities with the proposals by the conceptual model and supporting in the implementation of management systems integrated businesses [7].

In view of the above, it is important to note that for the support in the development and implementation of a low-cost ERP system, it is essential to develop a conceptual reference model of the typical modules related to the Business Processes of companies focused on the activities of production planning, in which, from this model, organizations can build their own according to each institutional reality.

With the purpose of supporting SME in the development and implementation of ERP systems of the activities and typical information of production management, the present work has the objective of developing a reference model that addresses the Business Processes related to S&OP and AP. In addition, this work aims to develop a software prototype through the Delphi interface in order to generate a greater consistency between the abstraction of the reference model and its application in supporting the implementation and development of business management tools.

The paper is divided into the following sections: Literature Review; Methodological Aspects; Results and Discussion; Application in the Educational Model; and, Final Considerations.

II. LITERATURE REVIEW

2.1 Sales & Operations Planning and the Aggregate Planning

S&OP aims to reconcile demand with long-term supply capacity and at the lowest possible cost, in which equilibrium occurs in terms of volume rather than product mix. Demand management interfaces with the AP through demand forecasting and long term capacity planning

(Resource Requirements Planning - RRP) is responsible for developing the feasible plan for resource availability. In this planning, the predictions are more accurate for families and groups than when we open for individual items [8].

The application of AP concepts is related to the grouping of the various products demanded by the market in families and, for convenience, also the processing capacity of production as a whole is added, not by productive unit [9]. The AP is part of the strategic decisions of the organization, having as one of its goals the directing of productive resources to the chosen strategies, giving consistency to the operational strategy [10]. Each strategy gives the organization a different flexibility in response to uncertain demand. To determine which strategy to adopt, one way is to take as a basis the total cost of each.

In hierarchical production planning systems, AP is designed to balance capacity requirements and production quantities for medium-term planning horizons [11]. Aggregate plans provide the basic input for new planning steps, such as Master Production Schedule (MPS).

The RCCP is a planning that supports the following decisions at the S&OP/AP level: anticipate the need for resource capacity that requires a relatively long term, in months, for its mobilization and procurement; and subsidize the decisions of how much to produce of each family of products, mainly regarding the limitation of capacity and resources, when it is not possible to fulfill all the sales plans [4] [12].

The identification phase of processes and hierarchical levels is considered the key step in process modeling, since it aims to identify all existing Business Processes in a particular activity of an organization.

The Figure 1 presents the model of the hierarchy of the PPC (Production Planning and Control) processes relating the planning of the capacity of its resources with the planning of the needs of its materials. The hierarchical decomposition of the PPC function starts from the understanding of the basic concepts related to the levels of material planning, namely: Sales & Operations Planning (S&OP) and Aggregate Planning (AP); Master Production Planning (MPS); Material Requirements Planning (MRP) and Production Schedule (PS) [4][16]. This paper will be limited in the development of the reference model of the S&OP/PA and RRP.

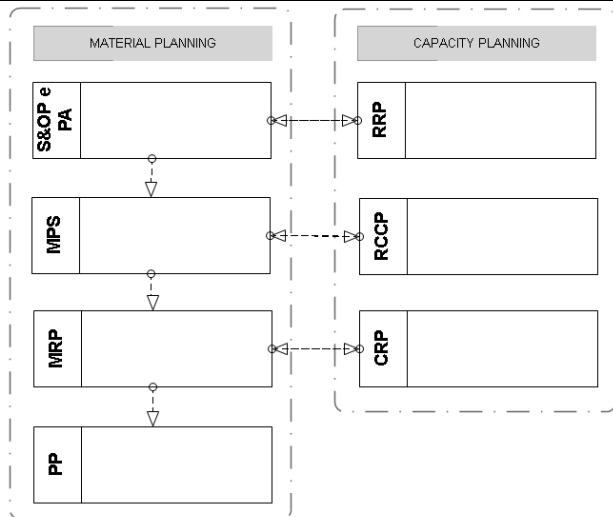


Fig. 1: Stages of research methodology

2.2 Reference Model

Reference modeling is defined as the process of formally documenting a problematic domain in order to understand and communicate stakeholders [13].

Reference models, which can be developed in real situations or in theoretical studies, document the various aspects of a business process [1] and distinguish between procedural or standard software implementation models, and business models such as models for production management and product development [3].

The objective of the reference model is to provide the company with an initial solution for its Business Processes, so that, through it, the particular model of the company [1] is specified and detailed.

The advantages in adopting reference models are to reduce time and cost in the development of the particular model; comparing the activities of the company with the activities proposed in the model, that is, best practices; and better support in the implementation of integrated enterprise management systems [14].

III. METHODOLOGICAL ASPECTS

3.1 Definition of research method

The reference model was developed from theoretical studies. Thus, this research uses the procedures of bibliographic research, since it was developed from previous works, such as dissertations, articles and books on the subject treated. In this way, future work can be based on the conclusions presented in this paper, and elaborate hypotheses aiming to deepen the study on the subject or related specific aspects.

On the other hand, this research can also be classified as experimental, since it is based on the creation of a reference model of a Production Planning and Control system, which was modeled through software.

Thus, with the objective of developing a reference model and exposing the way it was developed from the analysis

of the activities involved in the processes, allow this work to be classified as a descriptive research.

3.2 Stages of research methodology

The methodology used for the elaboration of this work was divided into eight sequential steps, as shown in Figure 2.

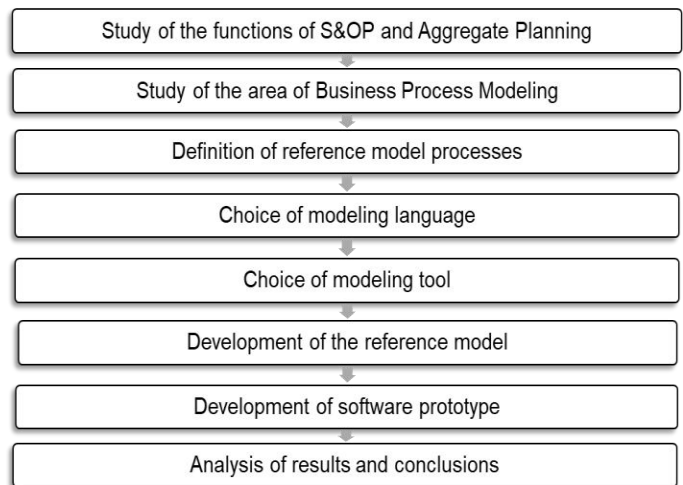


Fig. 1: Stages of research methodology

Initially, the bibliographical references related to the two main topics that covered the areas of knowledge of this work were studied: S&OP/AP and Business Process Modeling (BPM). The first is, in particular, concepts of functions and activities of production planning and the second about concepts, languages and reference models.

In the next step, the modeling language and, later, its tool were defined, in order to provide facilities in the understanding and visualization of the models, that is, the full understanding of the functions of a system. Based on the language and defined modeling tools, it was developed, based on theory and notation, reference models for the development of the S&OP/AP system module, in addition to the RRP, in Bizagi Process Modeler software version 3.1.0.011.

It is important to highlight that the success of business process modeling depends, above all, on the appropriate selection of the methodology used. Among the existing tools, BPMN is configured with one of the languages currently used by industry and universities [15]. However, it is observed in the researched literature that such notation is still little explored for the development of models for production planning.

Once the system model was elaborated, a software was developed with the purpose of applying the model, from the interface Delphi version 7.0, Object-Pascal language.

As a last step, the results presented in previous phases were discussed, as well as the conclusions obtained and suggestions for future work.

IV. RESULTS AND DISCUSSION

4.1 S&OP and AP model

S&OP is considered as a long-term planning instrument for production, sales and demand forecasting. Thus, the

S&OP and Aggregate Planning model, as shown in Figure 2, presents the production planning of a particular family of products where, initially, it is necessary to perform the demand forecast calculation, based on the demand history of this product in the pre-established planning period. It is noted that the intrinsic objective of S&OP is to maintain an adequate balance between supply and demand.

The input and output information required to construct the reference model of the S&OP and AP module are shown in Table 1.

Table.1: Information about S&OP and AP.

Information	
Input	Output
Product family	Demand Forecasting
Long-term planning period	Aggregate production
Aggregate demand history	Projected Stocks
Production strategy	Sales forecast
Productive costs	Prediction of delay or loss of sales
Stocking costs	Gross Revenue
Cost of sales losses or delays	Return of investment
Initial inventory	Aggregate Production Plan
Unit selling price	
Salary	
Long-term capacity plan	

The reference model for the proposed S&OP and Aggregate Planning (Figure 2) brings, firstly, the definition of the product family, in which production will be planned [8] [9] [16]. Next, the long-term planning period is also defined [11] [12] [16] [17] [18] [19].

Then, according to the model developed, it is necessary to choose the demand prediction technique (simple moving average, weighted moving average, linear regression or exponential smoothing). From a data base on the demand history of the product family and the selected forecasting technique, the aggregate demand forecast is calculated [12] [19] [20] [21] [22].

In the planning production stage, it is initially necessary to define the production strategy to be adopted by the organization (constant production, demand monitoring or mixed strategy) [22] [23] [24]. Based on the strategy chosen and the long-term productive capacity emitted by the RRP, discussed in topic 4.2, the planned aggregate production is defined [16].

Once the aggregate production plan is defined, the projected inventories are calculated, which for this operation takes into account the initial stock present in the organization and also the estimated demand forecast [16] [21] [25] [26]. In the same way, taking into account these two variables (forecast of demand and aggregate

production) is calculated the projections of sales losses and delivery delays.

In the production costs calculations phase, from the production plan issued, the company must carry out a survey of the costs organizations inherent to the production, considering the productive conditions, in addition to the normal ones, in extra shifts and, also, for the subcontracting of hand when necessary [16] [21] [25] [26].

After the calculation of productive costs, the total costs of wages are calculated, in which the value of wages and the quantity of labor is essential [16] [21] [25] [26].

In calculating raw material costs, information on the quantity of production in the family of products, as well as the unit cost of the raw material [16] [21] [25] [26] is required.

For the calculation of the storage cost, from the projection of inventories made, the organization must carry out a cost survey to maintain the inventory in the company. Following the same logic, it is also calculated the cost with sales losses and delivery delays [16] [21] [25] [26].

Next, the sales forecast calculation is carried out, which takes for computation purposes, the quantity of items produced, expressed in the aggregate production plan, and sales losses or delivery delays [16] [21] [25] [26]. Following this step, the gross revenue from the production of the planned product family is calculated based on the definition of the unit sales price of these products [18].

For calculating the projection of return on investments, the gross revenue calculated in the previous activity and the total calculated costs (production, storage and sales losses / delivery delays) are taken into account [21].

Finally, after the establishment of the production plan, projected inventory and return on investment, the aggregate production plan is issued. In case of need, it is possible to carry out a review of this plan elaborated. After the review, then, the consolidated plan of the S&OP and AP is issued [16] [25] [26].

4.2 RRP model

On the other hand, the RRP aims to calculate the need for resource capacity that require a relatively long term in months, and to subsidize the decisions of how much to produce of each family of products, mainly regarding the limitation of capacity and resources when it is not possible to meet sales plans. That is, it is a planning that aims to support the following decisions at S&OP and AP level.

The input and output information required to compile the reference model of the RRP module are shown in Table 2.

Table.2: Information about RRP

Information	
Input	Output
Product family	Planned normal capacity
Long-term planning period	Planned extra capacity
Working days	Planned subcontracted

Daily working hours Amount of labor Quantity of subcontracted labor Overtime of daily work Aggregate production rate	capacity loading rate Value of man-hours worked Resource Requirements Planning	Aggregate production In the RRP model, as shown in Figure 3, it begins with the definition of the product family [9] [15] [19] and the long-term planning time [4] [5] [19], according to with what was established by the S&OP and AP planning stage.
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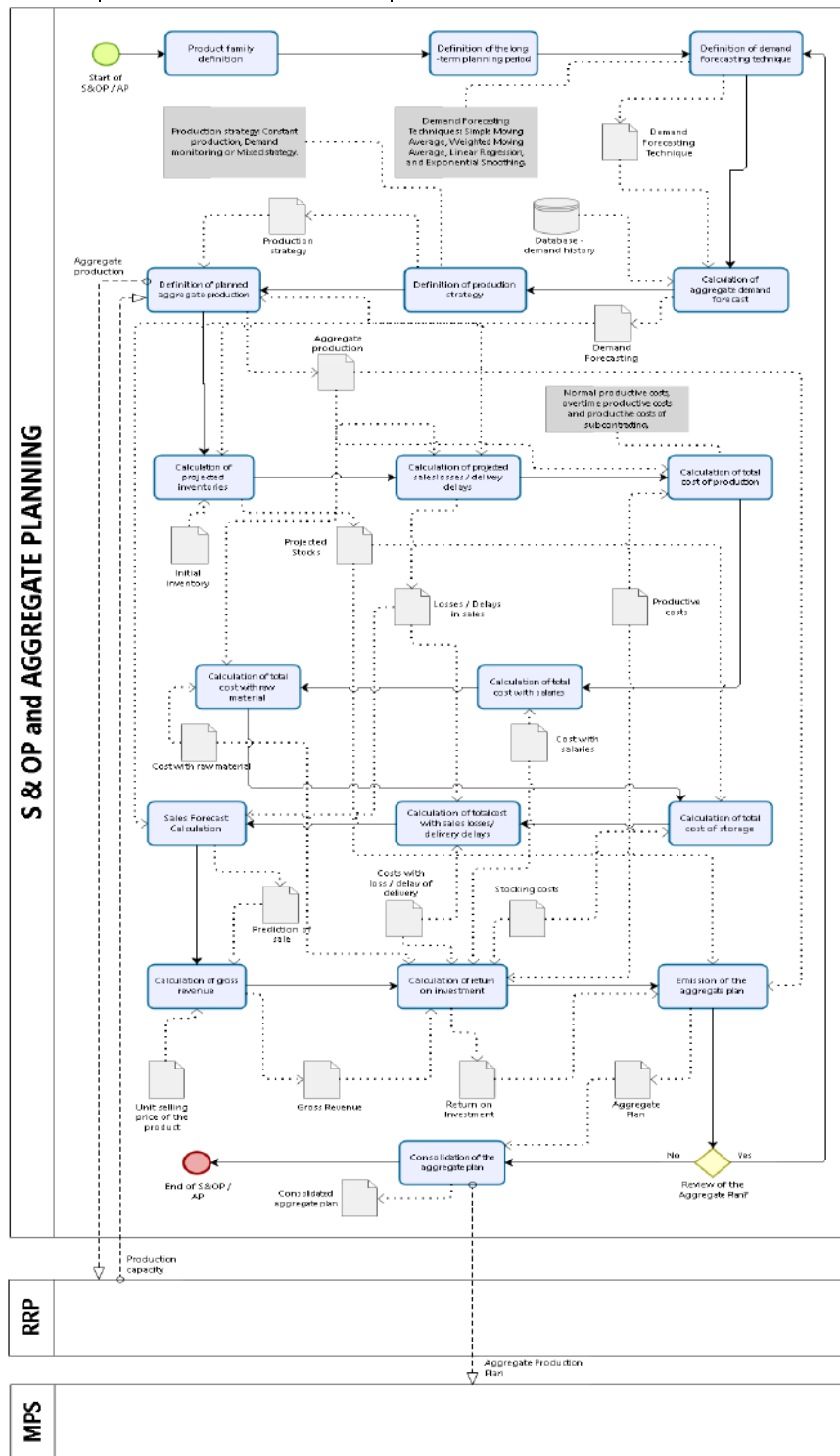


Fig. 2: S&OP and AP model in BPMN

Then, the planned capacity calculation is performed, which in this developed model was divided into: planned normal capacity, planned subcontracted capacity

(subcontracting of labor) and extra planned capacity (overtime) [4] [11] [21].

According to the RRP model, for the calculation of the normal capacity planned it is necessary to collect the

following information: quantity of labor, aggregate production rate, daily working day and working days of the planning period. Similarly to the previous evaluation, in order to calculate the planned subcontracted capacity, it is essential, in addition to the aggregate production rate, the daily working day and the working days of the planning period, the survey of the amount of subcontracted labor, if there is. In order to calculate extra-planned capacity, it is necessary to know the following information: quantity of labor, aggregate production rate, overtime and working days of the planning period [4] [11] [21]. From the calculation of planned normal capacity, planned subcontracted capacity and extra-planned capacity, the total planned production capacity is calculated.

Then, to calculate the loading rate, it is necessary to collect the production plan information from the planning stage of the S&OP and AP (total capacity required), as well as the total planned capacity [21].

Finally, in order to calculate the value of man-hours worked, it is essential to have information on the salary of each worker and also the working time of these workers, which includes the daily working hour, overtime and working days over the planning period [27]. After this last stage, the long-term capacity plan for S&OP/PA is issued. If necessary, a revision of this plan is possible [4] [11]. As previously seen, this information is required for the analysis and definition of aggregate production in the S&OP/PA step.

The reference model, in BPMN notation, referring to the RRP module is shown in Figure 3.

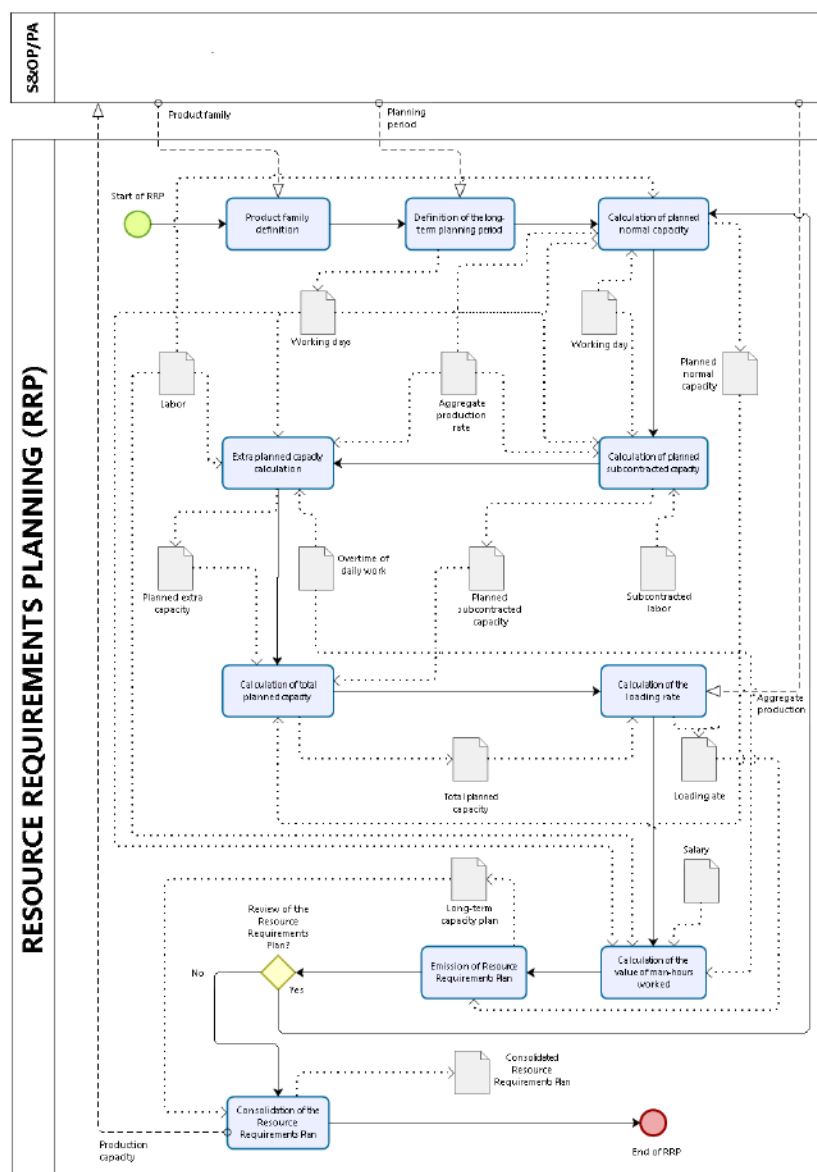


Fig. 3: RRP model in BPMN

4.3 Software prototype

With the intention of generating a greater consistency between the abstraction of the reference model and its application in supporting the implementation and

development of business management tools, a software prototype was developed through the Delphi interface. Figure 4 shows the first screen of the developed business management software.

Fig. 4: First screen of the computational program of the MPS and RRP module

In order to validate the software, several tests were carried out, with different planning scenarios and production strategies, in order to verify the accuracy and precision of the calculations used to prepare the final aggregate plan.

The results obtained by the computational program were compared with the results extracted manually and in electronic spreadsheets. In this way, software developed from the developed reference model proved to be reliable and apt to be used for the elaboration of aggregate production plans.

V. CONCLUSION

From a formal documentation, the reference model proved to be a useful tool in understanding and communicating the existing processes in S&OP/AP and RRP. It was also verified that this developed model is able to support the implantation of production management systems in real situations. However, for use in corporate environments, these processes should receive expertise from ERP systems, and users should be familiar with the terms and variables involved in the reference model.

It is worth mentioning that the reference model has been configured as an important tool for knowledge management, since it is capable of storing and documenting existing knowledge in the business processes and serves as a basis for planning the development of new knowledge, always being guided by the strategic objectives of the company. Another application observed for the reference model is the teaching of PCP.

For future work, it is suggested, in a complementary way to the model constituted in this work, the development of

a model approach in a holistic and hierarchical way the other modules of the Business Processes related to the PPC. For purposes of validation, it is suggested the dissemination and application of the software, developed from the reference model, in SMEs with activities focused on production planning.

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Investigation of Seismic Parameters of R.C. Building on Sloping Ground

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Abstract— As we all know that the R.C. structures which are constructed on slope of mountains are commonly asymmetrical in shape in downward gradient and when these are in contact with earthquake effects, exposed to massive destruction. When considering the horizontal and vertical planes of these R.C. structures, it shows dissimilar floor stiffness along with floor mass. The objective of this investigation is to compare the outcomes from dynamic method of earthquake analysis performed on R.C. structures with five different configurations like, regular building, Step back building 20⁰, Step back building 30⁰, Step back Set back 20⁰ building and Step back Set back 30⁰ building are presented. Analysis containing storey displacement in X and Z directions along with the storey drift, storey shear and time period has carried out by using Response Spectrum Method.
Keywords— Earthquake effects, Multistory building, Response spectrum, Sloping Ground, Step back, Step back set back.

I. INTRODUCTION

Since as per seismic history of India, I.S. 1893 shows the seismic zones where earthquake occurred and it is detected that most of them have been occurred in northern and north-eastern states of India especially in hilly region. Since there had been a problem of construction space limitation, a demand to construct buildings on hill slope has now the main attention. Since the shortage of plain earth in hilly area forces the construction activity on sloping ground.

The solution for this problem is to construct buildings on hill slope that is only feasible choice to put up the growing demand for commercial along with residential living space. However, adopting the construction activity of multi-storey structures in these earthquake prone areas, special attention should be given when designing these buildings earthquake resistant.

II. OBJECTIVES OF THE PRESENT STUDY

It was witnessed from the earlier seismic activities that the buildings which are situated over hilly regions have greater extent of failure due to earthquakes along with a mass factor which has supposed to be projected at a decline angle towards the valley. Hence for this active region extreme care should be taken for making these multistorey structures seismic proof.

The objectives of this work are as follows:

1. Use of response spectrum method in step back, step back set back and plain ground multistoried structure.
2. To compare the analytical results of 20⁰ and 30⁰ step back and step back set back structure.
3. To calculate maximum displacement and drift values for the comparison of all the 5 cases.
4. To compare base shear, time period along with mass participation factor shows dynamic response result of the 5 cases used.
5. To find out the most economical structural design on sloping ground using Staad pro software.

III. METHODOLOGY AND MODELLING APPROACH

This examination contains G + 8 storey residential building having 6 bays in x direction and 6 bays in z direction for a total of 5 cases that are mentioned in table 1 and figure 1-2. According to various cases, 20⁰ along with 30⁰ sloping structure were made. Using Indian Standard code 1893 (part 1): 2002, various parameters are taken, assuming the structure is to be located in seismic zone V and on rested over medium soil.

Several data used in this study for modeling and loadings are as follows:

- Length of building = 18 m along with a projection of 3 m of 12 m in width.
- Width of building = 18 m along with a projection of 3 m of 12 m in width.
- Height of each storey = 3.66 m.
- Dead load as per IS 875 part I = 12 KN/m² (intermediate floors).

- Dead load as per IS 875 part I = 10 KN/m² (roof).
- Live load as per IS 875 part II = 2 KN/m².

Design parameters for Zone V are as follows:

- Zone factor Z=0.36 (ZONE V)
- Importance factor I = 1
- Response reduction factor R = 5
- The fundamental natural period (Ta) for moment resisting frame building with brick infill panels:-

$$T_a = \frac{0.09h}{\sqrt{d}}$$

Total 5 Cases are used in this work and these models are prepared in Staad Pro software.

Table.1: Different Cases with respect to building configurations

S. No.	CASES	Building Configurations
1	CASE 1	Regular building on plane ground
2	CASE 2	Step back building 20 degree
3	CASE 3	Step back building 30 degree
4	CASE 4	Step back Set back building 20 degree
5	CASE 5	Step back Set back building 30 degree

Table 2: Geometrical properties of members for different Cases

CASES	Size of Beam	Size of Exterior Column	Size of Interior Column	Thickness of Slab
CASE 1	500 mm x 300 mm	450 mm x 450 mm	450 mm x 450 mm	125 mm
CASE 2				
CASE 3				
CASE 4				
CASE 5				

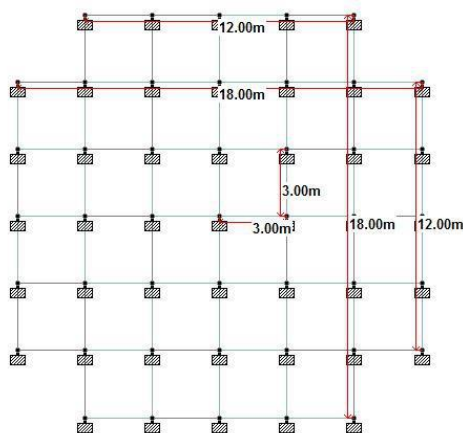


Fig.1: Plan of multistoried structure

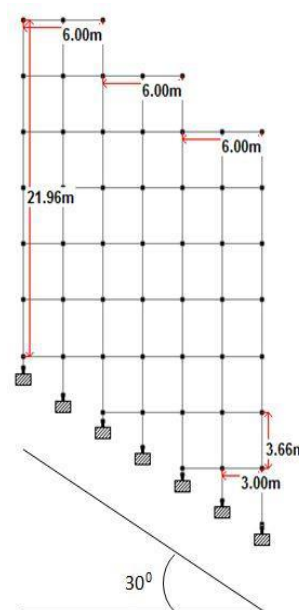
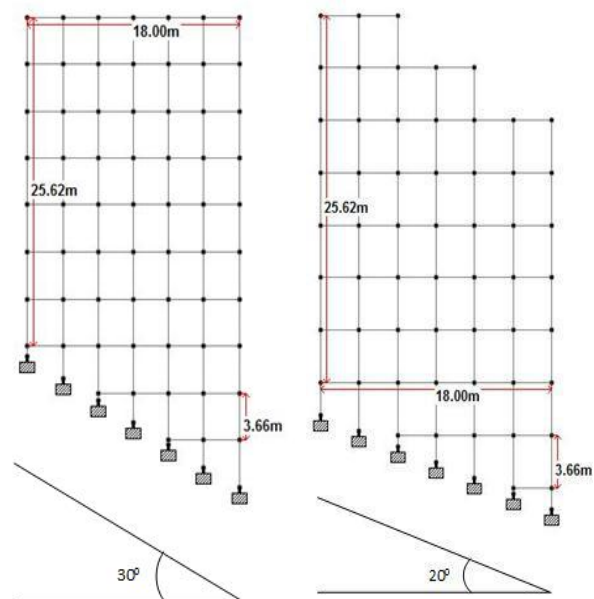
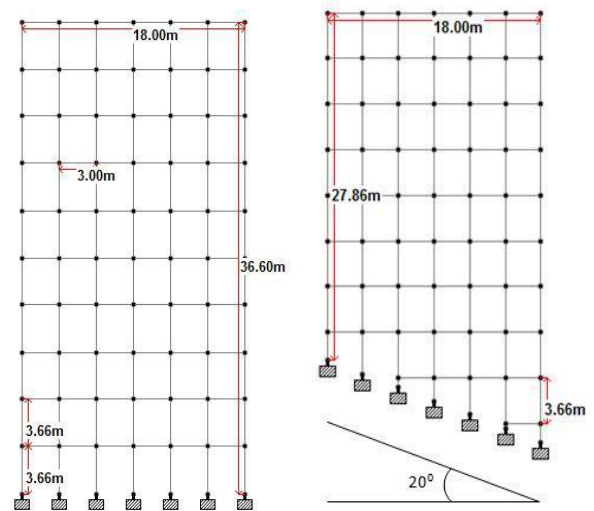


Fig.2: Elevation of various cases of multistoried structure

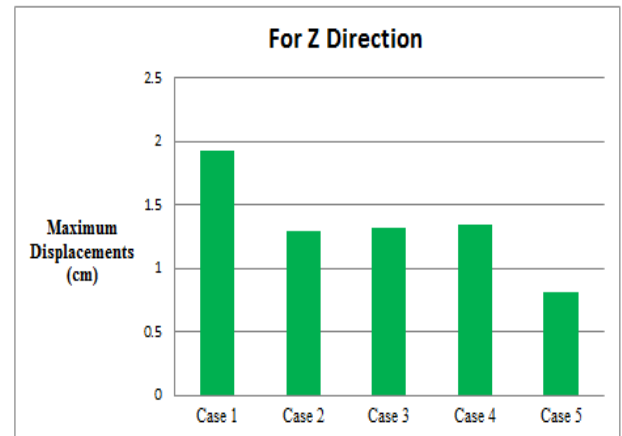
IV. RESULTS ANALYSIS

Since for the analysis of seismic effects, all the cases of the structures have been analyzed for seismic shake for longitudinal along with transverse direction. Various loads along with load combinations applied on all the cases and reflective result parameters have been analyzed with each other to determine the efficient case. Results are shown both in tabular form as well as graphical form.

Table.3: Maximum Displacement in X direction of R.C.C. for all 5 cases in Zone V

S. No.	Height (m)	Maximum Displacement (cm)				
		For X Direction				
		CASE 1	CASE 2	CASE 3	CASE 4	CASE 5
1	0	0	0	0	0	0
2	3.66	0.1782	0.0011	0.0020	0.0011	0.0001
3	7.32	0.4201	0.0182	0.0044	0.0178	0.0018
4	10.98	0.6684	0.1698	0.0461	0.1648	0.0043
5	14.64	0.9150	0.4127	0.3005	0.3953	0.0365
6	18.3	1.1535	0.6561	0.5768	0.6198	0.2257
7	21.96	1.3766	0.8878	0.8407	0.8247	0.4194
8	25.62	1.5757	1.0988	1.0812	0.9993	0.5874
9	29.28	1.7409	1.2788	1.2878	1.1311	0.7158
10	32.94	1.8615	1.4169	1.4494	1.2656	0.8478
11	36.60	1.9308	1.5054	1.5379	1.7217	1.0121

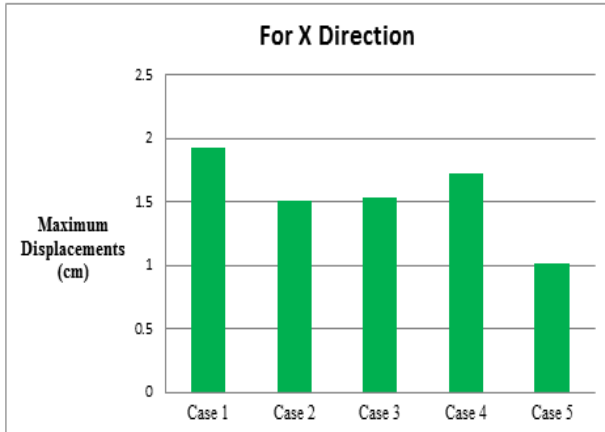
6	18.3	1.1535	0.5968	0.5337	0.5876	0.2331
7	21.96	1.3766	0.7992	0.7511	0.7826	0.4062
8	25.62	1.5757	0.9803	0.9443	0.9507	0.5567
9	29.28	1.7409	1.1302	1.1032	1.0783	0.6714
10	32.94	1.8615	1.2379	1.2168	1.1884	0.7622
11	36.60	1.9308	1.2962	1.3173	1.3457	0.8135



Graph 2: Maximum Displacement in Z direction of R.C.C. for all 5 cases in Zone V

Table.5: Storey Drift in X direction of R.C.C. for all 5 cases in Zone V

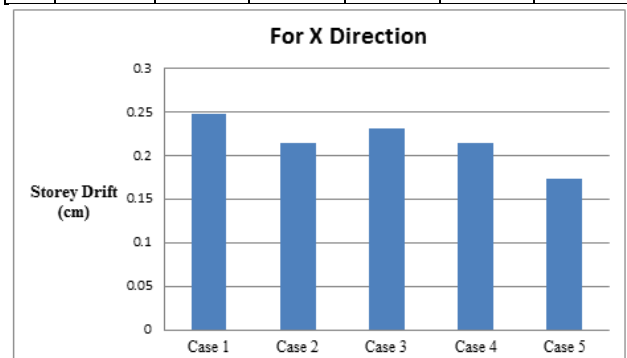
S. No.	Height (m)	Storey Drift (cm)				
		For X Direction				
		CASE 1	CASE 2	CASE 3	CASE 4	CASE 5
1	0	0	0	0	0	0
2	3.66	0.1782	0.0002	0	0.0002	0
3	7.32	0.2419	0.0221	0.0089	0.0206	0
4	10.98	0.2483	0.1445	0.0761	0.1414	0.0067
5	14.64	0.2466	0.2153	0.2174	0.2141	0.0573
6	18.3	0.2385	0.2147	0.2313	0.2113	0.1691
7	21.96	0.2231	0.2024	0.2174	0.195	0.1731
8	25.62	0.1991	0.1811	0.1932	0.1681	0.1505
9	29.28	0.1652	0.1499	0.1589	0.1276	0.1147
10	32.94	0.1206	0.1077	0.1136	0.1101	0.0908
11	36.60	0.0693	0.0583	0.1005	0.1573	0.0513



Graph 4: Maximum Displacement in X direction of R.C.C. for all 5 cases in Zone V

Table.4: Maximum Displacement in Z direction of R.C.C. for all 5 cases in Zone V

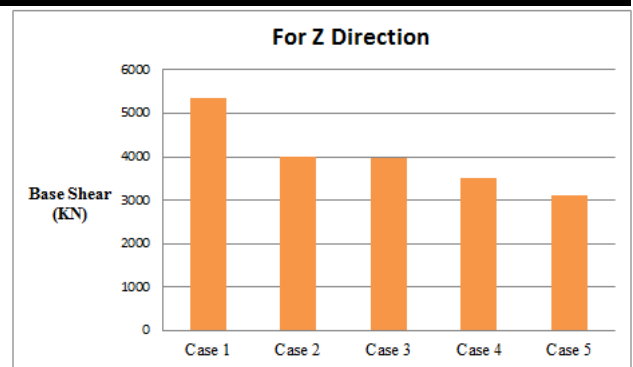
S. No.	Height (m)	Maximum Displacement (cm)				
		For Z Direction				
		CASE 1	CASE 2	CASE 3	CASE 4	CASE 5
1	0	0	0	0	0	0
2	3.66	0.1782	0.0002	0	0.0002	0
3	7.32	0.4201	0.0223	0.0089	0.0208	0
4	10.98	0.6684	0.1668	0.0850	0.1622	0.0067
5	14.64	0.9150	0.3821	0.3024	0.3763	0.0640



Graph 3: Storey Drift in X direction of R.C.C. for all 5 cases in Zone V

Table.6: Storey Drift in Z direction of R.C.C. for all 5 cases in Zone V

S. No.	Height (m)	Storey Drift (cm)				
		For Z Direction				
		CASE 1	CASE 2	CASE 3	CASE 4	CASE 5
1	0	0	0	0	0	0
2	3.66	0.1782	0.0002	0	0.0002	0
3	7.32	0.2419	0.0221	0.0089	0.0206	0
4	10.98	0.2483	0.1445	0.0761	0.1414	0.0067
5	14.64	0.2466	0.2153	0.2174	0.2141	0.0573
6	18.3	0.2385	0.2147	0.2313	0.2113	0.1691
7	21.96	0.2231	0.2024	0.2174	0.195	0.1731
8	25.62	0.1991	0.1811	0.1932	0.1681	0.1505
9	29.28	0.1652	0.1499	0.1589	0.1276	0.1147
10	32.94	0.1206	0.1077	0.1136	0.1101	0.0908
11	36.60	0.0693	0.0583	0.1005	0.1573	0.0513



Graph 6: Base shear comparison for Z direction

Table.8: Time Period and mass participation factor for case 1

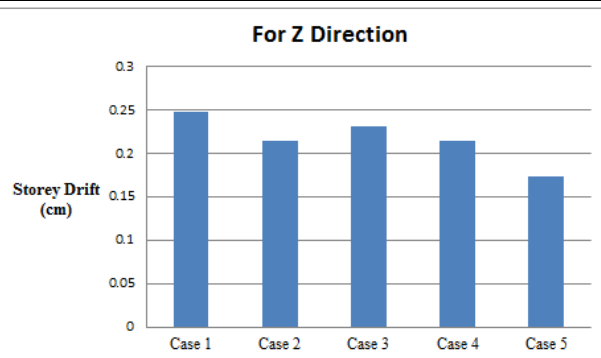
Mode No.	Time Period (Seconds)	Participation X %	Participation Z %
1	1.713	0.006	81.723
2	1.713	81.723	0.006
3	1.495	0	0
4	0.563	0	10.447
5	0.563	10.447	0
6	0.495	0	0

Table.9: Time Period and mass participation factor for case 2

Mode No.	Time Period (Seconds)	Participation X %	Participation Z %
1	1.371	0	71.91
2	1.347	74.291	0
3	1.172	0	3.079
4	0.449	0	9.158
5	0.441	9.598	0
6	0.387	0	0.412

Table.10: Time Period and mass participation factor for case 3

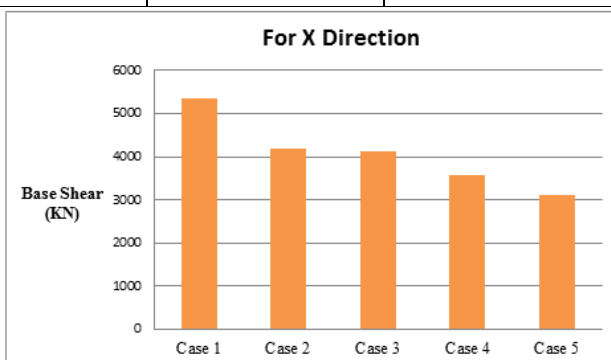
Mode No.	Time Period (Seconds)	Participation X %	Participation Z %
1	1.293	0	66.408
2	1.247	66.984	0
3	1.099	0	2.799
4	0.422	0	8.743
5	0.405	8.474	0
6	0.363	0	0.321



Graph 4: Storey Drift in Z direction of R.C.C. for all 5 cases in Zone V

Table.7: Base shear comparison for X direction

CASES	Base Shear (KN)	
	X direction	Z direction
CASE 1	5341.73	5341.73
CASE 2	4188.78	3988.71
CASE 3	4129.45	3977.33
CASE 4	3561.91	3520.29
CASE 5	3116.92	3098.08



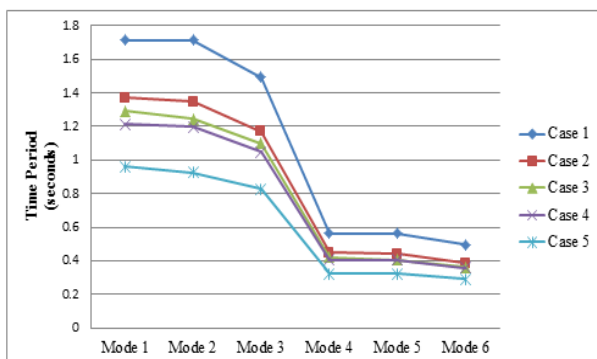
Graph 5: Base shear comparison for X direction

Table.11: Time Period and mass participation factor for case 4

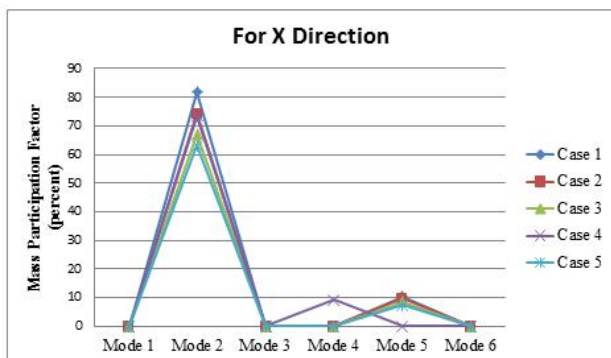
Mode No.	Time Period (Seconds)	Participation X %	Participation Z %
		CASE 4	
1	1.215	0	73.544
2	1.199	73.56	0
3	1.049	0	0.928
4	0.405	9.101	0
5	0.404	0	9.097
6	0.357	0	0.213

Table.12: Time Period and mass participation factor for case 5

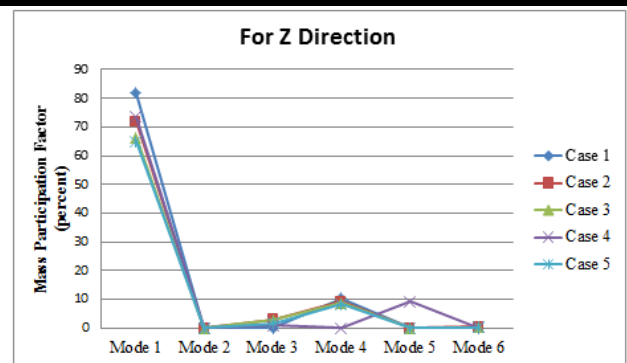
Mode No.	Time Period (Seconds)	Participation X %	Participation Z %
		CASE 5	
1	0.962	0	64.885
2	0.926	63.165	0
3	0.829	0	1.558
4	0.323	0	8.201
5	0.322	7.298	0
6	0.291	0	0.242



Graph 7: Time Period for total 5 cases



Graph 8: Mass participation factor for X direction of total 5 cases



Graph 9: Mass participation factor for Z direction of total 5 cases

V. CONCLUSION

The following conclusion has been investigated by different model configurations are as follows:-

1. At height of floors i.e. 3.66 m, the maximum displacement in longitudinal direction has a maximum value of 1.19308 cm for case 1 and minimum value of 1.0121 cm obtained for case 5. Transverse direction shows a maximum value of 1.9308 cm for case 1 and minimum value of 0.8135 cm obtained for case 5.
2. Storey drift seems to be greatest for case 1 with a value of 0.2483 cm and for transverse direction, maximum value seems to be 0.2485 cm for case 1.
3. Base shear values seem to be greatest for case 1 with a value of 5341.73 KN in longitudinal direction and least value seem to be in case 5 with a value of 3098 KN.
4. Time period along with participation factor seems to be acting mostly in case 1 and 2.
5. The most economical section for sloping ground when comparing all 5 cases has observed to be case 5 that is step back set back 30 degree model.

ACKNOWLEDGEMENTS

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The use of BMI and Abdominal Circumference in the Diagnosis of Obesity in Schools: a Systematic Review

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Abstract— *To verify body composition or body weight distribution in a more traditional way, isolated body weight or height adjusted weight has been used. In the last 5 years, evaluations have been used to verify the distribution of this fat, where these measures are more preventive to health. The objective of the study was to analyze the studies that indicate the use of BMI and waist circumference as a tool to diagnose obesity. The current study is a systematic review, where it followed the criteria of a systematized review and meta-analysis proposed by the PRISMA protocol. The criteria adopted for the selection of articles were the use of the following variables for obesity: BMI, Circumference of abdomen, relation of C.A with stature and C.A and body weight. After consulting the databases selected to search for articles, 1,846 articles were identified on the topic of interest with the descriptors (obesity in schoolchildren). 410 articles were found on the Scielo platform, 150 articles were found on the Bireme platform. In the Pubmed platform 1,236 articles and finally in the Scopus platform a total of 50 articles. After the exclusion, 16 articles were used for the analysis. The majority of the studies in the area of collective health are concluded, but only the BMI isolated for the diagnosis are indicated as evaluation measures. More recent studies indicate an evolution in the way of evaluating. As can be seen in the sixteen articles analyzed.*

Keywords— *BMI; abdominal circumference; schooling; obesity.*

I. INTRODUCTION

The etiology of obesity is profoundly complex and multicausal, where assessments should verify associations, interactions, and relationships of genes,

environments, lifestyles, and psychological variables [1]. For Gallwitz et al. [2], the modern environment may contribute greatly to the development of obesity. According to the author, there has been a decrease in levels of physical activity and an increase in caloric intake, where such combination are very strong environmental determinants.

The highest rate of increase in obesity, according to a study by Gong et al. [3], has been occurring in populations with higher levels of poverty and lower educational level. According to his study, there is a dangerous inversion, where about 20 years the poorest population suffered from hunger and malnutrition. This can be explained by the association of higher palatability and the low cost of high energy density foods.

Studies have warned of increased obesity in children, pointing to the possibility that obese children may become obese adults. Childhood obesity has been increasing in a disorderly way in the world, so it is inevitable to talk about it [4,5,6].

In the treatment of the obese patient in general, it is first necessary to be recognized the state of the body weight and this be accepted by the patient. It is important to have an interaction between the patient and health specialists, in this case with obesity in schoolchildren, the closest contact is the Physical Education Teacher. This professional will verify if there is really excess weight and if the patient really needs to have a deepening in their evaluation [7].

To verify body composition or body weight distribution in a more traditional way, isolated body weight or height adjusted weight has been used. In the last 5 years, we have used evaluations to verify the

distribution of this fat, where these measures are more preventive to health [8].

The combination of an assessment with body mass and body fat distribution has been considered the best option to meet a need for clinical evaluation, however, since all assessments for the diagnosis of obesity present ethnic and genetic limitations [5].

Thus, the association of BMI measurement with abdominal circumference at the present time is the most reliable means to diagnose obesity in a primary intervention [9].

Abdominal obesity is a key part of the constellation of risk factors for Metabolic Syndrome (MS) and is strongly associated with the risk of Type 2 Diabetes Mellitus (DM2). An analysis of the associations between risk factors for MS in 2,735 participants in the Dallas Heart Study showed that the highest BMI was significantly associated with MS in diabetic and non-diabetic patients. In a prospective cohort study that examined the association between MS and type 2 diabetes among 4,022 patients with atherosclerosis, abdominal obesity was the component most strongly associated with the risk of type 2 diabetes.

Data from nine European studies were examined to determine the association between MS and abdominal adiposity in more than 15,000 men and women. Weight reduction, alone or in combination with lifestyle intervention, leads to a significant reduction in the prevalence of MS [10]. With this, the objective of the research was to analyze the studies that point out the use of BMI and abdominal circumference as a tool to diagnose obesity.

II. METHODS

The current study is a systematic review, where it followed the criteria of a systematic review and meta-analysis proposed by the protocol (PRISMA) [11].

Eligibility criteria

The studies that verified the epidemiology of obesity and ways of evaluating obesity in schoolchildren in Brazil were considered eligible, with no restriction or limitation

in the year of publication and the language that were written. The criteria adopted for the selection of articles were the use of the following variables for obesity: BMI, Circumference of abdomen, relation of C.A with stature and C.A and body weight. In this review, we also included cross-sectional and case-control studies, where the data came from primary and secondary sources. Were excluded from the review: a) did not use BMI and abdominal circumference for obesity, b) presented insufficient data, c) complete texts not available, d) summaries, book chapters, comments.

The methodological quality of the studies was evaluated by the GRADE system proposed by the *Grades of Recommendation, Assessment, Development and Evaluation group* [12]. In addition, after the selection of the studies, a checklist containing questions (Table 2) was applied to verify their scientific inference.

Search sources

In the current review, detailed and individualized research strategies were performed in the databases: PubMed/MEDLINE, Scopus, LILACS and Scielo. The studies were separated into a list, where they were manually revised in order to verify whether or not the need to include additional references. The descriptors were searched between 10/10/2017 to 04/20/2018.

Methodology of search and collection of articles

The research began in the selection of articles individually, where the inclusion criterion was followed and according to the title and the summary of the selected references, just as in each selected article the criteria for its selection were checked. After this screening, the articles were read in their entirety excluding those that did not meet the established criteria. After reading the selected articles, the information collected from each one were: author and year of publication, state of study, type of study, sample number and prevalence of obesity. Finally, it was decided that the meta-analysis in the study would not be included, because the studies presented a very great heterogeneity, as well as the analyzes and statistical methods used are very discrepant.

Table 1: Studies used for final analysis according to author and year, study characteristic, sample, variables used and results achieved.

Author/Year	Kind of study	Sample	Variables	Results
Gong et al., (2014)[3]	Control Case	7-11 years old; 114 Fem.212 Masc.254	BMI, abdomen circumference, level of physical activity	BMI = 25.4 kg/m ² (masc.), 28.5 kg/m ² (fem) C.A = 89 cm Obesity = 8% Cardiac Risk = 10%
Schafiee et al., (2018)[4]	Descriptive	14,880 students, age = 6-18 years	Abdominal circumference, BMI, wrist circumference.	Excess abdominal weight = 85 cm, 12% cardiac risk. BMI = 27.3 kg/m ² , 10%

				obese
Neamat-Allah et al., (2014)[5]	Epidemiológico	Sample = 1.192 Age = 12-18 years old	BMI, circumference of abdomen, triceps skinfolds.	BMI = 25.3 kg/m ² Obesity = 7% Abdominal circumference = 78 cm Cardiac risk = 5%
Goluch-Koniuszy and Kuchlewska (2017)[6]	Longitudinal	Sample = 1,738, masc. 882, feminine 856 Age = 13 years	BMI, waist circumference,	BMI: Female (20.2 kg/m ² ± 3.3). Masc (20.1 kg/m ² ± 3.5) Obesity: 12.9% Female. 6.6% men. Abdominal circumference: Female. (70.3 ± 8.2), m. (72.2 ± 9.3)
El-Serag et al., (2014)[8]	Control Case	Sample = 426 Age = 12-18 years old	BMI, abdomen circumference, height/circumference of abdomen.	BMI = 28.6 kg/m ² Obesity = 7% Abdominal circumference = 87 cm Cardiac risk = 6.3%
Castro-Correia (2018) [13]	Descriptive	Sample = 44 (feminine) Age = 14-18 years	BMI, abdominal circumference, blood pressure, glycated hemoglobin	BMI = 26.3 kg/m ² Obesity = 8.2% Abdominal circumference = 79 cm Cardiac risk 9.4%
Patel et al., (2017)[14]	Transversal	Sample = 737 Ages = 10-16 years	BMI, abdominal circumference, biochemical analyzes	Obesity = 10% BMI = 26.3 kg/m ² Abdominal circumference = 87 cm Cardiac risk = 8%
Turconi et al., (2006)[15]	Transversal	Sample: 532 (254 males and 278 females, aged 15.4 ± 0.7) years.	BMI, waist circumference, skinfolds	Obesity masc. 4.7% Female obesity. 1.1%.
Mihrshahi et al., (2018)[16]	Longitudinal	Sample: 7.555. (3,100 men, 4,455 fem.) Age: 10.5 years.	BMI, abdomen circumference, abdomen/height circumference.	BMI masc. 11.5% obese (29.3 kg/m ²) BMI femin. 12.2% obese (29.8kg/m ²) Abdomen Circumference Masc. 76.2 cm (21% cardiac risk) Circumference of abdomen femin. 77.4 cm (21.4% cardiac risk)

Continuation Table 1: Studies used for final analysis according to author and year, study characteristic, sample, variables used and results achieved.

Ramirez-Velez et al., (2017)[17]	Transversal	Sample: 7954 (3460 males and 4494 females) Age: 12.8 (\pm 2.3) years].	BMI, Circumference of abdomen,	BMI Masc.19.4 kg/m ² (obesity 3.3%) Abdominal circumference: 66.0 cm (cardiac risk 8.1%) BMI female.20.0 kg/m ² (obesity 3.5%) Abdominal Circumference 64.8 cm (8.0% cardiac risk)
Suder, Gomula e Koziel (2017)[18]	Transversal	Sample: 34,005 male and 34,008 female. Age: 13.5 years (\pm 2.3)	BMI, Circumference of abdomen,	Female BMI. 23.4 kg/m ² (8% obese) Abdominal circumference 56 cm (9% cardiac risk) BMI masc. 22.3 kg/m ² (7% obese) Abdominal circumference 60 cm (8% cardiac risk)
Zhang et al., (2017)[19]	Transversal	Sample: 72,755 Age: 7 to 18 years old	BMI, Circumference of abdomen,	Obesity: 20.37% (boys) and 11.61% (girls).
Romanholo et al., (2018)[20]	Transversal	Sample: 482 230 male and 252 female. Age: 9.4 years	BMI, Circumference of abdomen,	BMI: 21% obese male. 19% obese women. Abdominal circumference: 9.3% male. 15% female.
Teixeira et al., (2017)[21]	Transversal	Sample: 505 students (female 284) and male 221) Age: 7,8 years	BMI, Circumference of abdomen,	BMI female.17.7 kg/m ² \pm 3.4 (10.3% obese) BMI masc. 17.6 kg/m ² \pm 3.3 (11.6% obese) Female abdominal circumference.61.2 \pm 8.8 (10.6% risk factor) Abdominal circumference male. 61.5 cm \pm 9.5 (12.7% risk factor)
Jensen, Camargo and Bergamaschi (2016)[22]	Transversal	Sample: 217 school children (n = 111 boys and n = 106 girls) Age of 9.2 years (dp 1.0 year)	Sum of skinfolds, BMI and abdominal circumference	BMI masc. 18.4 kg/m ² \pm 3.9 (8% obese) BMI female.18.5 kg/m ² \pm 3.8 (7.6% obese) C.A men. 54cm \pm 3.4 (9% risk) C.A. female. 53 cm \pm 3.1 (8.3% risk)
Zanella, Souza e Valentini (2018)[23]	Transversal	Sample: 48 children (5 to 7 years),	BMI and Abdominal Circumference	Abdominal Circumference = 63.3 cm (\pm 9.2 cm) BMI = 20.8 kg/m ² (\pm 12.8 kg/m ²)

Legend: A.C. = abdominal circumference.

Source: Own authors, 2018.

Table 2: Methodological evaluation according to GRADE criteria.

Evaluated parameters	Gong et al., (2014) [3]	Schafiee et al., (2018) [4]	Casto-Correia (2018) [13]	El-Serag et al., (2014) [8]	Neamat-Allah et al., (2014) [5]	Patel et al., (2017) [14]	Goluch-Komuszy e Kuchlewska (2017) [6]	Turconi et al., (2006) [15]	Mihrshahi et al., (2018) [16]	Ramirez-Velez et al., (2017) [17]	Suder, Gomula, Koziel (2017) [18]	Zhang et al., (2017) [19]	Romanholo et al., (2018) [20]	Teixeira et al., (2017) [21]	Jensen, Camargo, Bergamaschi (2016) [22]	Zanella, Souza e Valentini (2018) [23]
1. Are the outcomes presented scientifically relevant?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2. Is the methodology clearly and accurately described as the main outcome?	N	Y	Y	Y	N	Y	Y	N	N	Y	N	Y	Y	Y	Y	Y
3. As a primary outcome, do they use intervention applied to childhood obesity?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4. Is there another association with childhood obesity?	Y	Y	N	Y	N	Y	Y	Y	N	N	N	N	Y	Y	N	N
5. Is there a control group to compare the main outcome?	N	N	Y	Y	N	N	N	Y	N	N	N	Y	N	N	Y	N
6. Is the sample statistically significant?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
7. Do the authors clearly state the results?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
8. Do the results meet the hypothesis?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
9. Do the authors express the limitations of the study?	N	Y	N	Y	Y	N	N	Y	Y	Y	Y	N	Y	Y	Y	Y
10. Does the conclusion bring any scientific inference?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
11. Are potential conflicts of interest declared?	Y	N A	Y	Y	N A	N A	N A	N A	N A	Y	NA	S	N A	N A	N A	N A

Legend: Y: Yes; N: No; NA: Not applicable.

Source: Own authors, 2018

III. RESULTS

Selection of study using the databases selected to search for articles, 1,846 articles were identified on the topic of interest with the descriptors (obesity in schoolchildren). 410 articles were found on the Scielo platform, 150 articles were found on the Bireme platform. In the Pubmed platform 1,236 articles and finally in the Scopus platform a total of 50 articles.

After the removal of 220 duplicate articles, 1,624 articles in English, Portuguese and Spanish were obtained for the analysis. A comprehensive review of the title and

abstract eliminated 1,578 articles (did not contain all the variables required for the study, or different variables), resulting in 46 articles in the first stage of the study.

In the second step, all 46 articles were included and read in full, reading ops were excluded from the final analysis; 15 of them due to lack of data for the classification of nutritional status, 10 because the articles evaluated another outcome totaling 16 articles used in the study. The diagram showing the process of identification, inclusion and exclusion of studies is shown in figure 1.

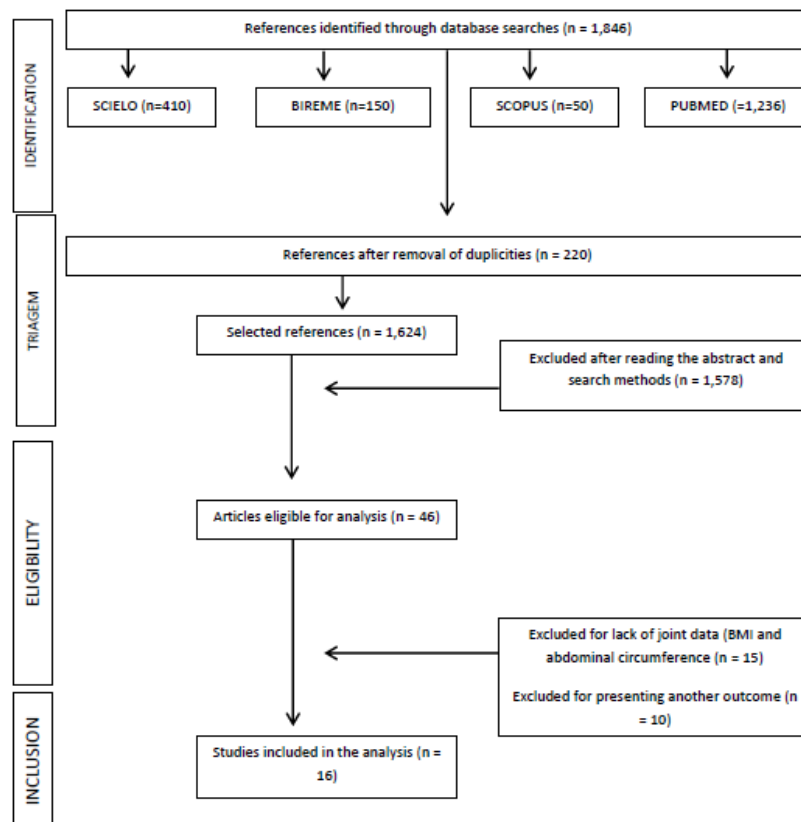


Fig.1: Diagram of bibliographic research adapted from PRISMA.

IV. DISCUSSION

The global data on obesity according to Costa, Brito and Lessa [24], show an increasing number of children and adults being overweight or really obese. The prevalence of obese individuals and overweight individuals may vary with age, sex, social classes and ethnicity. According to Sichieri et al. [25], about 50% of adults in the United States, Canada and some Western European countries have a BMI of 25 kg/m² or more.

Weight and height are essential for the evaluation of nutritional status, identifying a possible need or excess of calories and having to be analyzed according to age and sex [26].

An important feature of this method, according to Dos Anjos et al. [27], is that in individual conditions it is not

necessarily associated with the amount of visceral fat, since it does not provide information on body composition. People with the same BMI may present different amounts of body fat, and consequently different risks of morbidities [28].

According to research conducted by Dos Anjos et al. [27], Berria et al. [31] found similar BMI values in prepubertal children (before puberty) of both sexes, but with a higher percentage of fats between them compared to BMI.

BMI is the most widely used method for verifying and validating obesity. This test is known as the Quetelet index, and its result comes from the weight divided by the height squared. This test according to Guedes and Guedes [26] and Pollock [32], is a way to establish the thresholds

between malnutrition, healthy weight and different types of obesity.

However, there are some criticisms regarding the BMI test, according to authors such as Guedes and Guedes [26], Bouchard et al. [33] and Wipke-Tevis et al. [34], BMI is not able to distinguish central peripheral fat, nor does it differentiate lean mass from fat mass, thus overestimating obesity in athletic individuals. Therefore, according to Wipke-Tevis et al. [34], BMI is a means and not the end to diagnose obesity, that is, it is an important tool if associated with waist circumference.

Still, Guedes and Guedes [26] say that the information between weight and height are very useful in terms of growth and body composition, but should not be evaluated in isolation, since they are not enough data to answer questions about obesity and possible chronic diseases.

For Da Silva Pinto et al. [35] and Heremann et al. [36], affirm that in order to associate BMI with obesity, knowledge about the distribution and factors associated with obesity, especially the one located in the abdominal region, should be used, in order to contribute to the planning of interventions in order to prevent obesity and the associated factors.

A study on the abdominal obesity analysis of children and adolescents was developed in the municipality of Cascavel, Paraná. This study carried out several evaluations, among them BMI and waist circumference. In this study, the prevalence of abdominal obesity is close to 10%, and the factors associated with the outcome were school grade and nutritional status. Educational actions should be emphasized among school children, with special attention to those of Elementary School and with excess body weight [36].

In a study conducted by Dias et al. [37], evaluated abdominal fat and blood pressure in low-income students in the city of Santo André/SP. The waist measurement was directly related to the anthropometric indexes commonly used and did not work in the preschool age group as a predictor of cardiovascular risk, but was associated with obesity.

In a study by Teixeira et al. [21] evaluated the risk factors for the metabolic syndrome in schoolchildren aged 6 to 10 years. In the study they checked the circumference of the abdomen and BMI and verified that at least one risk factor was present in 61% (n = 308) of the sample.

Mhrshahi et al. [16], evaluated the obesity of Australian children and adolescents aged 5 to 16 years in the anthropometric variables BMI and waist circumference. In this study it can be verified that 15% of the evaluated ones were with the BMI classified as obese, and of these 80% were with the abdominal circumference classified as risk in developing cardiopathies.

The WHO points to obesity as one of the biggest public health problems in the world. It projected that, by 2025, about 2.3 billion adults would be overweight; and more than 700 million obese [38].

The Brazilian Association of Obesity (ABESO) warns about the number of overweight and obese children, according to their projections, in the world could reach 75 million if nothing is done. In Brazil, the values of obesity have been increasing in the population in a general way. Some surveys conducted by the Research Institutions (VIGITEL and ABESO) indicate that more than 50% of the population is overweight in the next 20 years. Among children, it would be around 15%. In the last official survey conducted by the IBGE between 2008/2009, we already noticed the growing movement of obesity [38].

V. CONCLUSION

According to the proposed objective, a total of 1,846 articles were initially collected with the proposed theme. However, when analyzing these studies it can be seen that some still use outdated or unreliable variables for the diagnosis of obesity and distribution of body fat in the school population.

Therefore, most of the studies are located in the area of collective health and indicate only the BMI isolated for diagnosis as evaluation measures. More recent studies indicate an evolution in the way of evaluating. Thus, it can be seen in the sixteen articles analyzed and in these studies the BMI is always related and compared to the waist circumference, to verify the nutritional aspects and possible cardiovascular risks.

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Geotechnical Investigation of Fracture Patterns in a Rock Mass during Excavation by Blasting

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Abstract— *Overcharging in rocks (wall faces) during blasting and excavation usually causes damage to rock mass in most mining and quarry industries. This creates blast-induced fractures which can relate with pre-existing fracture pattern thereby increasing sliding and rockfall from the crest and body of an excavated wall. The spacing and orientation of pre-existing fractures are predominant at a small-scale mining (galamsey) site at 'Atta ne Atta', a town near Beposo, in the Western Region of Ghana. Geotechnical field studies were carried out to investigate the possibility of any instability within the area to eradicate the occurrence of an unexpected future wall failure (rockfall). The geotechnical mapping conducted was focused on fracture distribution and spacing. Mean spacing (S_m) of existing fractures was calculated and corrections were made to obtain calculated spacing (S_c). The scanlines of wall face 001 and wall face 002 intersect with their corresponding strike and dip at 78° and 80° respectively creating a slightly favourable fracture pattern and rock wall stability. The fracture pattern created at Wall Face 003 and Wall Face 004 were unfavourable for rock stability with their corresponding scanlines having a strike and dip of 67° and 73° respectively. The instability of these wall faces (003 and 004) is as a result of parallel orientation of the induced fractures to the strike of the pre-existing fractures. Observations made from the stereographic projections and rose diagram indicate a cluster of fracture patterns with a general strike of NNE-SSW. Hence, the fracture patterns in the study area are composed of favourable (stable) rock mass at some walls and unfavourable (unstable) rock mass at other wall faces due to overcharging of blast holes.*

Keywords — *small-scale mining ('galamsey'), wall face, fracture pattern, fracture set, rock mass.*

I. INTRODUCTION

Generally, blasting through boreholes in rocks are associated with two types of forces that influence the surrounding rock; stress wave loading (the shock wave from the explosion) and explosion gas pressure loading [1]. During detonation, the walls of the blast holes are usually exposed to an immediate high pressure that initiates a shock wave that propagates through the rock mass [1]. Gas pressure loading is also generated after the stress wave and travels with a significantly lower speed but for a longer duration. The shock and stress wave cause a complete damage in a form of fragments around the vicinity of the blast and the gas pressure “later” extends these fractures radially [2].

Blasting in bedrock creates blast-induced fractures that strike parallel to pre-existing fractures in the bedrock. The blast-induced fractures can relate with the pre-existing fracture pattern to increase sliding and rock fall from the crest and body of an excavated wall. This can happen in various extents depending on distribution and frequency of pre-existing fractures, rock properties and fracture infilling [3].

Small-scale mining ('galamsey') trenches are prone to rockfall and rockslide after blasting since detailed geotechnical assessment which can be used to define fracture patterns are not considered. This can therefore affect the stability of engineering designs leading to rockfall and other associated geotechnical engineering problems including high construction cost by reinforcement. In order to safeguard the future existence of communities located near quarry and mining industries in Ghana, it is imperative to undertake a detailed geotechnical assessment of the fracture patterns initiated during dynamic blasting. In this study, the rock mass at a 'galamsey' site at 'Atta ne Atta', a community near Beposo, in the Western Region of Ghana was assessed and analyzed in order to provide a profound geotechnical description of fracture distribution, orientation, spacing

(frequency) and the general stability of a rock mass within the study area.

II. INFORMATION ABOUT THE STUDY AREA

2.1 Location and Accessibility

The 'galamsey' site is located at 'Atta ne Atta', a town near Beposo in the Shama District, Western Region, Ghana. The concession is about 1.7 km away from the Beposo Township. Access to the concession is through a feeder road off Takoradi – Cape Coast highway. The nearest community to this site is 'Atta ne Atta' Township, which is about 1 km away from the site. Fig. 1 is a geological map showing the location of the 'Galamsey' site [4].

The site hosts many illegal mining ventures wholly owned by corporate individuals. It was established to produce gold for small-scale mining industries and aggregate to serve the construction industries in the Western and Central Regions of Ghana. The size of this concession is approximately 10 acres and is predominantly composed of granitic outcrops which are used as a suitable aggregate for construction purposes. Aggregates obtained from these areas are used in the region for surface dressing, asphaltic concrete and concrete works, which have been proven to be very suitable and durable in all cases [4].

2.2 Topography, Climate and Vegetation

The area generally has a flat land with an isolated hill at Butre and Banso with height ranging between 20 to 40 metres above sea level between Cape Three Point and Princess Town [5].

The District is found within the South-Western Equatorial Climatic Zone of Ghana. The highest mean temperature is 34 °C which is recorded between March and April, while the lowest mean temperature of 20 °C is experienced in August. Relative humidity is very high averaging between 75 % to 85 % in the rainy season and 70 % to 80 % in the dry season. The District is located within the wettest region in Ghana. It experiences a double maxima rainfall of over 1,700 mm [5].

The area falls largely within the High Rain Forest Vegetation Zone, capturing several hectares of rubber plantation. To a large extent, this contributes significantly to reducing the problem of global warming, since the vegetation serve as a sink for CO₂ emissions.

The study area is also closer to Cape Coast, in the central region of Ghana. Cape Coast is dominated by batholith rock and is generally undulating with steep slopes. There are valleys of various streams between the hills, with kakum being the largest stream. The minor streams end in wetlands, the largest of which drains into the Fosu Lagoon at Bakano. In the northern part of the district, however, the landscape is suitable for the cultivation of

various crops. The metropolis has double maxima rainfall. The major rainy seasons occurs between May to July and the Minor rainy season fall within November to January [6]. Cape Coast is a humid area with mean relative humidity varying between 85 % and 99 %. The sea breeze has a moderately effect on the local climate. The hottest months of the year are February and March, just before the main rainy season, while the coolest months are between June and August [7]. The present vegetation of the municipality consists of shrubs of about 1.5 m high, grass and a few scattered trees. The original vegetation of dense shrubs supported by rainfall, has been replaced by secondary vegetation as a result of clearing for farming, charcoal burning, bushfires and other human activities [6].

2.3 Geology and hydrogeology

The site is underlain by rocks of the Birimian intrusion related to the late stages of the Eburnean Orogeny (late Pre-Cambium) series south to southeast areas. The area is characterized by foliated, often magmatic, potash rich granitoid in the form of muscovite/biotitic granite and granodiorite, porphyroblastic biotitegenesis, aplites and pegmatities [2].

The Dixcove granitoid complex is intruded along deep-seated faults in three distinct phases which follow one another from basic to acidic: gabbro-diorite-granodiorite. Although the Dixcove granite has been inferred to be younger than the Cape Coast granite, there is the presence of minor intrusions [8]. However, granites like members of the Dixcove suits have been observed within biotite gneiss of the Cape Coast type in many scattered areas throughout Ghana [9]. This suite consists of quartz diorite, tonalite and trondhjemite, granodiorite, adamellite, and to a lesser degree, granite [9&10]. They are typically hornblende-bearing and are commonly associated with gold mineralization where they occur as small plutons within the volcanic belts (Fig. 1).

As such, the top soil consists mainly of dark grey decomposition products of predominantly lateritic quartzite embedded in clayish silt sand followed by a zone of friable, highly weathered gneissic and mica-schist at depths. Overburden was around 5 m. The granite deposit is an outcrop with an average height of about 43 m above sea level. Conventional open pit is employed to mine the granitic deposit with 11 m benches which serve as the progressing excavation face [4].

Groundwater intrusion into the pit occurs often especially during the rainy season when the water table is high. The groundwater in these areas are predominantly controlled by the presence of secondary permeability due to the presence of fractures within the rock masses [4]. Also, the presence of rivers and streams in the area serves as a source of recharge for the groundwater.

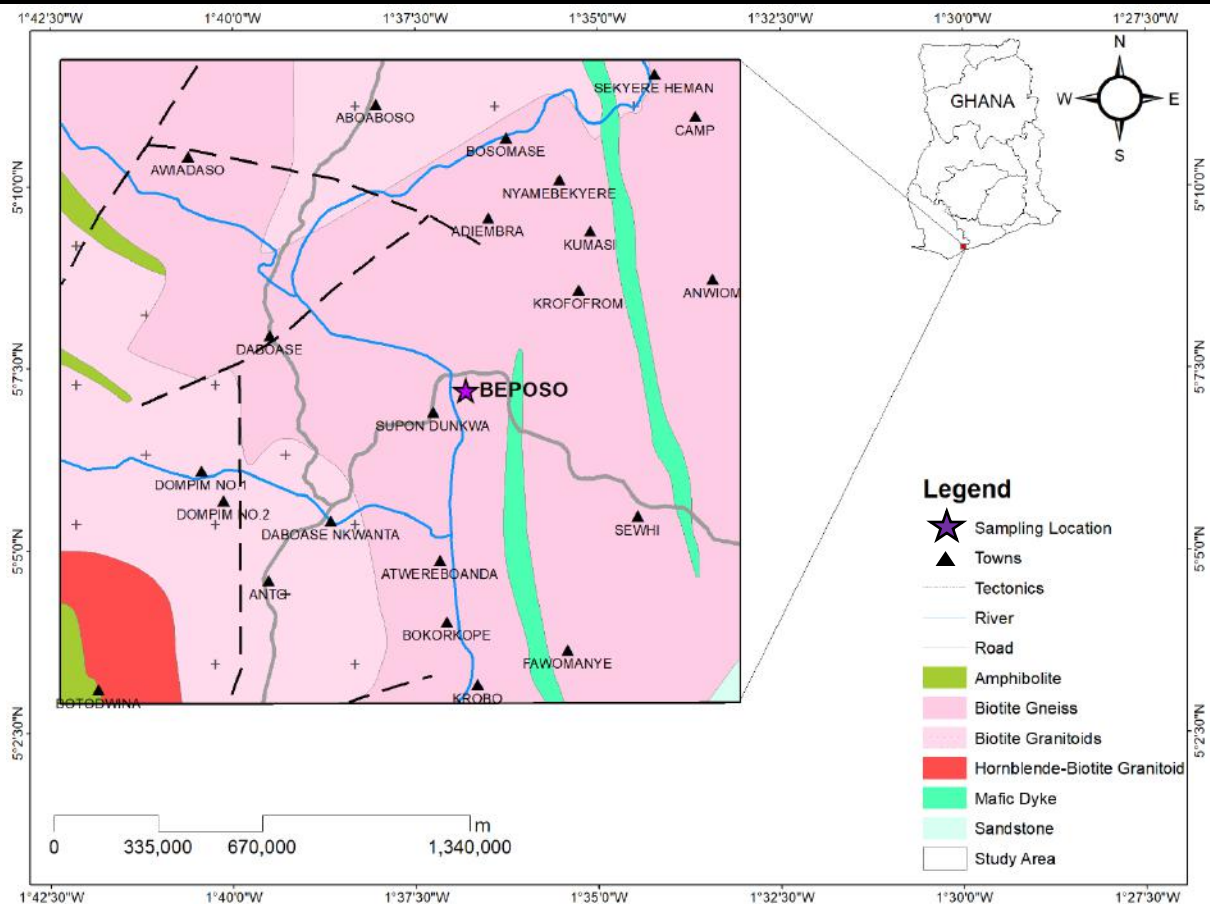


Fig. 1: Geological map of the Southern Part of Ghana showing the Sampling Locations

III. METHODS USED

Two major methods were used to acquire data and results for this study. These methods include geotechnical field mapping and data collection as well as data analysis.

3.1 Field Mapping and Data Collection

The criteria used for the collection of data in this study was mapping. The mapping exercise was carried out on four separate excavated walls which were selected based on differences in fracture distribution, pattern and spacing. The main emphasis during the mapping exercise was to determine pre-existing or blasting-induced fractures, fracture distribution, fracture spacing (frequency) and fracture orientation present within the selected wall faces. Account of lithology and foliation were also noted, as well as the orientation of any other geological structures, e.g. shear zones. The spacing and orientation of fractures were measured with a hand held Brunton compass and a measuring tape. The Brunton compass was used to measure the strike and dip of the fracture pattern and orientation. The measuring tape was also used to measure the length of spacing between the fractures and the scanline along the face of the walls. The measurement of fracture spacing and orientation was done at four (4) different walls, namely, Wall Face 001, Wall

Face 002, Wall Face 003 and Wall Face 004. Fig. 2 below shows the fracture pattern at the various walls.

3.2 Data Analysis

Fractures that are systematic are classified as a set of fractures. Pre-existing or blast-induced fractures are determined based on the existing surface conditions i.e. how fresh the surfaces are and whether they are open or closed. A closed, narrow and fresh fracture indicates a possible blast-induced fracture. Some of these fractures usually exist close to pre-existing fractures on the excavated wall and are mapped as blast-induced fractures [3].

According to the Rock Mass Rating System [11], discontinuity within rock mass is characterized by a standard stability limit less than 2 m for a non-continuous and unweathered wall rock. Therefore, for a wall face to achieve maximum stability, spacing of fracture set above 2 m will be considered to be favourable in this study. Hence, a defined boundary between the upper (favourable) and lower (unfavourable) limits for standard stability of rock masses has establish in this study as shown in Fig. 3.

The dip and strike of each wall face was illustrated on Stereographic projection and Rose diagram using the

Stereonet 10.0 software [12].

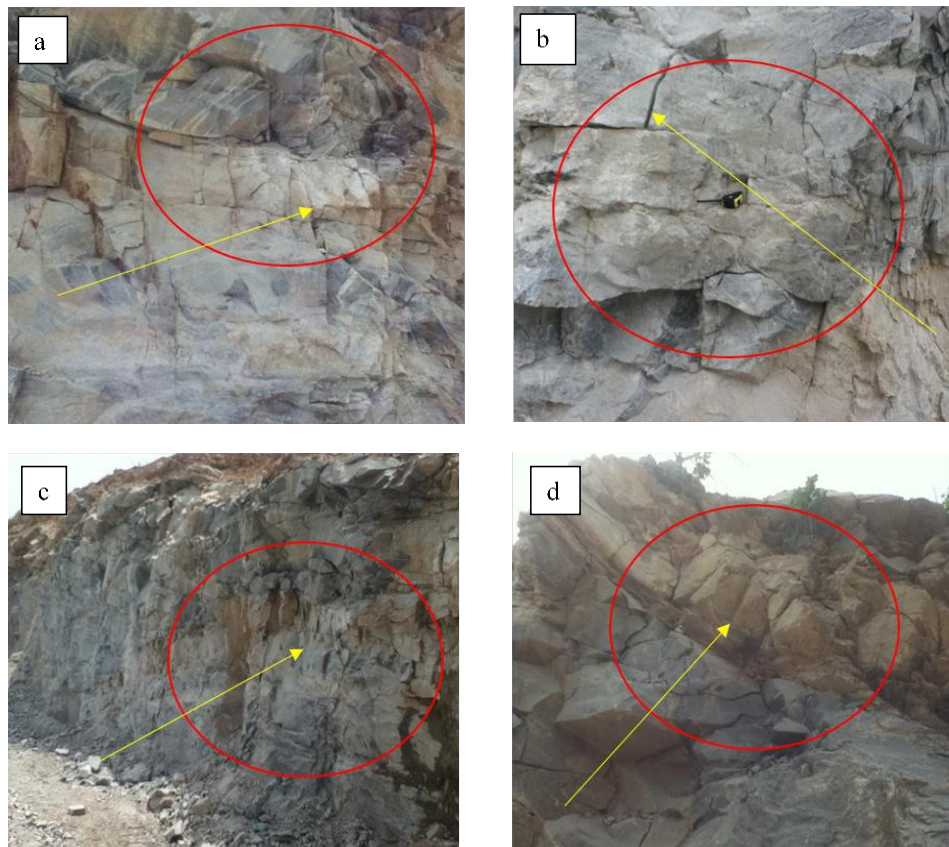


Fig. 2: (a) Fracture pattern at Wall Face 001 (b) Fracture pattern at Wall Face 002 (c) Fracture pattern at Wall Face 003 (d) Fracture pattern at Wall Face 004

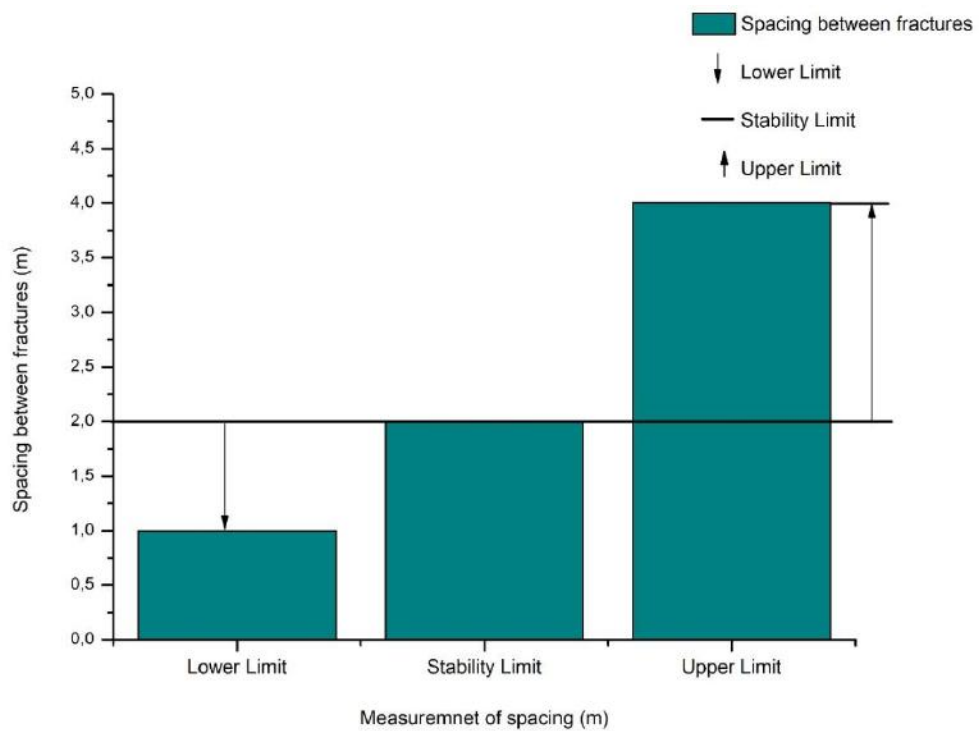


Fig. 3: A Graph of Standard Stability of Fracture Spacing

Mapping of fractures at the various walls gave different orientation of sets. The set of fractures at the various walls has different strikes and dips. Some fracture sets were identified to be parallel to different foliations. The alignment of the fracture sets to the foliations is as a result of the presence of folds yielding a continuous change in strike and dip within the study area.

The spacing (S; given as distance between fractures in m) of fractures were measured in the field by placing a measuring tape of any sort (a scanline), with a given length (L; m) (preferably a few m long depending on fracture frequency) perpendicular to the strike of the fracture set [13].

The measured length along the various walls was 50 m which was at least seven times longer than the spacing. A mean spacing (Sm; m between fractures of the same set) was calculated when the specified measurements are not perpendicular to the strike of the fracture [14]. By counting the number of fractures (N) of a set along the measuring tape, the mean spacing was calculated from the equation:

$$S_m = L/N \quad (1)$$

If spacing measured between two fractures of the same set is not measured perpendicular to the scanline, corrections can be performed to acquire calculated spacing (Sc) by measuring the acute angle (α) between the scanline and the strike of the fracture [13]. The mean spacing measured (Sm) in the set is then used to calculate the real spacing from the equation:

$$S_c = S_m \times \sin \alpha \quad (2)$$

In this study the angle for the scanline is the strike of the wall. For the N-S oriented wall the scanline is at different angles [13].

IV. RESULTS AND DISCUSSION

4.1 Results

The results of the measurement of fracture spacing and orientation from each excavated wall with their respective mean and calculated spacing as well as the scanline strikes for each wall face are shown in Tables 1 to 4 below.

Table 1: Measurement of Fracture Spacing and Orientation at Wall Face 001

Measurement of Fracture spacing						
Wall Face 001						
The scanline strikes 75°						
Distance from W-E	Strike	Dip	Length	Number of fractures	Mean Spacing	Calculated Spacing
	(°)	(°)	(m)	(N)	(Sm)	(Sc)
1-5	25	21	13.00	5	2.60	1.99
10	35	62	9.00	5	1.81	1.15
15	50	75	7.10	4	1.75	0.73
20	58	60	10.50	6	1.75	0.51
25	31	21	8.00	3	2.66	1.85
30	20	50	2.81	2	1.42	1.14
35	63	42	17.10	5	3.41	0.70
40	52	64	6.22	3	2.00	0.78
45	123	52	9.00	2	4.50	3.34
50	151	14	11.01	6	1.83	1.78

Table 2: Measurement of Fracture Spacing and Orientation at Wall Face 002

Measurement of Fracture spacing						
Wall Face 002						
the scanline strikes 80°						
Distance from W-E	Strike	Dip	Length	Number of fracture	Mean Spacing	Calculated Spacing
	(°)	(°)	(m)	(N)	(Sm)	(Sc)
1-5	48	24	15.40	8	1.92	1.02
10	64	10	24.40	9	2.67	0.73
15	133	5	8.67	11	0.72	0.58
20	155	4	4.60	3	1.53	1.48

25	70	10	11.00	3	3.66	0.64
30	135	67	17.00	7	2.42	1.98
35	22	9	5.60	3	1.86	1.53
40	50	6	9.00	5	1.80	0.90
45	64	13	6.00	5	1.21	0.33
50	72	42	13.01	4	3.25	0.45

Table 3: Measurement of Fracture Spacing and Orientation at Wall Face 003

Measurement of Fracture Spacing						
Wall Face 003						
The scanline strikes 67°						
Distance from W-E	Strike	Dip	Length	Number of Fracture	Mean Spacing	Calculated Spacing
	(°)	(°)	(m)	(N)	(Sm)	(Sc)
1-5	52	35	4.00	3	1.33	0.34
10	22	88	1.80	2	0.90	0.64
15	53	51	11.00	7	1.57	0.38
20	156	74	5.00	11	0.45	0.45
25	50	10	9.00	6	1.50	0.43
30	117	45	15.00	10	1.50	1.14
35	56	87	7.00	4	1.75	0.33
40	76	17	11.00	5	2.20	0.34
45	58	6	3.00	5	0.60	0.09
50	63	15	6.00	4	1.50	0.11

Table 4: Measurement of Fracture Spacing and Orientation at Wall Face 004

Measurement of Fracture Spacing						
Wall Face 004						
The scanline strikes 73°						
Distance from W-E	Strike	Dip	Length	Number of Fractures	Mean Spacing	Calculated Spacing
	(°)	(°)	(m)	(N)	(Sm)	(Sc)
1-5	52	10	3.00	5	0.60	0.22
10	62	35	20.00	6	3.33	0.63
15	68	60	15.00	11	1.36	0.11
20	57	46	5.00	3	1.67	0.45
25	20	37	7.00	5	1.40	1.11
30	126	86	5.00	7	0.71	0.57
35	67	11	8.00	10	0.80	0.08
40	23	6	13.00	8	1.62	1.24
45	73	32	7.00	6	1.16	0.00
50	59	61	11.00	6	1.83	0.44

4.2 Analysis and Discussion of Results

A bar plot showing a graph of mean and calculated spacing of fractures was developed for the various wall faces. The x-axis represents the distance in metres (m) along the wall and the y-axis represents the spacing between fractures in metres (m). A line indicating the

standard stability limit of a wall at 2 m mean spacing between fracture has been presented on each graph. This indicates that, the spacing between fracture at and beyond 2 m is secured for rock stability, however, spacing of fracture below 2 m may result in instability.

From Fig. 4 the scanlines strike 75° with their corresponding strike and dip creating a favourable fracture pattern. The fracture set at a distance of 5 m, 25 m, 35 m, 40 m and 45 m along the wall are above the 2 m spacing of fracture which represents the stability of the wall around these places. The fracture set at a distance of 10 m, 15 m, 20 m 30 m are all below 2 m spacing of fracture were observed to be unstable (below 2 m).

Considering the calculated spacing of the fracture sets, corrections were made for clear estimation of wall stability. The calculated spacing S_c was used in concluding the results because errors were corrected. As illustrated in Fig. 5, about 90 % of the fracture sets were below 2 m of mean spacing between fractures indicating marginal instability within the Wall face 001. Though only one i.e. the fracture pattern at the distance of 45 m as shown in Fig. 5 exceeded the 2 m spacing of fracture, other sets of fractures were closely below the standard stability limit making it marginally stable. The reason for the marginal stability of these walls by observation is as a result of mineral infillings (quartz veins) in the fractures and which prevents water encroachment between fractures. In addition, by physical observation on the walls, the blast holes were charged with small number of explosives hence small fracture zones were created.

The stereographic projection of the dip and strike of fracture spacing within Wall Face 001 shows a general strike of NNE-SSW (Fig. 6). Observations made from the Rose plot also shows a maximum of 30 % strike between 051° and 060° .

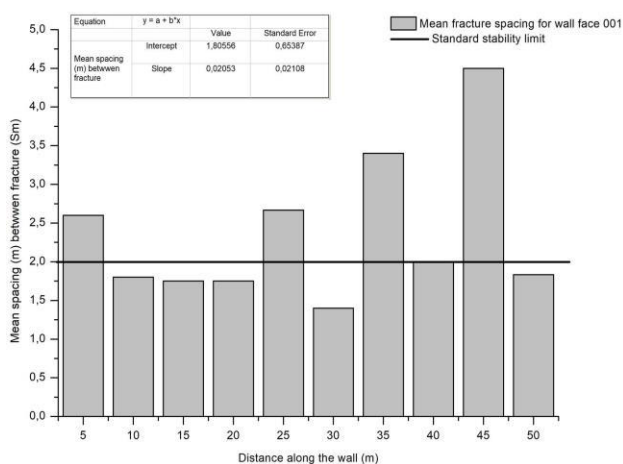


Fig. 4: A Graph of Mean spacing of Fracture at Wall Face 001

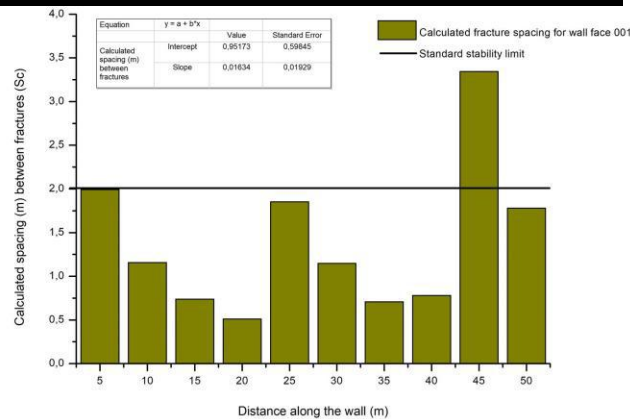


Fig. 5: A Graph of Calculated Spacing of Fracture at Wall Face 001

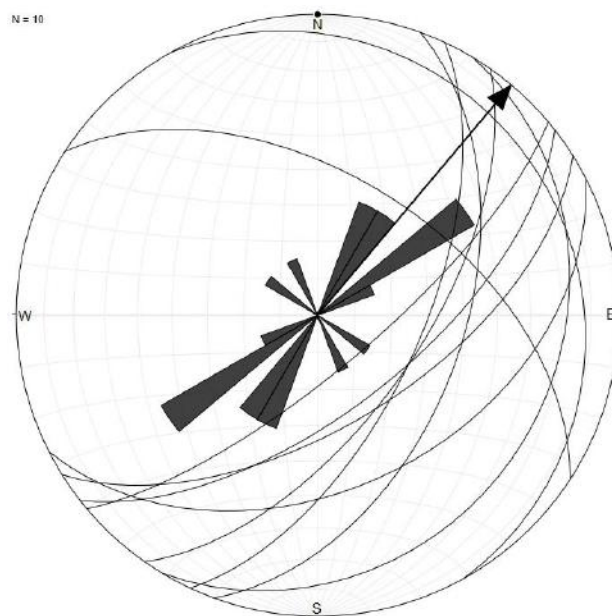


Fig. 6: Stereographic projection and Rose plot for Fracture Spacing at Wall Face 001

From Fig. 7 the scanlines strike 80° with their corresponding strike and dip creating a favourable fracture pattern. The fracture set at a distance of 10 m, 25 m, 30 m and 50 m along the wall are above the 2 m spacing of fracture which represents the stability of the wall around these places, however, other fracture sets were below the 2 m spacing of fracture which indicate unstable condition.

Again, the calculated spacing S_c was used in concluding the results because errors were corrected. As illustrated in Fig. 8, all the fracture sets were below 2 m of mean spacing between fractures indicating high instability condition within the Wall face 002. Stereographic projection of the dip and strike of fracture spacing within Wall Face 002 also shows a general strike of ENE-WSW. Observations made from the Rose plot also shows a maximum of 20 % strike between 061° and 070° (Fig. 9).

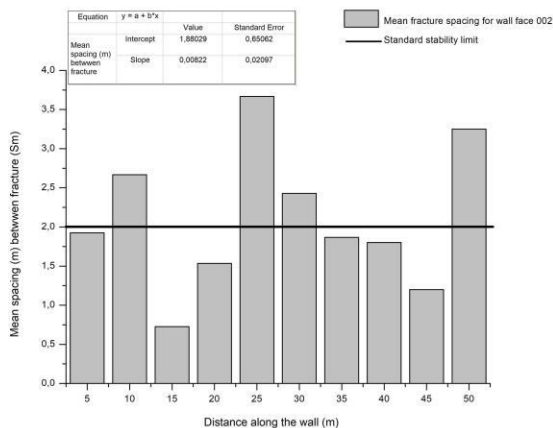


Fig. 7: A Graph of Mean Spacing of Fracture at Wall Face 002

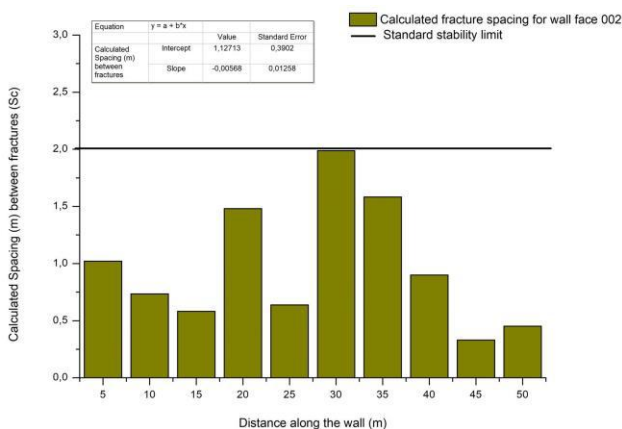


Fig. 8: A Graph of Calculated Spacing of Fracture at Wall Face 002

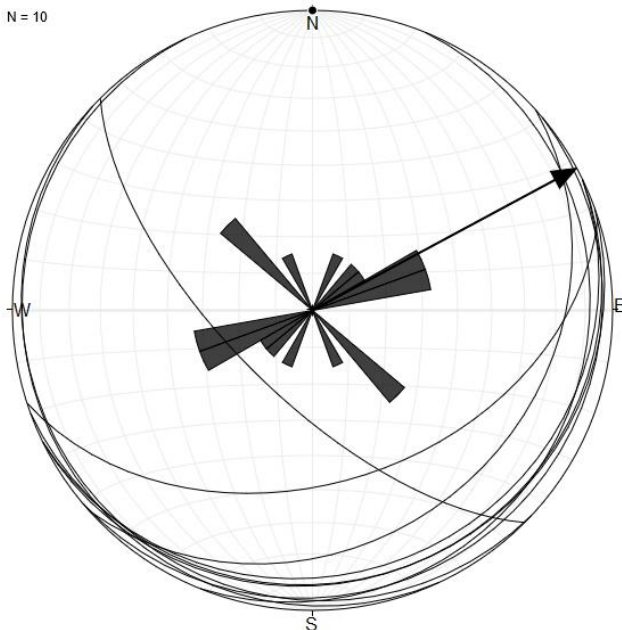


Fig. 9: Stereographic projection and Rose plot for Fracture Spacing at Wall Face 002

As illustrated in Fig. 10 the fracture set along the walls Face (003) at 40 m is are above 2 m spacing of fracture whereas the remaining 9 fracture sets were below the standard stability limit making them walls unstable and vulnerable to failure.

Wall Face 003 recorded the most harmful zones of fracture after estimation using the calculated spacing of fracture sets. Consequently, from Fig 11 all the fractures with their spacing of 0.00-1.24 m and their corresponding strikes created differential unstable parts of the walls which is very unfavourable in response to rock fall and rock slide. Blast induced fractures were observed to be widen as a result of weathering.

Results obtained from the Stereographic projection of the dip and strike of fracture spacing within Wall Face 002 also shows a general strike of NE-SW. Observations made from the Rose plot also shows a maximum of 50 % strike between 051° and 060° (Fig. 12).

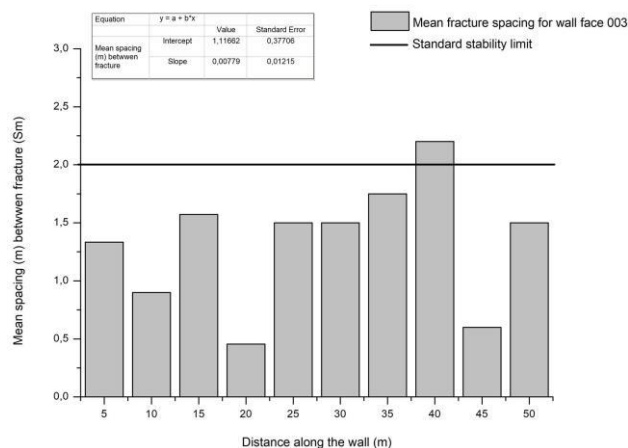


Fig. 10: A Graph of Mean Spacing of Fracture at Wall Face 003

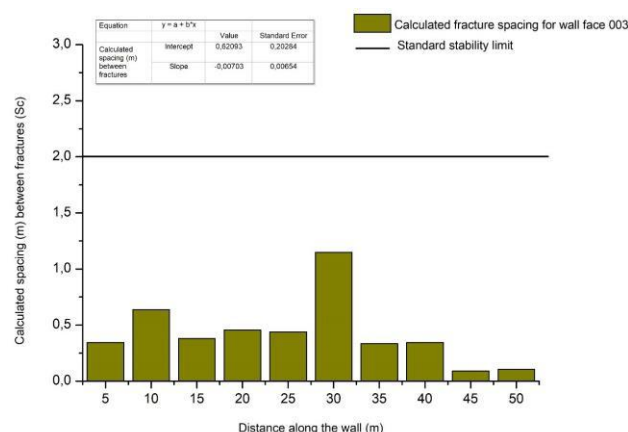


Fig. 11: A Graph of Calculated Spacing of Fracture at Wall Face 003

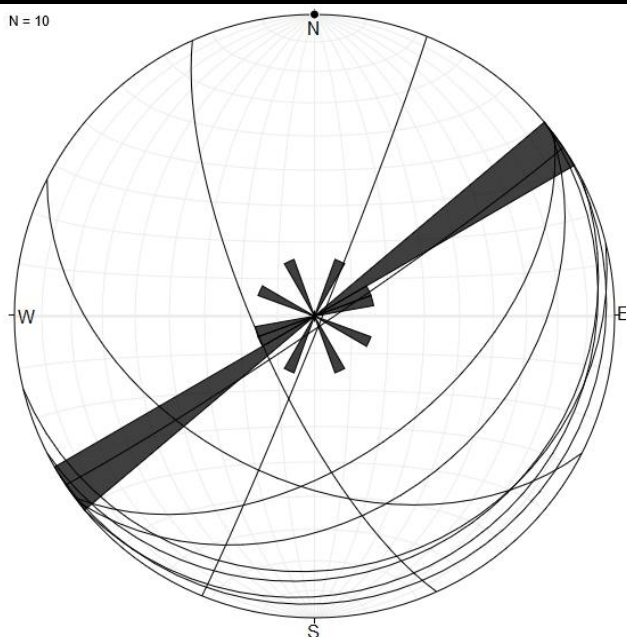


Fig. 12: Stereographic projection and Rose plot for Fracture Spacing at Wall Face 003

Observations made from Fig. 13 show the scanlines strike 73° with their corresponding strike and dip creating an unfavourable fracture pattern. The fracture set at a distance of 10 m along the wall is above the 2 m spacing of fracture which represents the stability of the wall around these places. However, the remaining fracture set were all below 2 m spacing of fracture which indicates high instability within this Wall Face (004).

Again, considering the calculated spacing of the fracture sets, corrections were made for clear estimation of wall stability. The calculated spacing S_c was used in concluding the results because errors were corrected. As illustrated in Fig. 14, all the fracture sets were below 2 m of mean spacing between fractures indicating high instability within the Wall face 004. The reason for the high stability of these walls by observation is as a result of absence of mineral infillings (quartz veins) in the fractures thereby enhancing weathering of the rock surfaces due to water encroachment between fractures. In addition, by physical observation on the walls, the blast holes were charged with high number of explosives due to the presence of mineralized zones within these areas resulting in the creation of high fracture zones.

The stereographic projection of the dip and strike of fracture spacing within Wall Face 004 shows a general strike of NE-SW (Fig. 15). Observations made from the Rose plot also shows a maximum of 30 % strike between 051° and 060° similar to the strike recorded in Wall Face 001.

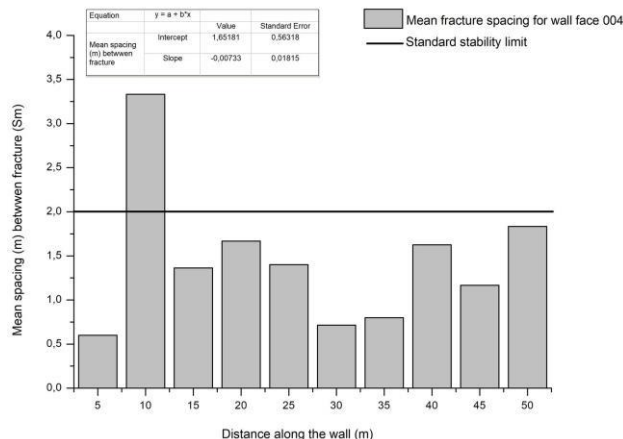


Fig. 13: A Graph of Mean Spacing of Fracture at Wall Face 004

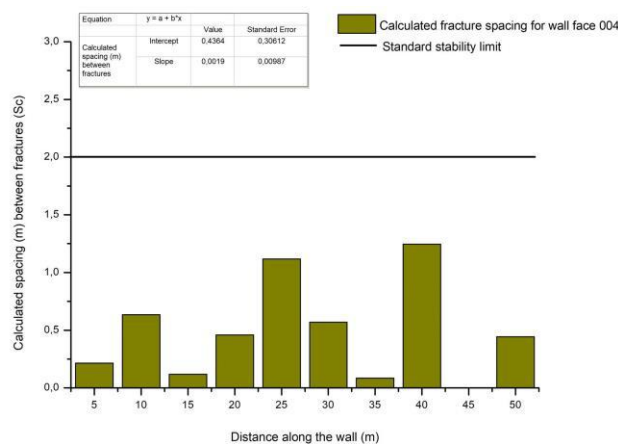


Fig. 14 A Graph of Calculated Spacing of Fracture at Wall Face 004

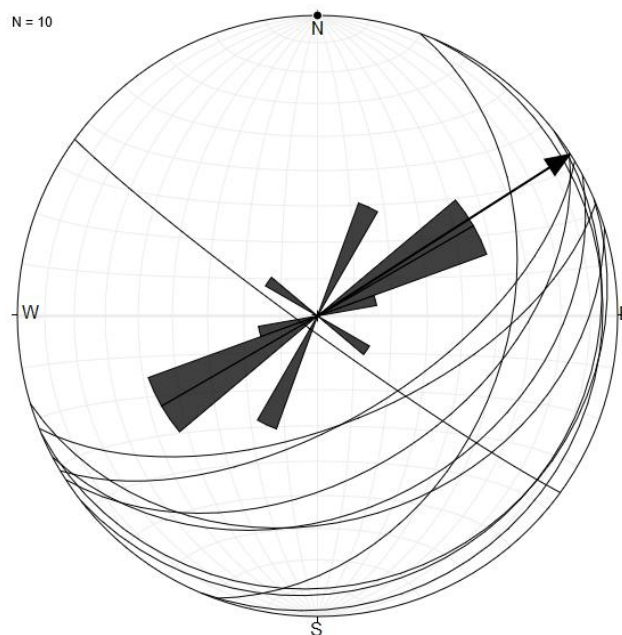


Fig. 15: Stereographic projection and Rose plot for Fracture Spacing at Wall Face 004

V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

From the studies and analysis of test results, some conclusions made on the presence of fracture patterns on the outcrops at the site, calculation from the data obtained and general safety of use of the site currently are described below:

- The fracture pattern created at Wall Face 001 and Wall Face 002 are slightly favourable for rock stability. No severe rockfall and rockslide is expected to occur, yet caution is needed when operating around these regions.
- The fracture pattern created at Wall Face 003 and Wall Face 004 are unfavourable for rock stability. The opened blast induced fractures are parallel to the strike of the pre-existing fractures which are exposed to water during rainfall. The infiltration of water usually triggers instability of the wall resulting in rockfall.
- Observations made from the Stereographic projections and Rose diagram indicate a cluster of fracture patterns with a general strike of NNE-SSW with a maximum of 30-50 % strike between 050° and 075°.

5.2 Recommendations

It is recommended that:

- Overcharging of blast holes should be avoided.
- The spacing of drill holes at regions of low stability should be wider.
- Drilling at regions of low stability should be done with extreme care.
- Investigation on the walls should be repeated after every episode of blasting.

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Antimicrobial activities of *Carica papaya* leaf against diarrhoea causing agents.

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Abstract— *The advent of science to the search for antibiotics principally depends on medicinal plants as raw materials. This present study evaluated the antimicrobial effect of Carica papaya leaf extracts against bacterial and fungal agents that causes diarrhoea. Fresh tender roots and leaves of this plant was collected, air-dried, powdered and percolated in n-hexane, methanol and aqueous solvents. The antimicrobial activities of the extract against test organisms were tested by using agar well diffusion assay and the MIC, MBC and MFC values were determined by agar dilution assay. The results revealed that the crude methanol and aqueous extracts of Carica papaya had no anti-fungal activity, but have antibacterial activity. N.hexane extract of C. papaya had most activity than other solvents with MIC ranged from 25 mg/ml to 50 mg/ml and MBC ranged from 50 mg/ml to 100 mg/ml. These results suggest that paw paw leaf extract is recommended as a diarrhoea disease remedy.*

Keywords— *Antimicrobial activity, Carica papaya, diarrhoea.*

I. INTRODUCTION

The search for newer sources of antibiotics is a global challenge pre-occupying research institutions, pharmaceutical companies, and academia, since many infectious agents are becoming resistant to synthetic drugs (1). Emergence of resistant strains of pathogenic microorganism has also continued to pose a major health concern about the efficacy of several drugs, most importantly antibiotics in current use (2). The importance of herbs in the management of human ailments cannot be over emphasized. It is clear that the plant kingdom harbours an inexhaustible source of active ingredients invaluable in the

management of many intractable diseases. Furthermore, the active components of herbal remedies have the advantage of being combined with other substances that appear to be inactive. However, these complementary components give the plant as a whole a safety and efficiency much superior to that of its isolated and pure active components (3).

Carica papaya belongs to the family Caricaceae. It has the following common names; pawpaw tree, papaya, papayer, tinti, pepol, chich put, fan kua, wan shou kuo, kavunagaci, kepaya etc. The parts that are usually used include the leaves, fruit, seed, latex, and root. The plant is described as a fast growing, erect, usually unbranched tree or shrub, 7-8 m tall with copious latex, trunk of about 20 cm in diameter. The plant is also described in a documented property forms and it act as analgesic, amebicide, antibacterial, cardiogenic, cholagogue, digestive, emenagogue, febrifuge, hypotensive, laxative, pectoral, stomachic and vermifuge. It is distributed throughout Asia, Nigeria etc (4). *Carica papaya* contains many biochemically active compounds. Two important compounds are chymopapain and papain, which are supposed to aid in digestion. Papain is used in the treatment of arthritis. The leaves of *Carica papaya* is used as soap substitute which are supposed to remove stains. The papain, the proteolytic enzyme has a wealth of industrial uses. It has milk-clotting (rennet) and protein digesting properties. Active over a wide pH range, papain is used in medicine, combating dyspepsia and other digestive disorders. In liquid preparations, it has been used for reducing enlarged tonsils. Nearly 80% of American beer is treated with papain, which digests the precipitable protein fragmented and then the beer remains clear on cooling. Papain is also used for degumming natural silk. But most of the papain imported in the U.S is used for meat-tenderizers and chewing gums.

Also used to extract the oil from tuna liver cosmetically, it is used in some dentifrices, shampoos and face-lifting preparations. Use to clean silks and wools before dyeing and to remove hair from hides during tanning (5). It is also used in the manufacture of rubber from latex (6). Recently, FDA has cleared chymopapain for intradiscal injection in patients with documented herniated lumbar inter-vertebral discs whose signs and symptoms have not responded to conservative therapy over an adequate period of time.

Papaya is a polygamous species and it is difficult to identify a plant whether it is male, female or hermaphrodite. *Carica papaya* is a lozenge tropical fruit, often seen in orange – red, yellow – green and yellow – orange hues, with a rich orange pulp. Papaya (*Carica papaya* Linn) is commonly known for its food and nutritional values throughout the world. The medicinal properties of papaya fruit and other parts of the plant are also well known in traditional system of medicine. Each part of papaya tree possess economic value when it is grown on a commercial scale (7). The leaves of the papaya plants contain chemical compounds of karpain, substance which kills microorganisms that often interfere with the digestive function (8). Papaya leaf-extracts have phenolic compounds, such as protocatechuic acid, p-coumaric acid, 5, 7-dimethoxycoumarin, caffeic acid, kaempferol, quercetin, and chlorogenic acid (9 and 10). During the last few decades, considerable progress has been achieved regarding the therapeutic properties of papaya. Recently, (11) had screened 13 Brazilian medicinal plants for antimicrobial activity against bacteria and yeasts. Antimicrobial is a substance that acts to inhibit the growth of harmful microorganisms or acts to destroy them, such as bacteria, virus, fungi, and protozoa. The discovery and development of antibiotics are among the most influential and successful achievements of modern science and technology for the control of infectious diseases. However, the rate of resistance of pathogenic microorganisms to conventionally used anti-microbial agents is increasing with an alarming frequency [12,13 and 14]. However, the past record of rapid, widespread emergence of resistance to newly introduced antimicrobial agents indicates that even new families of antimicrobial agents will have a short life expectancy while there are some advantages of using medicinal plants, such as often fewer side effects, better patient tolerance, relatively affordable treatment, profound therapeutic benefit, acceptance due to long history of use and being renewable in nature. For these reasons, researchers are increasingly turning their concentration to herbal products, looking for new leads to develop better drugs against multiple drug resistant microbial strains. Herbal medicine is still the stronghold of about 75-80% of

the whole population, and the major part of traditional therapy involves the use of plant extract and their active constituents [15].

(16) observed that the inhibitory action of the plant extracts could be attributed to the presence of the phytochemical constituents in the plant extracts such as alkaloid, flavonoid and saponin.

The objective of the study was to determine the antimicrobial activity, minimum inhibitory concentration (MIC), minimum bactericidal concentration (MBC) and minimum fungicidal concentration (MFC) of this plant extract on the tested organisms causing diarrhoea.

II. MATERIALS AND METHODS

2.1 Plant collection:

Carica papaya leaf was collected from Lilo town in Ihiala L.G.A of Anambra State, Nigeria. The plant was identified and authenticated in the Department of botany, Nnamdi Azikiwe University, Awka Nigeria where the sample was deposited. The leaf spread out and dried on a clean surface under a shade at room temperature to exclude direct Sunlight in order to prevent the active constituents of the leaf from being degraded due to photochemical reactions. It was air dried for about eight days after which, it was observed to be dried. The dried leaves were gathered, and crushed with grinder. The powder was weighed using an electric weighing balance by Kern ALS 220 – 4. The powder was then stored in an air tight bag at room temperature and used for further extraction.

2.2 Preparation of plant extract

The ground leaf was prepared in three ways to get the extracts.

2.2.1 Aqueous extract (Maceration Method)

Maceration method was used for aqueous extraction and powdered leaf of *Carica papaya* was used. 150 g of the plant was weighed and put in 375 ml of distilled water and allowed to stand for 48 hrs, agitate or shake for 45 mins. The extract was filtered using British standard mesh filter and first muslin cloth and concentrated by using air drying under constant air current and water bath at 50 °C. The extract was then transferred into a clean container and stored in the refrigerator until required for use.

2.2.2 Organic solvent extraction by maceration

This was carried out at Pharmacognosis Department, Faculty of Pharmaceutical Sciences, Agulu. 150 g of the plant sample was transferred into 1000 ml volumetric flask, then 375 mls of solvent (methanol and n-hexane) were added. This was covered and allowed for 48 hrs with continuous shaking, filtered and transferred to

rotary evaporator for concentration. The extract was then transferred into a clean container and stored in the refrigerator until required for use.

2.2.3 Extraction by Soxhlet method

This method was carried out by continuously extracting a sample with a non polar organic solvent for about 4-6 hrs.

III. ANTIMICROBIAL SCREENING OF PLANT EXTRACTS.

From the stored extracts in the refrigerator, the concentrated aqueous extracts of different plants were weighed 1200 mg of extract (1.2 g) as the stock. The extract was dissolved in 3 mls of distilled water to obtain 400mg /ml as our interest. This was done for aqueous extracts of the various plants.

1200 mg (1.2 g) of methanol and n-hexane extracts of the plants were weighed and dissolved in 3 mls of DMSO to make a concentration of 400 mg /ml.

3.1 Control Organisms used for Antimicrobial screening of Plants.

Standard organisms were used for the antimicrobial / antifungal sensitivity testing.

Four of these organisms were typed organisms and were collected from Department of Pharmaceutical Microbiology, Faculty of Pharmaceutical science, Agulu, Nnamdi Azikiwe University. The organisms were subcultured in different selective media for colony morphology confirmation of the typed organisms. All the organisms were re-confirmed through biochemical tests: catalase, coagulase, motility, indole, urease and Triple sugar iron agar (TSI).

<i>Salmonella typhi</i>	NCTC 10950
<i>E.coli</i>	NCTC 10418
<i>Staphylococcus aureus</i>	NCTC 6571
<i>Shigella dysenteriae</i>	ATCC 14420
<i>Candida albican</i>	

These organisms were control organisms and were stored in agar slants in a refrigerator at 2-4 °C until used.

Prior to use, these organisms were sub-cultured on Nutrient agar plates, or Sabouraud dextrose agar plates at 37 °C for 24 h.

3.2 Determination of Susceptibilities of Organisms to Crude Extracts

Prior to testing, each organism was sub cultured from the nutrient agar slope (storage system) into a nutrient agar plate. This was incubated at 37°C for 24 hrs. After 24 hrs incubation, a colony of each tested organism was inoculated into 5 mls of sterile Nutrient broth and incubated at 37°C for another 24 hrs. Thereafter, turbidity was checked.

The turbidity was adjusted to 0.5 Macfarland standard (see appendix 2 for preparation) and diluted to obtain a final turbidity in approximately 1×10^8 cfu / ml.

Muller Hinton agar was used for bacteria while Sabouraud dextrose agar was used for fungal cultivation. These media were sterilized in an autoclave at 121°C (15 lbs pressure) for 15 min before use. Petri dishes were sterilized in a hot air oven at 175°C for 1hr and was labelled appropriately.

3.3 Agar Diffusion Method :

From the first concentration (400 mg /ml) that was gotten from the stock i.e 1200 mg extract dissolved in 3 mls, further doubling dilution was prepared to give 1:200, 1:100, 1:50, 1:25, 1:12.5, 1:6.25, 1:3.125. Then, 0.1 ml of broth culture of each tested organism or fungi was placed at the centre of a sterilized petri dish and 20 ml of prepared Muller Hinton Agar or Sabourand's dextrose agar poured into it. The dish was swirled gently to ensure even distribution of the bacteria or fungi and the mixture was then allowed to gel. When gelled, six wells of 7 mm in diameter were bored in each petri dish using a sterile cork borer and each well was labeled appropriately for each crude extract or dilution of crude extract, the wells were carefully filled with 2 drops of a 2 ml pipette of both stock solutions (crude extracts) and different dilutions of the extracts, which is equivalent to 0.04 mls starting with the highest dilutions, the control drugs were added. DMSO, Methanol and conventional antibiotic (ciprotab) were used as controls. Ciprotab was used at a concentration of 200 mg/ml. This was achieved by dissolving 500 mg of the tablet in 2.5 ml of sterile water. The plates were kept for 30 mins on the bench for diffusion of the extract to take place before incubation. The dishes were incubated at 37°C for 24 hrs and observed for inhibition. The fungi were inoculated in Sabourand dextrose agar and incubated at room temperature (25°C) for 24 - 48 hrs. The zones of inhibition were measured and the results noted. This was done for aqueous, n-hexane and methanol extracts of all the plants in the tested organisms. The whole process was repeated in triplicate.

3.4 Agar Dilution Method:

1200 mg /ml (1.2 g) of the extracts each was weighed as stock solution, Muller Hinton agar and Sabourand dextrose agar was prepared. Then, using formular:

$$C_1 V_1 = C_2 V_2$$

Because we want to get 400 mg /ml as first dilution.

Where ,

C_1 = Concentration of stock (1200), V_1 = Unknown, C_2 = 400 mg / ml (our interest), V_2 = Final volume of agar to prepare (5 mls).

It was allowed to gelled, the petri dish was divided, then from the adjusted 0.5 Macfarland broth culture of tested organism, with a loopful of diluted tested organism was streak with wire loop on top of the gelled mixture of extract and agar. Incubated at 37°C for 24 h for bacteria and at room temp for fungi. Observed for growth or absence of growth. Presence of growth was indicated using positive (+) sign or negative (-) sign. From here, the tentative minimum inhibitory concentration (MIC's) was obtained, that was the last or minimum dilution of the extracts which inhibits the visible growth of organisms. Also the tentative minimum bactericidal concentration (MBC) was obtained, that was the last or minimum dilution of the extracts in which there is no growth after subculture onto fresh media. These were indicated using (-) sign.

3.5 Minimum Bactericidal Concentration (MBC)

From the tubes showing no visible sign of growth in MIC determination, test microorganisms were inoculated onto sterile nutrient agar plates by streak plate method. The plates were then incubated at 37°C for 24 hrs. The least concentration that did not show growth of test organisms after subculture was considered as the MBC.

IV. RESULTS

The antimicrobial activities of the crude n-hexane, methanol and aqueous extracts of *Carica papaya* against test organisms were shown in Figures 1 to 3 using agar well diffusion method by measuring the diameters of growth inhibition zones in triplicate. From the results crude methanol and aqueous extracts of *Carica papaya* had no inhibitory effect on *Candida albicans* (0±0) but n-hexane extracts of *Carica papaya* had antifungal activity with mean ±SD zone diameter of (5±1). In Figure 1, n-hexane extract of *Carica papaya* had no inhibitory effect on *E.coli*(0±0) but Methanol and Aqueous extract of *Carica papaya* had activities on *E.coli* (5.33±0.57) at 400mg/ml. Also the Methanol crude extract of *Carica papaya* had no activity in all the organisms tested except in *Candida albicans*.

Table 1 shows the minimum inhibitory concentrations (MBCs / MFCs) of different extracts of *Carica papaya* on test organisms. The Aqueous extract show that the MIC_s of *E.coli* and *Shigella dysenteriae* were 100mg/ml with MBC_s of 200 mg/ml and Methanol extract show that MIC of *Shigella dysenteriae* was 25 mg/ml with MBC of 50 mg/ml, MIC of *S.aureus* was 50 mg/ml with MBC of 100 mg/ml. N-hexane extract of *Carica papaya* also show that the MIC of *S.aureus*, *E. coli* and *Shigella dysenteriae* were 25 mg/ml with MBC_s of 50 mg/ml. The MIC_s of *Candida albicans* was 50 mg/ml with MFC of 100 mg/ml.

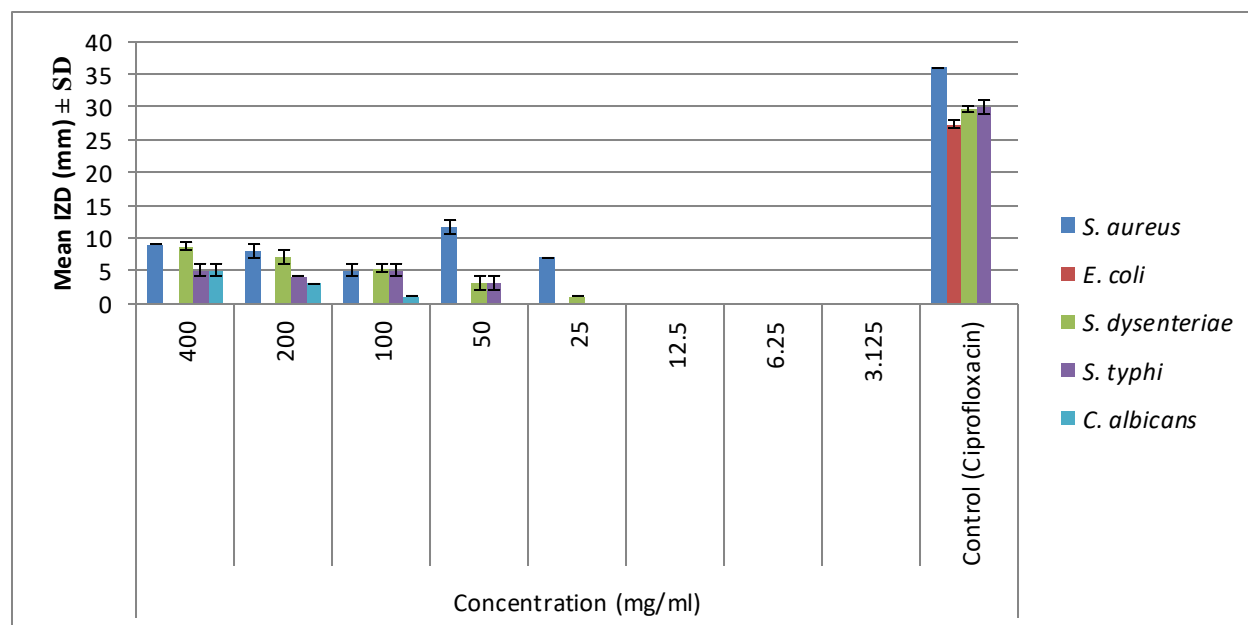


Fig.1: Antimicrobial activity of the crude n-hexane extract of *Carica papaya* leaves showing the mean inhibition zone diameters and standard deviation produced against test organisms.

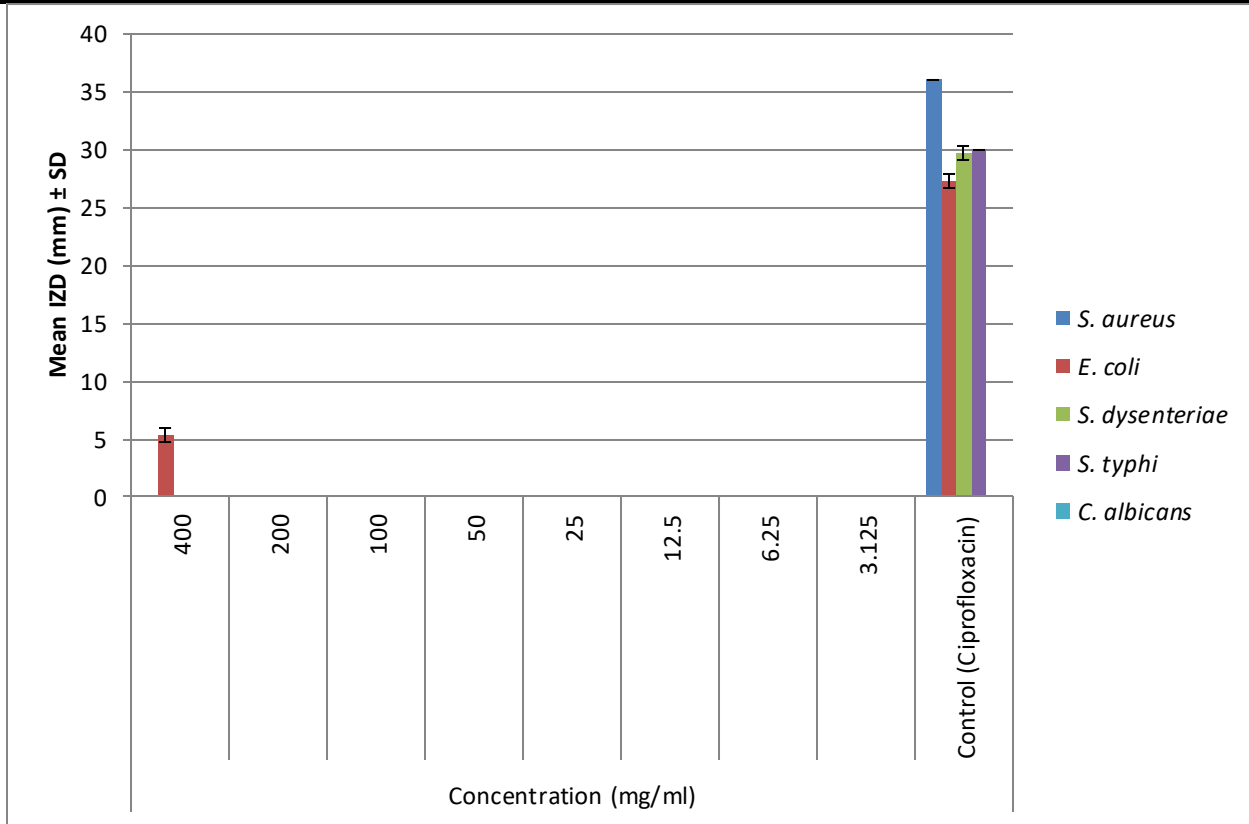


Fig. 2: Antimicrobial activity of the crude methanol extract of *Carica papaya* leaves showing the mean inhibition zone diameters and standard deviation produced against test organisms.

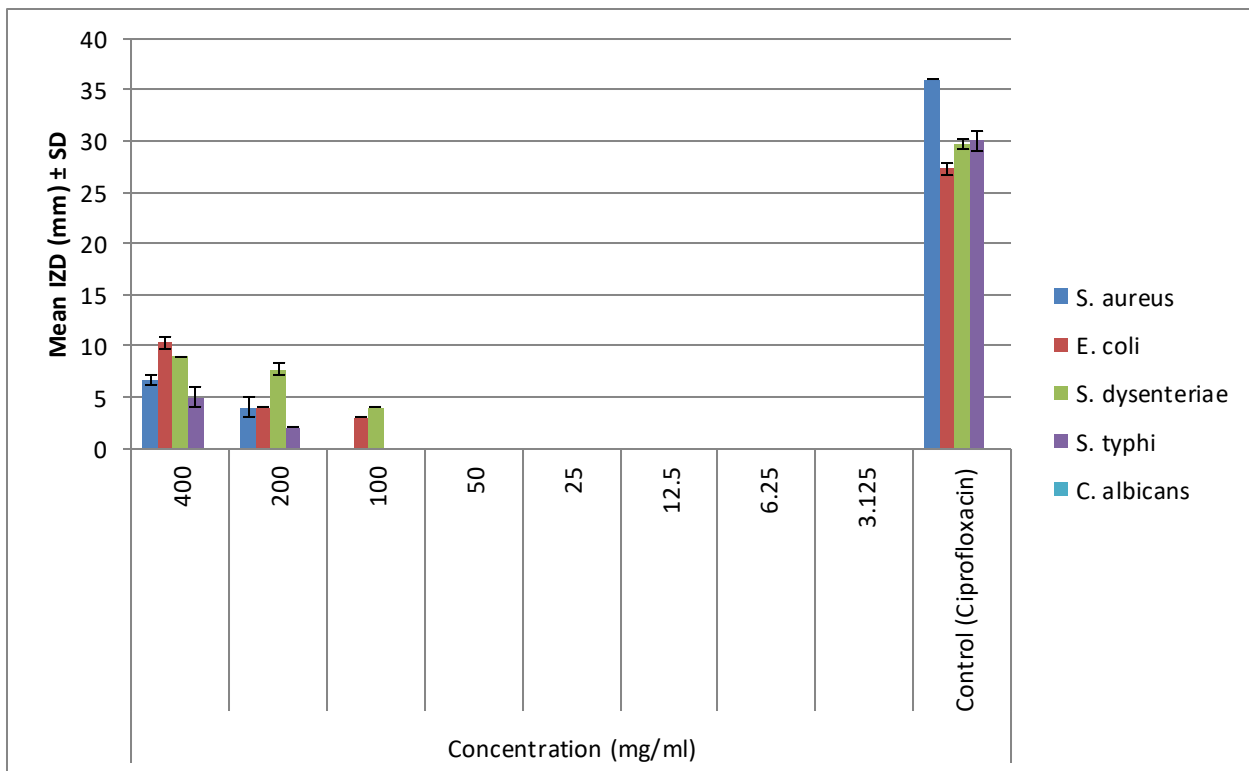


Fig. 1: Antimicrobial activity of the crude aqueous extract of *Carica papaya* leaves showing the mean inhibition zone diameters and standard deviation produced against test organisms.

Table 1: Minimum Inhibitory Concentrations (MICs) and Minimum Bactericidal/Fungicidal Concentrations (MBCs/MFCs) of extracts of *C. papaya* on test organisms.

Test Organisms	Aqueous		Methanol		N-Hexane	
	MICs	MBCs/MFCs	MICs	MBCs/MFCs	MICs	MBCs/MFCs
<i>S. aureus</i>	200	400	50	100	25	50
<i>E. coli</i>	100	200	100	200	25	50
<i>S.dysenteriae</i>	100	200	25	50	25	50
<i>S. typhi</i>	200	400	100	200	50	100
<i>C. albicans</i>	-	-	-	-	50	100

V. DISCUSSIONS

This study evaluated the antimicrobial effect of n-hexane, methanol and aqueous extracts of *Carica papaya* (paw paw) leaf against bacterial and fungal agents that causes diarrhoea. The results of the present study showed that the n-hexane extract of *Carica papaya* had significant antimicrobial effects.

The antimicrobial effect observed against the test organisms may also be as a result of these bioactive components present in the crude extract as reported by (17).

The results of the antimicrobial screening tests revealed that the crude methanol extract of *Carica papaya* were devoid of antifungal activities in- vitro as no zone of inhibition was observed on the culture plates.

The crude aqueous extract of *Carica papaya* root produced antibacterial effects but had no antifungal effect on *Candida albicans*.

The minimum inhibitory concentration (MIC), minimum bactericidal concentration (MBC) and minimum fungicidal concentration (MFC) of the plant on the test organisms varied, showing that the effect of the plant extracts differed from one organism to the other.

The n-hexane extract of *Carica papaya* had more activity than other solvents with MIC ranged from 25 mg/ml to 50 mg/ml and with MBC ranged from 50 mg/ml to 100 mg/ml. However, the present study revealed that n-hexane was the best extracting solvent for *Carica papaya*. (18) had earlier reported that the percentage recovery from plants were dependent on the type of solvent used. The n-hexane extract of *Carica papaya* had more activity than other solvents with MIC of 25 mg/ml to 50 mg/ml and with MBC of 50 mg/ml to 100 mg/ml. These results clearly confirm that *Carica papaya* leaf is effective alternative therapy against microbial agents that cause diarrhoea disease.

VI. CONCLUSION

We conclude that the *Carica papaya* leaf extracts have a significant antimicrobial activity against diarrhoea causing agents. The demonstration of antimicrobial activity of

Carica papaya may help to discover new chemical classes of antibiotic substances that could serve as selective agents for diarrhoea disease control.

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Lattice Energies from Hydration Enthalpies: Some acid-base and Structural Considerations

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Abstract— In the present work, using reference values for the hydration enthalpies for a series of mono, di, tri and tetra cations, as well as reference values for the lattice energies of a series of mono, di, tri and tetrahalides, it is shown that reliable lattice energies for such halides can be calculated by $U_{POT} = (\Delta H_{hyd}^+ + \Delta H_{hyd}^-)$, by $U_{POT} = (\Delta H_{hyd}^+ + 2\Delta H_{hyd}^-)$, by $U_{POT} = (\Delta H_{hyd}^+ + 3\Delta H_{hyd}^-)$ or by $U_{POT} = (\Delta H_{hyd}^+ + 4\Delta H_{hyd}^-)$ for mono, di, tri and tetrahalides, respectively. Linearized improved versions of such simple equations, parametrized in order to take into account factors such as dilution and entropic contributions, were also obtained. Lattice energies for a series of halides and other salts are calculated by using the obtained empirical equations, providing results in very good agreement with literature reference values. Furthermore, a series of empirical equations were derived, relating several acid-base parameters with lattice energy. It is shown that the cation and anion volumes (obtained by X-ray data), are very closely related with the cation and anion absolute hardness, that is, are very closely related with the frontier (HOMO and LUMO) orbitals energies.

Keywords— Lattice energies, hydration enthalpies, empirical equations.

I. INTRODUCTION

Lattice energy is a prominent parameter in chemistry, since it could be related with a series of properties of a given compound, such as solubility, melting point, etc. (Dasent, 1982). Furthermore, hydration enthalpy is one of the fundamental quantities for the thermodynamics of aqueous systems.

Most recently, we have been developed an empirical equation to calculate the lattice energies for metal monohalides from average orbital electronegativities (de Farias, 2017).

In the present work, are derives empirical equation that allows the calculation of lattice energies for +1, +2, +3 and +4 salts (specially halides) based only on hydration enthalpies.

II. METHODOLOGY, RESULTS AND DISCUSSION

The up to date hydration enthalpies for group 1 monocations and group 17 monoanions (Housecroft, 2017) as well as the lattice energies (U_{POT}) to the respective halides (Glasser, 2000; Mu, 2000) are summarized in Table 1. As can be verified, the sum of cations and anion hydrations enthalpies are in very good agreement with the lattice energies for the respective metal halides. Taking into account the uncertainties that there are in both, U_{POT} and ΔH_{hyd} values, such agreement is really quite good. Hence, the following equation can be derived:

$$U_{POT} = (\Delta H_{hyd}^+ + \Delta H_{hyd}^-) \quad (1)$$

where ΔH_{hyd}^+ and ΔH_{hyd}^- are the hydration enthalpies of the respective cation and anion.

Table.1: Hydration enthalpies (kJmol^{-1}) for group 1 monocations and group 17 monoanions, and lattice energies (kJmol^{-1}) for group 1 halides.

	$-\Delta H_{hyd}^0$	$\Delta H_{hyd}^+ + \Delta H_{hyd}^-$	$U_{POT} (\text{Ref.})$	$\Delta\%$
Li ⁺	578.1			
Na ⁺	463.3			
K ⁺	380.3			
Rb ⁺	355.2			
Cs ⁺	330.6			
F ⁻	463.7			
Cl ⁻	319.5			
Br ⁻	288.7			
I ⁻	246.8			
LiF		1042	1030	+1.2
LiCl		898	834	+7.7
LiBr		867	788	+10.0
LiI		825	730	+13.0
NaF		927	910	+1.9
NaCl		783	769	+1.8
NaBr		752	732	+2.7
NaI		710	682	+4.1
KF		844	808	+4.6
KCl		700	701	-0.1

KBr	669	671	-0.3
KI	627	632	-0.8
RbF	819	774	+5.8
RbCl	675	680	-0.7
RbBr	644	632	+1.9
RbI	602	617	-2.4
CsF	794	759	+4.6
CsCl	650	670	-3.0
CsBr	619	647	-4.3
CsI	577	613	-5.9

When lattice energy is plotted as a function of the sum of the respective cation and anion hydration enthalpies, the curve shown in Figure 1 ($r = 0.9687$) is obtained, from which the following empirical equation is derived: .

$$U_{POT} = 0.820 (\Delta H_{hyd}^{+} + \Delta H_{hyd}^{-}) + 118.236 \quad (2)$$

Such phenomena ($U_{POT} = \Delta H_{hyd}^{+} + \Delta H_{hyd}^{-}$) can be explained if we take into account that in the solid state (where cations are surrounded by anions and anions by cations, e.g. in a 6:6 environment, as in NaCl), or in solution (where both, cations and anions are surrounded by the solvent molecules), both, cations and anions are "looking for" (thermodynamic) stability.

In these systems, stability means to interact with positive or negative species in order to equalize their electronic chemical potentials (Parr, 1978), and such stability is achieved by exothermic interactions, with the total amount of energy required by the cation (or by the anion) been the same, no matter if the interactions occurs with other anions (or cations) in the solid state or, as in a aqueous solutions, with the negative (or positive) poles of the solvent molecules.

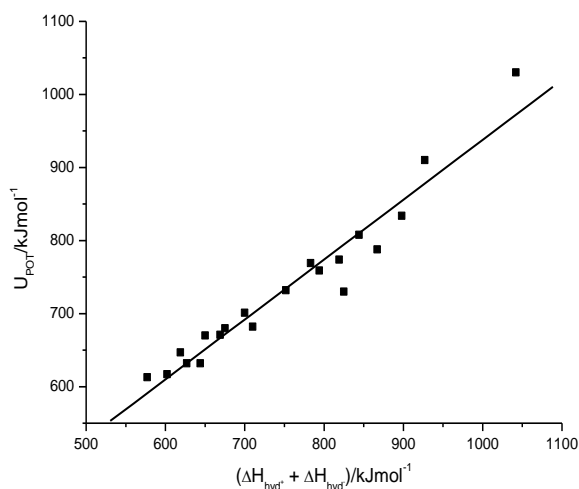


Fig. 1: Lattice energies for group 1 halides, as function of the sum of the hydration enthalpies to the respective cations and anions.

The same procedures were repeated to group 2 halides, and the respective data are summarized in Table 2. The experimental hydration enthalpies for group 2 dications are those provided by (Smith, 1977). The agreement between reference and lattice energies calculated by using the equation:

$$U_{POT} = (\Delta H_{hyd}^{+} + 2\Delta H_{hyd}^{-}) \quad (3)$$

are very good, as verified in Table 2 data, and Figure 2.

Table.2: Hydration enthalpies ($kJmol^{-1}$) for group 2 dications and group 17 monoanions, and lattice energies ($kJmol^{-1}$) for group 2 halides.

	$-\Delta H_{hyd}^{\circ}$	$\Delta H_{hyd}^{2+} + 2\Delta H_{hyd}^{-}$	$U_{POT} (Ref.)$	$\Delta\%$
Be ²⁺	2494			
Mg ²⁺	1921			
Ca ²⁺	1577			
Sr ²⁺	1443			
Ba ²⁺	1305			
F ⁻	463.7			
Cl ⁻	319.5			
Br ⁻	288.7			
I ⁻	246.8			
BeF ₂		3421	3526	-3.0
BeCl ₂		3133	3033	+3.3
BeBr ₂		3069	2914	+5.3
BeI ₂		2988	2813	+6.2
MgF ₂		2848	2978	-4.4
MgCl ₂		2560	2540	+0.8
MgBr ₂		2498	2451	+1.9
MgI ₂		2415	2340	+3.2
CaF ₂		2504	2651	-5.5
CaCl ₂		2216	2271	-2.4
CaBr ₂		2154	2134	+0.9
CaI ₂		2071	2087	-0.8
SrF ₂		2370	2513	-5.7
SrCl ₂		2082	2170	-4.1
SrBr ₂		2020	2040	-1.0
SrI ₂		1937	1976	-2.0
BaF ₂		2232	2373	-6.2
BaCl ₂		1944	2069	-6.0
BaBr ₂		1882	1995	-5.7
BaI ₂		1799	1890	-4.8

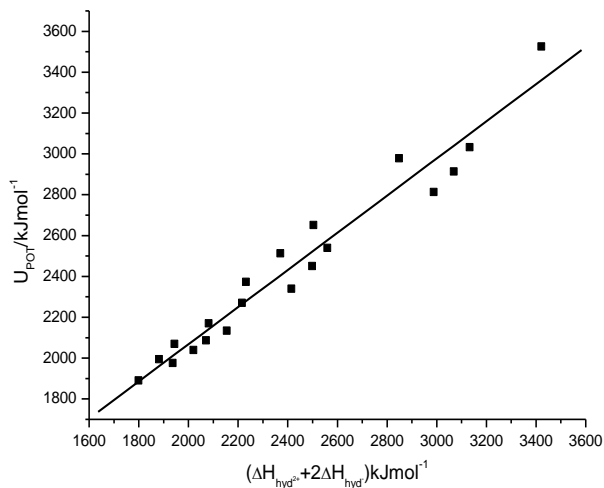


Fig. 2: Lattice energies for group 2 halides, as function of the sum of the hydration enthalpies to the respective cations and (x 2) the hydration enthalpies to the anions.

When lattice energy is plotted as a function of the sum of the respective cation and (plus 2) anion hydration enthalpies, the curve shown in Figure 2 (r = 0.9775) is obtained, from which the following empirical equation is derived:

$$U_{POT} = 0.909 (\Delta H_{hyd}^{2+} + 2\Delta H_{hyd}^{-}) + 248.573 \quad (4)$$

The same procedures were repeated to group some halides, and the respective data are summarized in Table 3. The experimental hydration enthalpies for trications are those provided by (Smith, 1977). In Tables 1-3, the U_{POT} values taken as references are those previously reported (Glasser, 2000; Mu, 2000).

The agreement between reference and lattice enthalpies calculated by using the equation:

$$U_{POT} = (\Delta H_{hyd}^{+} + 3\Delta H_{hyd}^{-}) \quad (5)$$

is very good, as verified in Table 3 data.

Table.3: Hydration enthalpies (kJmol⁻¹) for some trications and group 17 monoanions, and the lattice energies (kJmol⁻¹) for the respective halides

	$-\Delta H_{hyd}^0$	$\Delta H_{hyd}^{3+} + 3\Delta H_{hyd}^{-}$	$U_{POT} (Ref.)$	$\Delta\%$
Fe ³⁺	4430			
Al ³⁺	4665			
Ti ³⁺	4154			
Tl ³⁺	4105			
Cr ³⁺	4560			
Ga ³⁺	4700			
F ⁻	463.7			
Cl ⁻	319.5			
Br ⁻	288.7			

I	246.8		
FeCl ₃	5389	5436	-0.9
AlF ₃	6056	6252	-3.1
AlCl ₃	5624	5513	+2.3
AlBr ₃	5531	5360	+3.2
AlI ₃	5406	5227	+3.4
TiF ₃	5545	5665	-2.1
TiCl ₃	5113	5153	-0.8
TiBr ₃	5020	5023	-0.1
TiI ₃	4894	4971	-1.5
TlF ₃	5496	5431	+1.2
TlCl ₃	5064	5278	-4.1
TlBr ₃	4971	5146	-3;4
CrF ₃	5951	6065	-1.9
CrCl ₃	5519	5529	-0.2
CrI ₃	5300	5294	+0.1
GaF ₃	6091	6238	-2.4
GaCl ₃	5659	5665	-0.1
GaBr ₃	5566	5569	-0.1
GaI ₃	5440	5496	-1.0

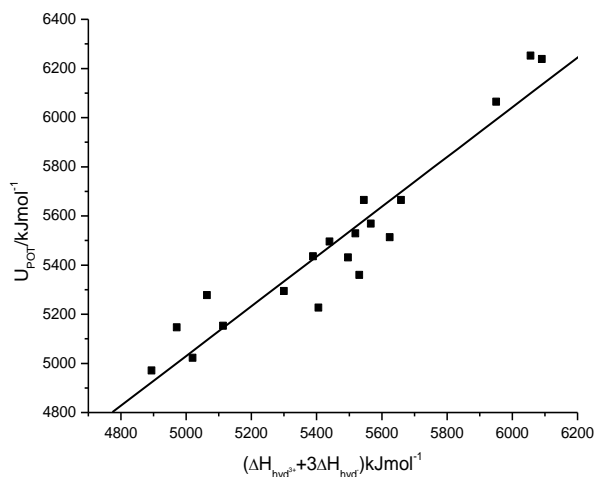


Fig. 3: Lattice energies for trication halides, as function of the sum of the hydration enthalpies to the respective cations and (x 3) the hydration enthalpies to the anions.

When lattice energy is plotted as a function of the sum of the respective cation and (x 3) anion hydration enthalpies, the curve shown in Figure 3 (r = 0.9515) is obtained, from which the following empirical equation is derived:

$$U_{POT} = 1.012 (\Delta H_{hyd}^{3+} + 3\Delta H_{hyd}^{-}) - 30.211 \quad (6)$$

The same procedures were repeated to some +4 cations halides, and the respective data are summarized in Table 4. The experimental hydration enthalpies for tetracations are those provided by (Smith, 1977).

The agreement between reference and lattice enthalpies calculated by using the equation:

$$U_{POT} = (\Delta H_{hyd}^{+} + 4\Delta H_{hyd}^{-}) \quad (7)$$

is very good, as verified in Table 4 data.

Table.4: Hydration enthalpies (kJmol^{-1}) for Zr^{4+} and Sn^{4+} and group 17 monoanions, and the lattice energies (kJmol^{-1}) for the respective halides.

	$-\Delta H_{hyd}^{\circ}$	$\Delta H_{hyd}^{4+} + 4\Delta H_{hyd}^{-}$	$U_{POT} \text{ (Ref.)}$	$\Delta\%$
Zr^{4+}	6953			
Sn^{4+}	7591			
F^{-}	463.7			
Cl^{-}	319.5			
Br^{-}	288.7			
I^{-}	246.8			
ZrF_4		8808	8971	-1.8
ZrCl_4		8231	8144	+1.1
ZrBr_4		8108	7984	+1.6
ZrI_4		7940	7801	-1.8
SnCl_4		8869	8930	-0.7
SnBr_4		8746	8852	-1.2

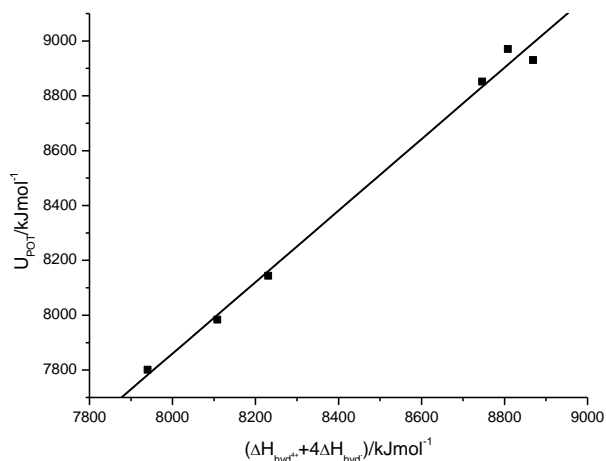


Fig. 4. Lattice energies for tetracation halides, as function of the sum of the hydration enthalpies to the respective cations and (x 4) the hydration enthalpies to the anions.

When lattice energy is plotted as a function of the sum of the respective cation and (x 4) anion hydration enthalpies, the curve shown in Figure 4 ($r = 0.9969$) is obtained, from which the following empirical equation is derived:

$$U_{POT} = 1.303 (\Delta H_{hyd}^{4+} + 4\Delta H_{hyd}^{-}) - 2566.765 \quad (8)$$

Of course, Eq. (2), (4), (6) and (8) are improved versions of Eq. (1), (3), (5) and (7), and are parametrized in order to take into account factors such as dilution and entropic contributions (Persson, 2010; Hünenberger, 2011).

In order to verify the reliability and general application of Eq.(1), (3) and (5), they were employed to calculate the lattice energies for a series of salts. Despite the fact that the equations were obtained based on data for halides, they were also applied to salts with another kind of anions. The employed auxiliary data and the obtained results are summarized in Table 5. Of course, is possible to apply the values calculated by Eq.(1), (3) and (5) in Eq. (2), (4) and (6) and obtain a new set of calculated values.

Table.5: Calculated lattice energies (kJmol^{-1}) for a series of salts, employing Eq. (1), (3) or (5). The reference hydration enthalpies and lattice energies are in kJmol^{-1} .

	$-\Delta H_{hyd}^{\circ}$	U_{POT}	$U_{POT} \text{ (Ref.)}$	$\Delta\%$
		(Eq. 1, 3 or 5)		
Cu^{+}	593			
Ag^{+}	473			
Au^{+}	615			
Tl^{+}	326			
F^{-}	463.7			
Cl^{-}	319.5			
Br^{-}	288.7			
I^{-}	246.8			
S^{-2}	1495			
CuF		1057	1088	-2.8
CuCl		913	996	-8.3
CuBr		882	978	-9.8
CuI		840	966	-13.0
AgF		937	974	-3.8
AgCl		793	918	-13.6
AgBr		762	905	-15.8
AgI		720	892	-19.3
AuCl		935	1066	-12.3
		(1144) ^a		(+7.3)
AuBr		904	1059	-14.6
		(1106) ^a		(+4.4)
AuI		862	1070	-19.4
		(1055) ^a		(-1.4)
TlF		790	920	-14.1
		(980) ^a		(+6.5)
TlCl		646	822	-21.4
		(801) ^a		(-2.6)
TlBr		615	798	-22.9
		(763) ^a		(-4.4)
TlI		573	762	-24.8
		(711) ^a		(-6.7)
Cu^{2+}	2100			
Mn^{2+}	1841			
Zn^{2+}	2046			
Cd^{2+}	1807			

Ni ²⁺	2105		
Co ²⁺	1996		
Sn ²⁺	1556		
Be ²⁺	2494		
Mg ²⁺	1921		
Ca ²⁺	1577		
Sr ²⁺	1443		
Ba ²⁺	1305		
BeS	3989	3770	+5.8
MgS	3416	3238	+5.5
CaS	3072	2966	+3.6
SrS	2938	2779	+5.7
BaS	2800	2643	+5.9
CuS	3595	3694	-2.5
MnS	3336	3795	-12.0
NiS	3600	3415	+5.4
ZnS	3541	3674	-3.8
SnS	3051	3201	-4.7
CdS	3302	3460	-4.6
CoS	3491	3653	-4.4
CuF ₂	3027	3102	-2.4
CuCl ₂	2739	2824	-3.0
CuBr ₂	2677	2774	-3.5
CuI ₂	2594	2694	-3.7
MnF ₂	2768	2803	-1.2
MnCl ₂	2480	2551	-2.8
MnBr ₂	2418	2482	-2.6
MnI ₂	2335	2388	-2.2
Mn ³⁺	4544		
La ³⁺	3296		
Ce ³⁺	3337		
MnF ₃	5935	6012	-1.3
MnCl ₃	5503	5556	-1.0
LaCl ₃	4255	4242	+0.3
LaBr ₃	4162	4280	-2.8
LaI ₃	4036	3986	+1.3
CeCl ₃	4296	4348	-1.2
CeBr ₃	4203	4418	-4.9
CeI ₃	4077	4061	+0.4

In Table 5, the experimental hydration enthalpies for cations are those provided by (Smith, 1977). Except for F⁻, Cl⁻, Br⁻ and I⁻, for which were used the values provided by Housecroft (Housecroft, 2017), the hydration enthalpies for anions are those provided by (Smith, 1977).

As can be verified from Table 5 data, Eq. (1) works very well for CuF and AgF. However, as the anion hardness decreases, the agreement between calculated and

reference values turns bad. This is a surprisingly result, since Cu⁺ and Ag⁺ are soft acids, and F⁻ is hard base. For example, when applying average orbital electronegativities to calculated lattice energies (de Farias, 2017), it was verified (in agreement with HSAB theory) that the worst results were obtained, exactly, to CuF and AgF.

On the other hand, for all copper (II) halides, Eq. (3) provides very good results. Hydrated Cu(I), d^{10} , [Cu(H₂O)₄]⁺ exhibits a tetrahedral geometry, whereas hydrated Cu(II), d^9 , [Cu(H₂O)₆]²⁺ has an octahedral structure, with Jahn-Teller distortion (Persson, 2010). The same structures (tetrahedral and octahedral) are those exhibited by Cu(I) and Cu(II) halides (Villars, 2014). Hence, for Cu(I) halides, the crystal field stabilization energy (CFSE) is zero, whereas for Cu(II) compounds, there is a net CFSE to be computed (Pfennig, 2015).

So, it is possible to suppose that Eq.(1) works better for compounds for which a zero or minor CFSE is computed (a natural conclusion, since it was obtained by using experimental data for group I halides).

The spectrochemical series for the halides is F⁻ > Cl⁻ > Br⁻ > I⁻ (Pfennig, 2015)., and all halides anions are weaker field ligands than water. Since, considering only the halides, F⁻ is the ligand with the strongest field, this is the explanation why to exchange four water molecules by four F⁻ ions in the coordination sphere of Cu(I) leads to a very good lattice energy calculated by using Eq. (1), whereas the results turns progressively bad for Cl⁻, Br⁻ and I⁻.

It is also necessary to consider that, despite the fact that Li⁺ is a hard acid and that Cu⁺ is a soft acid, four coordinated Li⁺ (Mähler, 2012) and four coordinated Cu⁺ (Shannon, 1976) have the same radius: 60 pm. Hence, like in Kapustinskii equation (Kapustinskii, 1956), eq.(1) is closely related with the cation radius.

Furthermore, the number of water molecules in the coordination sphere increases from Li⁺ to Cs⁺ (Persson, 2010; Mähler, 2012), and then, whereas Li⁺ is also four coordinated (like Cu⁺), Na⁺ and K⁺, for example, have six and eight water molecules in their coordination sphere (Persson, 2010; Mähler, 2012). Then, the entropic contribution is more prominent for Cu⁺ than to Cu²⁺ halides, if the lattice energies are calculated by using hydration enthalpy data.

Based on the results obtained to Ag⁺ halides (Table 5) can be concluded that Eq.(1) provides underestimated lattice energy values for compounds with a high degree of covalence, and that such disagreement (between calculated and reference values) increases as the degree of covalence increases. Since Ag⁺ is a soft acid, the degree of covalence increases from F⁻, Cl⁻ (hard bases) to Br⁻ (borderline base) and I⁻ (soft base).

For Au(I) halides the obtained results are really not good. However, Is necessary to remember that for gold, ($Z = 79$), relativistic contributions matters (Leszczynski, 2010), and that gold is the element with the (proportionally) higher relativistic contraction/effects.

The relativistic and non-relativistic equations can be related by using $\gamma = 1/[1-(v^2/c^2)]$, where v is the velocity of the considered body (in our case, an electron). The velocity of the 1s electron is $\approx Z/137$, where Z is the atomic number. Hence, $\gamma = 1/[1-((Z/137)^2/c^2)]^{1/2}$. For gold ($Z = 79$), and so, $\gamma = 1.224$.

Multiplying the lattice energy values calculated using Eq. (1), by γ , "corrected" lattice energy values are calculated for gold, and are shown between parenthesis in Table 5. Is worth noting that, considering the relativistic corrected values, the agreement between calculated and reference values increases from Cl^- to I^- , in agreement with the fact the Au^+ is a soft acid and Cl^- is a hard base, Br^- a borderline base and I^- a soft base.

A relativistic correction is also necessary for thallium halides. For Th, $Z=81$, and $\gamma = 1.240$.

As can be verified from Table 5 data, despite the fact that it was derived from group 1 halides data, Eq. (1) works well for group 2 sulfides, as well as for other +2 cations sulfides (CuS , MnS , etc.). Hence, can be concluded that Eq.(1) works for any 1:1 compounds, despite the cation or anion charge/nature.

Housecroft (Housecroft, 2017), based on hydration enthalpy data for group 1 cations and group 17 anions, have derived the following equations:

$$\Delta_{hyd}H^o = -(48.2 V_m^{-1/3} + 154.6)$$

(9)

$$\Delta_{hyd}H^o = -(214.71V_m^{-1/3} + 271.96)$$

(10)

Eq. (9) is valid for + 1 cations and Eq. (10) is valid for -1 anions. In such equations, V_m is the cation or anion volume, a paramount parameter in volume based thermodynamics, VBT (Glasser, 2011).

Hence, Eq.(1) can be rewritten as:

$$U_{POT} = [-(48.2 V_m^{-1/3} + 154.6) - (214.71V_m^{-1/3} + 271.96)]$$

(11)

In Eq.(11), (+) and (-) superscripts were included to differentiate between cation and anion volumes.

Furthermore, it was shown that there are a very close relationship between hydration enthalpies and absolute hardness for cations and anions. For group 1 cations (Kaya, de Farias, 2018).

$$\Delta_{hyd}H^o = -(9.645\eta^+ + 245.930)$$

(12)

where η^+ = cation absolute hardness (eV).

For group 17 anions:

$$\Delta_{hyd}H^o = -(64.601\eta^- + 12.321)$$

(13)

Hence, Eq.(1) can be rewritten as:

$$U_{POT} = [-(9.645\eta^+ + 245.930) - (64.601\eta^- + 12.321)]$$

(14)

Taking Eq. (11) and (14), and multiplying both sides by -1, we have:

$$[(48.2 V_m^{-1/3} + 154.6) + (214.71V_m^{-1/3} + 271.96)] = [(9.645 \eta^+ + 245.930) + (64.601 \eta^- + 12.321)] ;$$

$$48.2 V_m^{-1/3} + 214.71V_m^{-1/3} + 426.6 = 9.645 \eta^+ + 64.601 \eta^- + 258.3;$$

$$48.2 V_m^{-1/3} + 214.71V_m^{-1/3} + 168.6 = 9.645 \eta^+ + 64.601 \eta^- ;$$

$$48.2 (V_m^{-1/3} + 4.5 V_m^{-1/3} + 3.5) = 9.645 (\eta^+ + 6.7 \eta^-);$$

$$5 (V_m^{-1/3} + 4.5 V_m^{-1/3} + 3.5) = (\eta^+ + 6.7 \eta^-);$$

$$[(V_m^{-1/3} + 4.5 V_m^{-1/3} + 3.5) / (\eta^+ + 6.7 \eta^-)] = 1/5 \quad (15)$$

Eq. (15) shows that the cation and anion volumes (obtained by X-ray data), are very closely related with the cation and anion absolute hardness, that is, are very closely relates with the frontier (homo and lumo) orbitals energies.

It is noteworthy that have been shown that (Tissander, 1998) absolute hydration enthalpy values can be calculated from a set of cluster-ion solvation data, without the use of extra thermodynamic assumptions. Hence, could be concluded that the empirical equations obtained in the present work (Eq. 15, for example), can also be related with the previously derived hydration enthalpy equations, based on cluster-pair-based approximation.

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Reference Models for Production Planning and Control Systems: A Bibliometric Analysis and Future Perspectives

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Abstract— *The activity of modeling business processes is still not a common practice among organizations which contributes to increase the cost and time of systems deployment, improvement projects and educational software, due to the need to develop new models related to Business Processes. In this context, one of the Business Processes essential for organizations, especially those located in countries such as Brazil, where production activities are more pronounced than product development, is Production Planning and Control (PCP). In this scenario, in order to present a picture of scientific production, contribute to the literature review and identify gaps in the scientific literature within the framework of the Reference Models and PCP approach. This work aims to perform a bibliometric research in these areas of study. In this study, we used the bibliometric revision method composed of four phases: definition of database, definition of research keywords, selection of papers and analysis of papers. As a result, it was found that most scientific studies are focused on very specific situations in industrial planning or addressing particular business sectors.*

Keywords— *Reference Model, Bibliometric Analysis Planning and production control.*

I. INTRODUCTION

Modeling the processes of a company provides a better understanding of the assumptions regarding the management inherent in its systems and, also, and also viable alternatives to existing organizational activities, in order to provide an effective framework for decision-making (CORREA; SPINOLA, 2015).

Based on a reference model, it is possible to analyze the best use of its industrial potential, in order to obtain more

effective answers to the constant changes that have occurred in the market. However, the business process modeling activity is not yet a common practice among organizations, which contributes to the increase in cost and time of system implementation or improvement projects, due to the need to develop new models related to their Business Processes (BREMER; LENZA, 2000).

In the business context, one of the most important business processes for organizations, especially those located in countries such as Brazil, where production activities are more pronounced than product development, is Production Planning and Control (PCP).

According to Thurer & Filho (2012), most companies are aware that they must improve their PCP activities in order to achieve reductions in lead time and work in process, thereby achieving greater operational efficiency. However, for the authors, especially small and medium-sized organizations, simply do not know how to do this, since the vast majority of research and solutions for PCP are focused on large and complex companies.

Therefore, it is important to note that there is an academic gap regarding work to support the implementation of PCP systems. In addition, there is a great and growing attention, both in academia and in business, in the development of models that support the planning of business resources (CORREA; SPINOLA, 2015). However, studies found in the literature focused on the development of PCP models are mostly oriented to particular industrial segments and that address modules of specific activities of Production Management, as observed in the papers published by Ji, Wang and Hu (2016), Mariel and Minner (2015), Carvalho and Pacheco (2014), Lu et al. (2013) and Costa e Silva (2010).

In this way, in order to present a picture of the scientific production, contribute to the literature review and identify gaps in the scientific literature within the framework of the Reference Models and PCP approach, this work aims to perform a bibliometric research in these areas of study. The paper is organized as follows: Section 2 discusses the literature review on Reference Models and PCPs, section 3 deals with the applied methodology of bibliometric revision, section 4 presents the study performed and the results obtained, and finally section 5 presents the final considerations.

II. REVIEW OF LITERATURE

III Reference Model

Reference modeling is defined as the process of formally documenting a problematic domain in order to understand and communicate stakeholders (SIAU; ROSSI, 2011). The reference models, which can be developed in real situations or in theoretical studies, document the various aspects of a business process. According to Bremer and Lenza (2000), the purpose of reference model is to provide the company with an initial solution for its Business Processes, so that, through it, the particular model of the company is specified and detailed. For the same authors, these models, through documentation, storage and use of knowledge, are key instruments in the process of management of educational learning.

For Vernadat (1996), a reference model must contain a certain degree of generality and be customizable. Therefore, For Vernadat (1996), the reference model must contain some degree of generality and be customizable. Therefore, it should serve as a basis for discussion, a formal or semiformal suggestion for the elaboration of specific models, bringing information regarding to the business process design.

Keller e Teufel (1998) understand that the reference models can be applied in cases of accumulated experience in a type of business, and can be applied to business process solutions implemented and executed in enterprise management software.

The reference models can be distinguished between procedural models, or standard software implementation, and business models (models for production management and product development). Bolloju and Leung (2006) suggest that during the analysis phase of an information system development, the reference model can be used to capture and represent the requirements of development and deployment of such technologies.

According to Climent, Mula and Hernández (2009), reference models are useful in describing and graphically representing important aspects of a particular process, distinguishing, for example, people, departments and the connection between them. In addition to Vergidis, Turner,

and Tiwari (2008) the models adequately portray and represent processes, emphasizing the aspects that need to be communicated and addressed.

In a review elaborated by Hernandez, Mula e Ferriols (2008), it was proposed that a reference model describe the social and physical aspects of the world in order to understand and communicate. Supplementary, it has also been described that the reference model must go beyond the terms "specifications" and "requirements" and apply three linguistic concepts (syntax, semantics and pragmatics) to four aspects of modeling: language, domain, model and participants.

Tsai and Sato (2004) proposed a reference model in UML notation called by the authors of the Agile Production Planning and Control System (APPCS). The authors created a model of PCP in order to develop a system contemplating the following functions: material requirements planning; task-oriented programming / operations; purchasing; and production control. Bremer and Lenza (2000) have developed a reference model through academic research on production management, of practical work developed and by interviews with companies.

Briefly, the advantages to be attributed to these models consist in reducing the time and cost in the development of particular model; comparing the activities of the company with the activities proposed in the model, that is, best practices; and better support in deploying x integrated business management systems teaching support software.

II.2 Planning and production control

PCP is an administrative function whose purpose is to accomplish the plans that guide production and serve as a guide for its control, aiming to increase efficiency and effectiveness through the management of what is to be or is being produced, in order to satisfy consumer demand (ANTUNES; SEHNEM; LIMA, 2014).

PCP systems are responsible for defining how the organization should follow to achieve its strategic objectives supporting the decision-making of managers, mainly on the following issues: what to produce, how much to produce, when to produce, and with what resources to produce. Thus, it can be said that this system dictates the rhythm of the production in the company and can be considered as one of those responsible for a fundamental competitive advantage: the quality of the goods produced.

Still according to Fernandes and Filho (2010), Production Planning deals with aggregate decisions in a medium-term universe. Production Control is responsible for regulating (planning, coordinating, directing and controlling), in the short term, the flow of materials into a

production system through information and decisions to execute.

For Andrade and Fernandes (2015), PCP is an activity that consists in the establishment of an operational plan, being worried about managing the activities of the productive operation such as to meet the demand of consumers. For the authors, the PCP provides information for the efficient management of the flow of materials for the effective use of people and equipment available for the coordination of internal activities with those of external suppliers and for an effective communication between the needs of the consumer market and the productive system.

A quantitative case study performed by Fernandes et al. (2013), seeking to improve the management of a production line, showed that the productive processes were optimized queues and lead time were reduced, after the implementation of an effective PCP system.

III. RESEARCH METHOD

Bibliometrics provides statistical metrics related to the study of quantitative processes of production, dissemination and use of information and also designates advanced processes and mechanisms of online search and information retrieval techniques, being important tools for management of teaching and knowledge, once that it is possible to detect gaps in the scientific literature (BUFREM; PRATES, 2006).

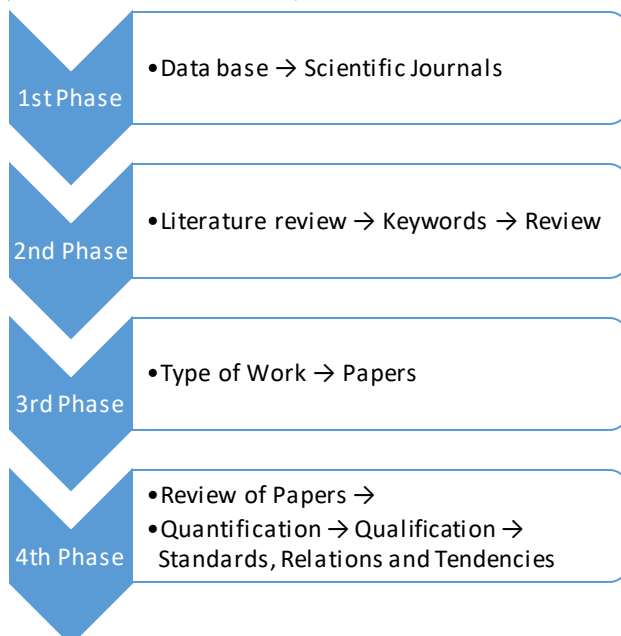


Fig. 1: Flow chart of methodology to be applied in the bibliometric review.

This research can be considered theoretical and conceptual and is focused on the bibliographic analysis to be carried out through a structured review of the

literature, aiming to analyze the Reference Model theme from the PCP point of view. Will be used the method of bibliographic revision, proposed by Marasco (2008), with four different phases (definition of database, definition of research keywords, selection and analysis of papers), as shown in Figure 1.

In the first phase for the composition of the bibliographic portfolio, the SciVerse Scopus databases were defined. The choice of this database is due to the fact that it encompasses the journals that most publish research related to Production Engineering (MARASCO, 2008). Although the results and conclusions from this research are limited to the selected database, the ideas presented in this paper contribute to the development of the field of knowledge and can serve as inspiration for the development of new knowledge, both for academics and professionals in the field of PCP.

Surveys were conducted in journals without temporal delimitation of published studies. The total amount of works found in the mentioned databases was a result of the combinations of keywords searched in the titles and in the summaries of the papers. The research was conducted in January of the year 2018.

In the phase of definition of keywords for the bibliographic review, from the SciVerse Scopus database, the following keywords were used: "Production Planning" OR "Production Planning and Control" AND "Reference Model".

These terms were submitted to the selection filter, which included the inclusion criterion by reading the title, summary and keywords. This search resulted in a sample of 18 papers published in the subareas Business, Management & Accounting and Engineering, main fields of research on this subject. Subsequent to the definition of the sample, the data available in the SciVerse Scopus database were extracted as: authors, title, journal, year and number of citations.

In the analysis of citations of papers collected at the SciVerse Scopus database, two activities are presented: calculation of the corrected index of citations and ordering of the most cited papers. Equation 1 shows the calculation of the Corrected Citation Index (CCi), in which the CI is the citation index extracted from the database and IF is the impact factor of the journal in which the paper was published (IRITANI et al. 2015). According to Lopes and Carvalho (2012), the correction of citation index aims to contain, in addition to the number of citations, the relevance of the journal in which the paper was published.

$$CCi = CI \times (IF + 1) \quad (1)$$

IV. RESULTS AND DISCUSSION

The first analysis of publications was that of journals per year, in which it was possible to identify the evolution of the publications of papers focused on the study and development of reference models for PCP environments. Figure 2 shows the evolution chart of the number of publications over the years according to the Scopus database. It is observed that few studies that simultaneously approach the concepts of Reference Models and PCP have been published over the last 30 years, which shows that this area of study still has many aspects to be explored.

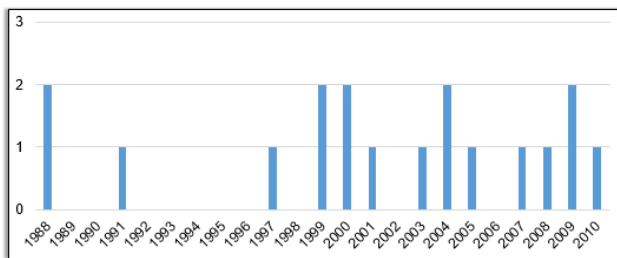


Fig. 2 Evolution of the number of publications over the years in the Scopus database.

It is also worth noting that in the last ten years only five studies focused on this theme were produced, the last one being published in 2010. The following are the most recent works in the areas of reference models and production planning:

- Abele and Schrems (2010) proposed, based on a reference model, a software tool that helps the production engineer to choose the most efficient production techniques. This tool is based on a methodology to calculate the anticipated consumption of energy and resources of different process techniques.
- Aguilar, Chacal and Bravo (2009) developed a general reference model for automated applications, which perform production planning functions and production factor management. Then, this reference model was used to propose a model for the ERP system based on multi-agent systems.
- Martinez-Olvera (2009) proposed a reference model on-demand manufacturing environments (MTO – Make-To-Order). The MTO-based reference model was presented through IDEF notation and was derived from domain knowledge in the manufacturing execution area.
- Hernandez, Mula and Ferriols (2008) proposed a reference model for the conceptual modeling activity of production planning processes, from the description of a methodology for the identification and analysis of inputs, outputs, processes and subprocesses.

- Aviv (2007) studies the potential benefits of Collaborative Forecasting (CF) in a supply chain consisting of a manufacturer and a dealer. To reflect reality in production environments, the author proposed performance indicators that captures inventory and production considerations and adherence to plans. Finally, a prescriptive and convex production planning model was presented for the manufacturer and a spare model for the dealer. The integrative reference model was used to study the potential benefits of CF partnerships.

Among the 36 authors surveyed, the authors who published the most are shown in Figure 3.

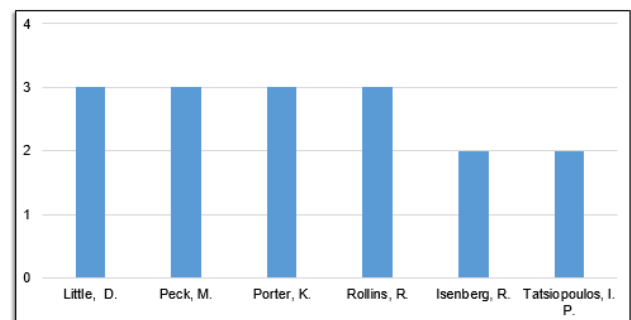


Fig. 3: Quantitative publications of the main authors in the Scopus database.

Following are the papers published by the main authors in the area of reference models in PCP systems according to the Scopus database:

- Little et al. (2000, 2001) concluded research based on case studies aimed at the development of new planning reference models for industrial sectors where MRP II was not appropriate. for data capture in the companies where the case studies took place and the use of ARIS for the production of sector reference models. However, according to the authors, the reference models are determined for a specific industrial sector.
- Porter et al. (1999) presented a review of some common manufacturing classification systems, and attempted to direct them against accepted paradigms for production planning and control approaches. The authors also discussed a method for mapping production processes, with the objective of creating a series of reference models for the PCP.
- Isenberg (1988) described the analysis, design, and implementation of a work cell controller that uses knowledge-based system technology in the electronics industry. The central task of the work cell controller was to fill the gap between the high-level PCP system of the logistics department and the short-term planning at the shop floor level through the use of reference models.

- Meyer, Isenberg and Hubner (1988) also presented a unified methodology for analysis, design and implementation of software modules as experienced systems for production planning, quality control and preventive maintenance. It was also selected by these researchers an extension of the hierarchical reference model for a distributed intelligent controller model.
- Tatsiopoulous and Mekras (1999) presented a specialized rule-based system that can be used to select a package of suitable PCP software to be applied in a specific manufacturing company. A tipologia do sistema de produção e um modelo de referência de software PCP
- The typology of the production system and a reference model of PCP software Tatsiopoulous (1997) presents a data-oriented reference model for the order-release process that forms the link between the PCP system and the production execution system. A generic architecture is described in the form of a module structure which includes: order manager, material manager, and capacity manager. The architecture is further decomposed into a data model layer and a function layer creating a reference model with generic, partial, and particular views.

Table.1: Shows the list of extracted, in descending order of the number of citations, at the Scopus database, specifying the number of citations and the that was published, impact factor and the citation index ran.

Table 6. List of papers and their respective CI, IF, e IC¹. CI – Citation Index; %CI – Relative Citation Index RCI; JIF- Journals Impact Factor (2016); CIC – Citation index corrected.

Paper	Journal	CI	JIF	CIC
Aviv (2007)	Management Science	89	2,822	340,158
Brinke et al. (2000)	International Journal of Production Research	21	2,325	69,825
Hernandez, Mula e Ferriols (2008)	Production Planning and Control	16	2,369	53,904
Meyer, Isenberg e Hubner (1988)	International Journal of Computer Integrated Manufacturing	11	1,949	32,439
Persona,	Journal of	30	-	30,000

Regattieri e Romano (2004)	Manufacturing Technology Management			
Tatsiopoulous (1997)	Computers in Industry	8	2,691	29,528
Porter et al. (1999)	Integrated Manufacturing Systems	27	-	27,000
Bertolini et al. (2004)	Journal of Enterprise Information Management	12	-	12,000
Tatsiopoulous e Mekras (1999)	Production Planning and Control	3	2,369	10,107
Singh e Hindi (1991)	Journal of Intelligent & Robotic Systems	4	1,512	10,048
Martinez-Olvera (2009)	International Journal of Production Research	3	2,325	9,975
Aguilar, Chacal e Bravo (2009)	Computer Systems Science and Engineering	5	0,348	6,740
Abele e Schrems (2010)	ZWF Zeitschrift fuer Wirtschaftlichen Fabrikbetrieb	4	-	4,000
Little et al. (2001)	Integrated Manufacturing Systems	4	-	4,000
Little et al. (2000)	Production Planning and Control	1	2,369	3,369
Ayhan (2005)	Industrial Diamond Review	2	0,138 ²	2,276
Vosniakos (2003)	International Journal of Mechanical Engineering Education	2	-	2,000
Isenberg (1988)	International Journal of Advanced Manufacturing Technology	0	2,209	0,000

¹ Impact Factor for the year 2016.

² Evaluation related to the year 2007 (last evaluation performed).

The work of Aviv (2007) stands out for having published in a journal of great relevance and world qualification, besides having a high index of citation. Also highlighted in this requirement is the paper published by Brinke et al. (2000). Based on the product information structure related to the Production Engineering reference model, Brinke et al. (2000) proposed a method for estimating costs based on variants. This structure defines a product in terms of elements and their relations. The elements and their properties constitute characteristics of the product that can be used to compare products. For proper use in different engineering processes, product characteristics are related to the four cost requirements: geometry, material, processes and production planning.

Finally, below are the other papers that compose the bibliographic portfolio from Scopus database:

- Persona, Regattieri and Romano (2004) developed a work that aimed to identify the general requirements and guidelines for the definition of an integrated order model for the delivery cycle in an environment with high variety and relatively low volumes.
- Bertolini et al. (2004) defined the main characteristics of a corporate model for the fashion industry. The characteristics required by the ERP model were identified, with specific attention to the PCP modules.
- Vosniakos (2003) described a model to teach the concepts and practical aspects of the integration of manufacturing systems for mechanical engineers.
- The approach adopted took into account six areas of computer-based manufacturing systems: design, production planning, process planning, material control, store scheduling and quality assurance.
- Ayhan (2005) presented a reference model to optimize PCP specifically for the marble industry by calculating production costs.
- Singh and Hindi (1991), as a contribution to the debate on reference models derived from concepts of control theory, formulated the basic problem of management of computer-assisted production from the point of view of control theory and examined the main difficulties in using gross basis as a basis for decision making.

An accomplished bibliometry will be able to discover how the characteristics of publications of the field and, with this, to visualize the scientific scene, the main authors and works, the most relevant journals and the distinctive features that integrated the studies carried out, which helps in the elaboration of dissertations and papers, since it is possible to analyze

the existing gaps in the scientific literature of a given area of research.

With regard to reference models in PCP systems, it was observed that such models prove to be a viable tool to support the development, selection or adoption of integrated management systems and software, as could be seen in the works of Abele and Schrems (2010), Aguilar, Chacal and Bravo (2009), Tatsiopoulos and Mekras (1999) and Meyer, Isenberg which are available in the SciVerse Scopus database. However, it was noticed that most of the studies are focused on very specific situations of industrial planning (AVIV, 2007; LITTLE et al., 2000, 2001; MARTINEZ-OLVERA, 2009; PERSONA; REGATTIERI; ROMANO, 2004) or address particular business sectors (AYHAN, 2005; BERTOLINI et al., 2004; VOSNIAKOS, 2003). This situation has also been verified, as previously mentioned, in the works published by Ji, Wang e Hu (2016), Mariel e Minner (2015), Carvalho e Pacheco (2014), Lu et al. (2013) e Costa e Silva (2010). Additionally, it was found that there were no studies on reference models for support in the development of educational software in the area of PCP.

V. CONCLUSION

Bibliometric analysis is a starting point regarding the characteristics of science in the area of PCP and Reference Models. In this sense, the bibliometric study of the bibliographic portfolio consisted of the analysis of the set of papers for the structuring of an information frame and the scientific knowledge about the researched topic. Thus, this study supports the elaboration of new scientific works (dissertations and papers), since it is possible to analyze the existing gaps in the scientific literature in the area of reference models in the PCP system.

According to the SciVerse Scopus database, the models developed by the extracted works proved to be viable in supporting the development, selection and adoption of integrated management systems and software. However, most of these studies are directed at very specific situations in industrial planning or addressing particular business sectors.

As gaps in the scientific literature, it was verified that there were no studies regarding reference models for support in the development of software to support teaching in the area of PCP.

Faced with this scientific scenario in the area of reference models and PCP, it is suggested as a proposal for future works, the development of a conceptual, holistic and hierarchical reference of activities related to a complete PCP system, in order

to advance international business planning models. Another application found for this model of reference is the teaching of production management, for example, from the elaboration of educational software. undergraduate course in Production Engineering.

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Approach of Passive Filters using NSGA II in industrial installations: Part I

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Abstract—The optimization of passive filters in industrial systems has been presented by different computational methods. The objective of this paper is to develop a computational algorithm with NSGA II to select the configuration and design parameters of a set of passive filters for industrial installations. As a methodology, the optimization problem was addressed using three independent objective functions of innovative character for compensation of harmonics through passive filters as a multiobjective problem. The results were the computational solution to this problem that determines a set of Pareto optimal solutions (Frontier). In addition, the computational tool has several new features such as: calculates the parameters that characterize the filters, but also selects the type of configuration and the number of branches of the filter in each candidate bar according to a set of pre-established configurations according to PRODIST-M8 (Brazilian Standard) and IEEE 519-2014. Also determine solutions with good power quality indicators (THD, TDD and NPV) for several characteristic and non-characteristic scenarios of the system that allow to represent: daily variations of the load, and variations of system parameters and filters. It evaluates the cost of energy bills in an industrial power grid that has different operating conditions (characteristic scenarios) and evaluates the economic effect of harmonic filters as reactive power compensators.
Keywords—Quality Power, NSGA II, Passive Filters, multiobjective optimization.

I. INTRODUCTION

Modern electrical systems contain the quantities of sources capable of contaminating or producing various harmonic impacts in the distribution network where the non-linear loads found in industrial sectors, commercial

and residential installations stand out. The optimization of passive filters in distribution systems has been approached through different approaches. In general, these can be classified as single goal formulations (Ghiasi, Rashtchi, & Hoseini, 2008; J. C. A. Leite, I.P.; Azevedo, M.S.S., Nascimento, M.H.R.; Moraes, N. M., Reis, A.M. , 2015; Mahaboob, Ajithan, & Jayaraman, 2018; A. Zobaa, Vaccaro, Zeineldin, Lecci, & Monem, 2010) and multiobjective optimization (J. C. Leite, Abril, de Lima Tostes, & De Oliveira, 2017; C. f. Yang, Lai, & Su, 2013).

Medium and high-power contaminant sources generally focus on industrial electrical systems. These include static power converters and electric arc furnaces. For this purpose single goal formulations usually attempt to determine the least costly filters that ensure compliance with relevant standards of power quality standards. In multiobjective approaches, other objectives are added to achieve the following: minimum total current distortion (Acuna et al., 2015; Ji, Liu, Zeng, & Zhang, 2012), minimum total demand ratio (Beres, Wang, Liserre, Blaabjerg, & Bak, 2016), minimum total voltage distortion (A. F. Zobaa, 2014), minimum investment cost of filters (Busarello, Pomilio, & Simões, 2016), minimum cost losses (Hu, He, & Gao, 2015; N.-C. Yang & Le, 2015), etc.

In commercial and residential installations, a large number of nonlinear loads of small power are employed, which due to their large numbers cannot be neglected as a source of distortion. This is the case of home and office equipment, discharge lamps as shown by the standards (Association, 2014; Maciel, Lins, & Cunha, 1996), among others.

The harmonics injected into the electrical system by the non-linear loads produce effects: in the electric

power systems themselves and in the electric charges connected to them, as well as in the communications systems (Std.153L, 2003).

II. PASSIVE FILTERS

a. Introduction of Passive Filters

When designing an industrial installation containing large non-linear loads, the limits recommended by harmonic distortion standard are generally violated. Given this premise, measures must be taken to ensure compliance with these limits and, in this way, reduce the undesirable effects of the harmonics in the industrial electrical system, thus avoiding the extension of power quality problems to the external supply system

The means of compensation of the harmonic distortion by excellence are the filters of harmonics that aim essentially to restrict the circulation of the harmonic currents by the network, in order to avoid the distortion of the tension in the bars (Arrillaga & Watson, 2004).

For the operating principle, the harmonic filters can be: passive, active or hybrid (when using a mixture of the first two). Although active filters have shown advantages in low voltage systems, passive filters are still the most attractive in medium and high voltage systems (Nassif & Xu, 2007). There are several types of parallel passive filters that can be classified into tuned filters and damped filters (Nassif, Xu, & Freitas, 2009).

A. Filter types

a) Filterstuned

In the tuned filters or bandpass filters, the passive circuit consists of a capacitor and a series inductance to a low value resistor (Dehini & Sefiane, 2011). Figure 1 shows the tuned filter

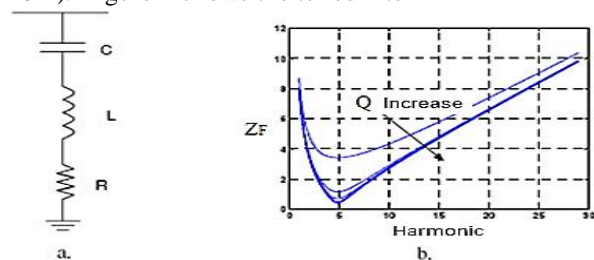


Fig.1: Filter tuned. a) Topology, b) Impedance versus frequency.

Source: Adapted from (Kahar & Zobaa, 2018).

b) Damped Filter (High pass)

The damped filters shown in Figure 2 are characterized by having an impedance characteristic versus smoother frequency, which allows the passage of high frequencies and therefore their elimination.

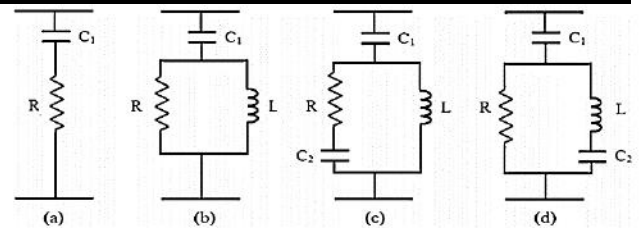


Fig.2: Damped filters. (a) 1st order, (b) 2nd order, (c) 3rd order, (d) type C. Source: (Abdel Aleem, Zobaa, & Balci, 2017).

c) Second order filter

The most used damping filter in practice is the second order filter as shown in Figure 3 whose behavior depends on the quality factor used in its design. A high quality factor implies a more selective bandwidth, while a low quality factor reduces the impedance of the filter for high frequencies

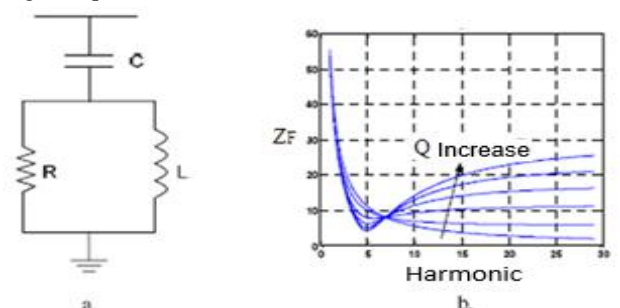


Fig.3: Filter of second order: a) Topology, b) Impedance versus frequency. Source: Adapted from (Maundy & Elwakil, 2015).

d) Third-order filter

The third-order filter incorporates a new capacitor C_2 in the circuit (Figure 4).

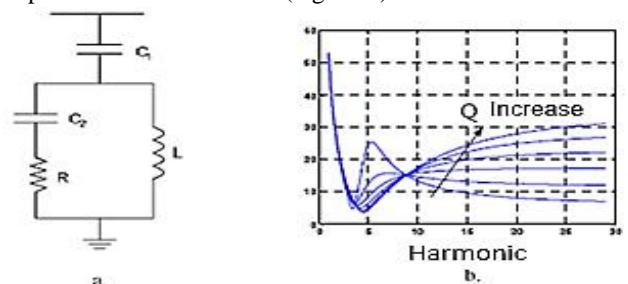


Fig.4: Third order filter. a) Topology, b) Impedance x frequency.

Source: Adapted from (Zhang, Wang, Xu, & Sither, 2018).

e) C type filter

The design of this filter shown in Figure 5 is based on the fact that X_L is equal to X_{C2} and therefore produces a series resonance therebetween at the fundamental frequency so that the resistance is short-

circuited at this frequency and the filter operate as a capacitor (Zhang et al., 2018).

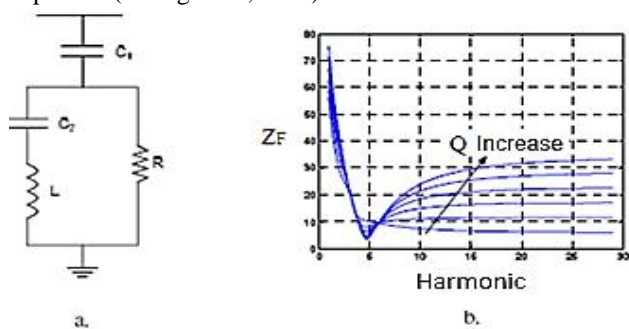


Fig.5: Filter type C. a) Topology, b) Impedance versus frequency. Source: Adapted from (Zhang et al., 2018).

The impedance of the type C filter for the frequency n in (1) is:

$$Z = \frac{jR(XL \cdot n - Xc_2/n)}{R + j(XL \cdot n - Xc_2 \cdot n)} - jXc_1/n \quad (1)$$

Following the described procedure, the resistance is obtained from (Abril, 2012) according to (2):

$$R = \frac{Xc_1}{n^3(n^4 - 1)Q} \left((n^2(Q^2 + 2) - n^4 - 1) + \dots + \sqrt{n^{12}(Q^4 + 2Q^2 + 2) - 2n^{10}(3Q^2 + 4) + n^8(4Q^2 + 11) + 2n^6(Q^2 - 2) - 2n^4(Q^2 + 2) + 4n^2 - 1} \right) \quad (2)$$

C. Saturation of components

The standard ("IEEE Standard for Shunt Power Capacitors," 2013) states that the power capacitors of the harmonic filters must be able to operate on a continuous basis under any condition of the system provided that the following conditions are met:

- 1) The *rms* voltage applied to the capacitor does not exceed 110% of its rated voltage *rms* (V_{cnom}).
- 2) The peak voltage applied to the capacitor (including harmonics but not transients) does not exceed 120% of its rated peak voltage.
- 3) The *rms* current flowing through the capacitor does not exceed 135% of its nominal current *rms* (I_{cnom}).
- 4) The reactive power generated by the capacitor does not exceed 135% of its nominal reactive power (Q_{cnom}).

Thus, if h is the set of harmonics to which the capacitor is subjected, one can establish the following relations (3), (4), (5) e (6):

$$\sqrt{\sum_{h \in H} V_h^2} \leq 1.1 \cdot V_{cnom} \quad (3)$$

where V_h represents the harmonic voltage h applied to the capacitor.

$$V_{peak} \leq 1.2 \cdot \sqrt{2} \cdot V_{cnom} \quad (4)$$

where V_{peak} is the peak voltage applied to the capacitor.

$$\sqrt{\sum_{h \in H} I_h^2} \leq 1.35 \cdot I_{cnom} \quad (5)$$

where I_h represents the current of the harmonic h that circulates through the capacitor

$$\sum_{h \in H} Q_{ch} \leq 1.35 \cdot Q_{cnom} \quad (6)$$

where Q_{ch} is the reactive power of the harmonic h generated by the capacitor.

In the saturation of reactors and resistors, although there is no specific norm (Std.153L, 2003), it is considered that the values of *rms* voltage, *rms* current and the nominal power of these elements, cannot surpass any condition of stable operation of the filter.

D. Filter costs

The investment cost of a filter is the sum of the costs of its component elements (Std.153L, 2003):

- 1) Capacitors, reactors and resistors;
- 2) Protection (fuses, switches, etc.), and;
- 3) Housing (Chassis, etc.)

With respect to the cost of the other elements, this can be considered as 1% of the total cost of the filter (Std.153L, 2003).

III. MATERIAL AND METHODS

A. Formulation of the problem

Given the issues raised, this thesis formulates the problem of optimizing the design of passive filters in industrial electrical systems as a multiobjective problem that seeks the selection and design of passive filters necessary to meet the following objectives: Maximize Net Present Value (NPV) installation filters design; Minimize total distortion of current in the CCP, and; Minimize the total distortion of the voltage in the bars of the industrial electrical system. Subject to the restrictions of: 1) Meeting the current energy quality standards; 2) Compliance with technical specifications.

A.1. Problem variables

The independent variables of the optimization problem, represented by the X arrangement, are the types of passive filters to install and their respective design parameters. In a genetic algorithm the problem variables are somehow encoded on a chromosome representing the data corresponding to a solution or individual. The computational implementation of the NSGA-II used in this work uses a direct coding in real numbers, facilitating the interpretation of the data stored in this chromosome.

To represent a set of data on a chromosome that can be of variable size (the type of filter and the number of branches chosen may differ from one solution to another), this chromosome must be able to represent the maximum number of data it defines a filter.

For the location of the passive filters in the industrial installation, a set of K -bars should be determined where such filters are to be installed. These bars are usually those in which there are significant nonlinear loads or distribution centers which have a set of such loads (Nassif et al., 2009).

The chromosome representing an individual's data consists of an arrangement of the K elements, where each S_k element as shown in Table 1 is an arrangement of integer and real data representing the various parameters of the harmonic filter to be located on bar k .

Table.1: Variables that describe a filter represented on the chromosome (J. C. LEITE, 2013).

Variable	Description
Cfg	ConfigurationType (1, 2, 3, 4)
m	Number of branches tuned (if it is type 1 filter)
Qc	Total reactive power in capacitors
Fd_1, \dots, Fd_{w+1}	Factors for the distribution of reactive power among all branches
Fq_1, \dots, Fq_{w+3}	Tuning frequencies of all branches
Q_1, \dots, Q_{w+3}	Quality factors of all branches

IV. RESULTS AND DISCUSSIONS

NPV offilters design

The installation of the harmonic filters in the system has two fundamental effects: the reduction of the harmonic distortion of the voltages and currents; and the compensation of the reactive power of the load. The reduction of the harmonic distortion of the voltage in the system bars improves the quality of energy supplied to the loads supplied from the electrical system of the industrial installation as well as from other consumers that are fed from the PCC or the bar under consideration. Although it is known that increasing the quality of energy means reducing the operating costs of electrical equipment, it is difficult to economically evaluate this result.

In addition, when the filters are installed, the currents circulating in the network are reduced at the fundamental frequency, due to the large increase in the power factor, and the harmonic frequencies due to the filtering effect of the filters. Reducing harmonic currents through the network reduces the loading of generators, transformers, cables, and other elements of the system,

reducing system losses. The impact of reducing filter losses is easier to assess economically when the required network and load data are known. In an industrial company, the cost components of the electric energy bill is a convenient way to measure the annual cost of the electrical energy consumption of the facilities (*Costs*). To determine the economic effect of filter installation, we choose (L) scenarios typical of the daily load variation to calculate the power consumption and the power factor of the installation. These characteristic scenarios correspond to the different load levels that are repeated daily for a given time.

For each daily load scenario, the total active power (P_T) and the total reactive power (Q_T) supplied by the network, as well as the active and reactive power losses in each element of the installation (including the filters) can be calculated by a power flow program at fundamental frequency and with a harmonic penetration program. Using the calculated values of P_T and Q_T , the maximum demand for active and reactive power as well as the active and reactive power consumption of the installation can be estimated for a typical working day. Therefore, the monthly and annual electricity bill can be estimated when considering a number of typical working days per year. This method of aggregation can be more or less exact, insofar as the load of the installation is better characterized. The Electric Energy Billing Manual defines various types of tariffs to be used in electric energy billing and defines the concepts of DREX Excess Reactive Demand and EREX Excess Reactive Energy, magnitudes that are calculated as the demand and the reactive energy that exceeds the reactive energy and demand values corresponding to a power factor of 0.92. As the circuit load varies in different L characteristic load states, the billed energy is the sum of the active power and the reactive power consumed in each state k of the annual duration Δt_k :

$$E_F = \sum_{k=1}^L (P_{Tk} \cdot \Delta t_k + EREX_k) = \sum_{k=1}^L (P_{Tk} + DREX_k) \cdot \Delta t_k \quad (8)$$

In the same way, the demand billed D_F is composed of the sum of the active demand and the surplus reactive demand of the scenario k of maximum load

$$D_F = \max_{k \in L} \{P_{Tk} + DREX_k\} \quad (9)$$

Thus, the annual costs of electricity billing are calculated by:

$$Cost(x) = c_D \cdot D_F(x) + c_E \cdot E_F(x) \quad (10)$$

Where c_D (\$/kW) and c_E (\$/kWh) are coefficients of the

corresponding electric charge cost.

Thus, the benefits of installing the filters for the characteristic L scenarios are determined as the difference between the annual cost of electricity bill before $Cost(0)$ and after the installation of the $Cost(x)$ harmonic filters. The investment cost of $I(x)$ filters is composed of the costs of capacitor, reactor, resistor and other elements. The cost of the capacitor, reactor and resistor depends linearly on its power for each voltage level, while the other components of the cost can be assumed proportional to the reactive power of the filter (Std.153L, 2003). Thus, the investment cost of the filter is:

$$I(x) = \sum_{i \in C_C} K_{C_i} Q_{C_i} + \sum_{i \in C_L} K_{L_i} Q_{L_i} + \sum_{i \in C_R} K_{R_i} P_{R_i} \quad (11)$$

where K_C (\$/kvar), K_L (\$/kvar) and K_R (\$/kW) are the power cost coefficients of capacitors Q_C , inductors Q_L and resistors P_R respectively, and C_C , C_L and C_R represent the sets of each one of these types of elements.

Considering a period of evaluation of N years with an interest rate i , the NPV of the installation project of the filters is calculated as shown by the relation (12):

(12) $NPV(x) = -I(x) + \sum_{j=1}^N (Cost(0) - Cost(x)) / (1+i)^j$ project, the NPV(x) must be maximized. However, genetic algorithms usually work by minimizing the objective functions. In this way, the first objective function to be minimized is defined as (13):

$$f_1(x) = -NPV(x) \quad (13)$$

a) *Harmonic control objectives*

Passive harmonic filters are primarily harmonic control devices whose function is to avoid the circulation of distorted currents through the elements of the system, reducing the harmonic distortions of voltage in the bars. To evaluate the effect of filters on distortion rates, all possible operating scenarios of the system should be evaluated, including the L characteristic scenarios considered and another set of special system and load conditions. These special conditions may include variations in network impedance, different modes of operation of harmonic producing loads, tuning of filters, etc. They are non-characteristic operating states for which a daily operating time is not allocated, with impacts on energy calculations, power factor, etc., but with influence on the determination of harmonic distortion rates.

For each scenario k considered, the total distortion of the current in the PCC (TDD_k) and the total distortion of the voltage in each bar i ($THD_{k,i}$) can be calculated by a harmonic flow program. Both rates, the

total distortion of current in the PCC and the total distortions of voltage in the bars should be minimized by the optimization process (ANEEL, 2018; Association, 2014).

To minimize TDD in all possible scenarios it would be necessary to define an objective function for each scenario. However, considering that all harmonic control standards limit only the maximum value (95% or 99% probability) of harmonic distortion, it is only easier to minimize only the maximum TDD value of all the operating scenarios of the system as shows (14) (ANEEL, 2018; Association, 2014):

$$f_2(x) = \max_{k \in W} \{TDD_k(x)\} \quad (14)$$

Following the same reasoning, the maximum THD value between all operating scenarios and all system buses using the function f_3 according to (15) is minimized.

$$f_3(x) = \max_{\substack{k \in W \\ i \in U}} \{THD_{k,i}(x)\} \quad (15)$$

b) *Restrictions*

The body of constraints of the filter optimization problem consider:

1. The stress quality constraints on the system bars;
2. The quality constraints of the currents in the PCC, and;
3. Saturation constraints on the filter components.

The way of evaluating the quality restrictions of the voltage and current depends on the standard adopted to formulate the problem. If the standards of (ANEEL, 2018) or (Std.153L, 2003) are used, there are no limits for current distortion in the CCP, so this set of constraints is not taken into account. Therefore, the formulation used here considers all possible restrictions according to the adopted norms.

In addition, to ensure that the optimization program obtains feasible solutions to the problem, a fourth objective function to be minimized, which represents the quadratic sum of all constraint violations of the problem is defined as (16):

$$f_4(x) = \sum_{v_i(x) > l_i} (v_i(x) - l_i)^2 \quad (16)$$

Where v_i and l_i represent the calculated value and the limit value of parameter i bounded by the corresponding constraints.

Para determinar o valor de f_4 para um conjunto de filtros x instalados, têm-se o seguinte procedimento (as sentenças estão escritas em pseudocódigo):

- 1) Initialize with $f_4 = 0$.
- 2) For each operating scenario k and each bar i of the system, the voltage quality constraints of the type are evaluated:

a) Limit the value of the voltage modulus V_{mk} , i according to (17).

$$\text{if } V_{m_{k,i}} > V_{lim_i}, f_4 = f_4 + (V_{m_{k,i}} - V_{lim_i})^2 \quad (17)$$

b) Limit the total voltage distortion THD_k , i . as shown (18).

$$\text{if } THD_{k,i} > THD_{lim_i}, f_4 = f_4 + (THD_{k,i} - THD_{lim_i})^2 \quad (18)$$

For each harmonic h , the limiting of the individual distortion limit of the voltage $IHD_{k,i,h}$, is evaluated. as shown (19).

$$\text{if } IHD_{k,i,h} > IHD_{lim_{i,h}}, f_4 = f_4 + (IHD_{k,i,h} - IHD_{lim_{i,h}})^2 \quad (19)$$

3) For each system operating scenario k (only for standard (ANEEL, 2018), the current quality restrictions in the PCC of the type::

a) Limite a distorção total da demanda TDD_k . de acordo com (20).

$$\text{if } TDD_k > TDD_{lim}, f_4 = f_4 + (TDD_k - TDD_{lim})^2 \quad (20)$$

For each harmonic h , the limit constraint of the individual distortion of the current demand $IDD_{k,h}$, is evaluated as shown (21):

$$\text{if } IDD_{k,h} > IDD_{lim_h}, f_4 = f_4 + (IDD_{k,h} - IDD_{lim_h})^2 \quad (21)$$

4) For each system operating scenario k and each capacitor j of the filters installed, the saturation restrictions of capacitors of the type are evaluated:

a) Limit the voltage applied to the capacitor V_{ck} , i . according to (22).

$$\text{if } V_{c_{k,j}} > 1.1V_{cnom_j}, f_4 = f_4 + (V_{c_{k,j}} - 1.1V_{cnom_j})^2 \quad (22)$$

Limit the peak voltage applied to the capacitor $V_{cpeak_{k,j}}$. according to (23).

$$\text{if } V_{cpeak_{k,j}} > 1.2\sqrt{2}V_{cnom_j}, f_4 = f_4 + (V_{cpeak_{k,j}} - 1.2\sqrt{2}V_{cnom_j})^2 \quad (23)$$

b) Limit the circulating current through the capacitor $I_{ck,i}$. according (24)

$$\text{if } I_{c_{k,j}} > 1.35I_{cnom_j}, f_4 = f_4 + (I_{c_{k,j}} - 1.35I_{cnom_j})^2 \quad (24)$$

c) Limit the reactive power generated by the capacitor $Q_{ck,i}$. according (25).

$$\text{if } Q_{c_{k,j}} > 1.35Q_{cnom_j}, f_4 = f_4 + (Q_{c_{k,j}} - 1.35Q_{cnom_j})^2 \quad (25)$$

Having evaluated all constraints of the problem, f_4 is the quadratic sum of all violations of such constraints. If f_4 is zero, solution x will be feasible, otherwise ($f_4 \neq 0$) the solution will not be efficient with the characteristics adopted for one or more constraints.

Then the global optimization problem is defined as shown in (26):

$$\min\{f_1(x), f_2(x), f_3(x)\} \text{ sujeito a } \{f_4(x) = 0\} \quad (26)$$

There are different ways to manipulate constraints in an optimization problem. However, since zero is the smallest possible value of f_4 and there is a multiobjective optimization method, the problem can be formulated as shown in (27)

$$\min\{f_1(x), f_2(x), f_3(x), f_4(x)\} \quad (27)$$

By minimizing f_4 , the algorithm tries to obtain the zero value of this function, in other words, it looks for the viable solutions of the problem. In this way, both feasible and quasi-viable solutions ($f_4 \approx 0$) are obtained, which may be advantageous in very difficult solution problems.

V. OPTIMIZATION ALGORITHM

For the problem formulated for the design of filters whose nonlinear features with real and integer variables whose solution requires an optimization algorithm using the NSGA II. The types of optimization problems present several objective functions, which are almost always in conflict, and if one wishes to optimize simultaneously in this case, in an innovative way, it presents three objective functions (f_1 , f_2 and f_3). In multiobjective optimization, the notion of optimal solution is replaced by the notion of Pareto unpaired or optimal solution (Kawann & Emanuel, 1996).

5.1 APPLICATION EXAMPLES

This example corresponds to an industry that contains medium and low voltage loads. The electrical system uses a primary distribution network of 4160V that feeds the medium voltage loads and four substations that feed the loads of 480V. The nonlinear loads are concentrated in the low voltage part and are formed by three-phase six-pulse converters.

In this case it is considered that the voltage of all the nodes of the network must comply with the quality indicators as established in the standard (ANEEL, 2018). The industrial plant is described according to the single-line diagram shown in Figure 6.

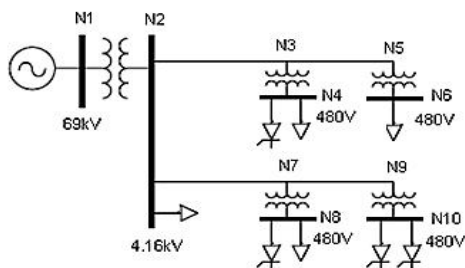


Fig.6: Industrial plant single line diagram.
 Source: (Abril, 2012).

For the optimization process, five possible operating scenarios are considered, which are presented in Table 2.

Table.2: Scenarios for the analyzes.

Parameter	Scenarios				
	1	2	3	4	5
Daily scenario duration (h/day)	6	10	8	0	0
FilterCapacitanceDepreciation ΔC (%)	0	0	0	0	10
Filterinductancedepreciation ΔL (%)	0	0	0	-5	5
Short-circuit MVA in PCC (MVA)	25	25	25	12	12
	0	0	0	5	5

The first three scenarios are load regimes characteristic of a normal industrial plant work day, considered to evaluate the 12-month energy bill with 30 days. These scenarios do not consider depreciation of the filters components, since they assume that they exactly maintain their design parameters. Scenarios four and five are pessimistic conditions of network operation with reduced short-circuit MVA in the PCC. In addition, these scenarios add a depreciation of capacitance (ΔC) and inductance (ΔL) for all filters that are installed. The bars (N4, N8 and N10) were selected for the installation of filters considering that they are the ones that feed non-linear loads. To evaluate the economic effectiveness (NPV) of the compensation project, it was considered a duration of five years, with a rate of return of 10% per year. The following cases were analyzed:

- 1) Design of filters for the three characteristic scenarios;
- 2) Design of filters for the five possible scenarios.

In both cases, the limits of voltage harmonics (ANEEL, 2018) were used as energy quality constraints. In addition, 100 generations of the algorithm were performed, with a population of 500 individuals.

5.2 Design of the filters for the three characteristic scenarios

The initial results of the problem (base case), considering only the three characteristic scenarios (1, 2 and 3) are presented in Table 3.

Table.3: Initialresults (case 1).

Parameter	Value
Annualenergycost (\$/ year)	840124
Maximum TDD (%)	7.412
Maximum IDD (%)	6.498
Maximum THD (%)	8.349
Maximum IHD (%)	6.267
Power factor	0.797

According to (ANEEL, 2018), these levels of distortion are within the established limits. Finished 100 generations, the genetic algorithm produced a population of 500 solutions, for example. Extracting only viable solutions, the results obtained are shown in 9 for the Pareto frontier of the problem, as shown in figure 7.

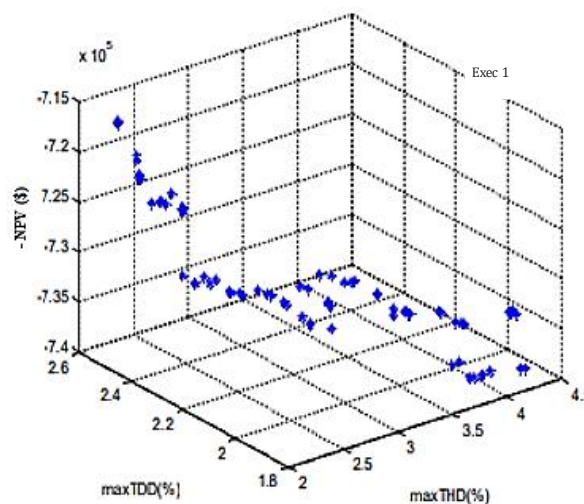


Fig.7: Pareto frontier.

In order to select the possible solution to the problem, considering that the PRODIST-Module 8 standard only restricts the voltage distortion, we can order the solutions in ascending order of $maxTHD$, $maxTDD$ and $-NPV$ respectively. Figure 8 shows the ordered solutions, where as $maxTHD$ increases, $maxTDD$ and $-NPV$ decrease.

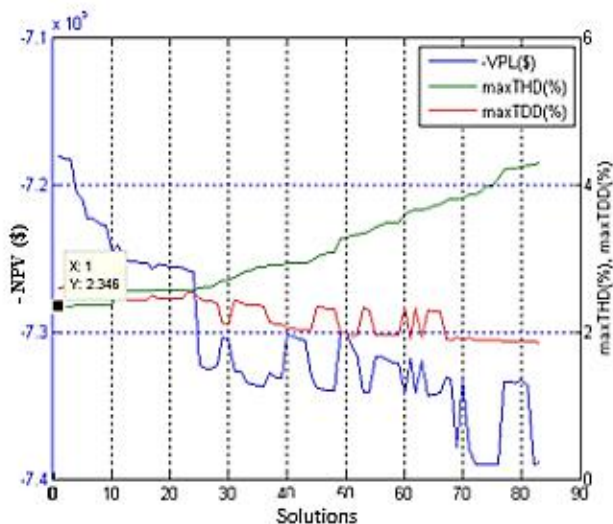


Fig.8: Possible ordered solutions (case 1).

Here, different criteria can be used to choose the solution and to be used. If the least voltage distortion solution is selected as shown in Figure 10, a variant is obtained whose parameters are shown in Table 4.

Table.4: Parameters of selected filters (case 1).

Bus	Parameter	Branch 1	Branch 2	Branch 3	Branch 4
N4	Type	tuning in	2 ^o order		
	Capacitors	4x50 kvar	4x50 kvar		
	Frequency	4.7	7.6		
	Qualityfactor	21.6	10		
N8	Type	tuning in	tuning in	tuning in	tuning in
	Capacitors	4x50 kvar	1x50 kvar	2x50 kvar	1x50 kvar
	Frequency	4.7	6.6	10.4	13
	Qualityfactor	37.9	19.8	22.2	8
N10	Type	tuning in	tuning in		
	Capacitors	3x50 kvar	2x50 kvar		
	Frequency	4.7	6.6		
	Qualityfactor	28.1	34		

This solution is composed almost exclusively of tuned filters, since the selected second order branches have a high quality factor. Thus, it is possible to obtain a solution only with tuned filters, adopting the possible

configurations of the variables are given to a single configuration of type 1. The developed program admits this possibility. The results obtained, when installing the selected filters, are shown in Table 5, where a great reduction of the harmonic distortion indicators and the annual cost of electric power is proven.

Table.5: Final results (case 1).

Parameters	Value	%
Annualenergycost (\$ / year)	638400	75.989
Maximum TDD (%)	2.596	35.024
Maximum IDD (%)	2.064	31.763
Maximum THD (%)	2.346	28.097
Maximum IHD (%)	1.635	26.090
Power factor	0.992	124.582
Cost of investment of the filters (\$)	46687	
NPVfromtheproject	718005	

To verify the effectiveness of the solution for variations of the filter parameters, the harmonic penetration program is executed for all scenarios with different depreciation of these parameters and the results are shown in Figure 9, where a reduction of the maximum TDD between 31 to 37% and the maximum THD between 27.2 and 47.1% compared to the base case values for all scenarios of the problem and considering the possible depreciation of the filters.

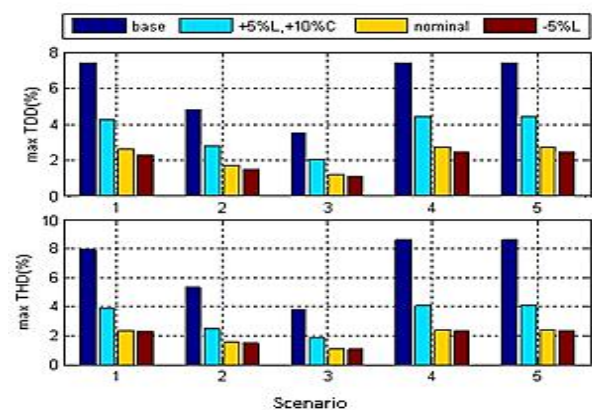


Fig.9: Results with depreciation of the filters (case 1).

As shown in Figure 9, the worst results are obtained when the components of the filters have a positive depreciation, which reduces the frequency of tuning, separating them from the harmonics to be eliminated. This same behavior is repeated for the individual harmonics, which is exemplified for the current distortion in the PCC shown in Figure 10 and the voltage distortion in the N10 bar shown in Figure 11 for scenario 1.

VI. CONCLUSION

It is concluded that the computational solution to this problem was achieved using the genetic algorithm NSGA-II that determines a set of optimal solutions of Pareto (Frontier) that allow the designer to choose the most appropriate solutions to the problem. In addition, the computational tool developed has several novelties such as: The parameters that characterize the filters are calculated, but also the type of configuration and the number of branches of the filter in each candidate bar according to a set of configurations preestablished; Two standards have been programmed to evaluate the energy quality constraints that can be selected by the user; We determine solutions with good performance indicators for several characteristic and non-characteristic scenarios of the system that allow us to represent: the daily variations of the load, and the variations of the system parameters and the filters; It evaluates the cost of energy bills in an industrial power grid that has different operating conditions (characteristic scenarios) and evaluates the economic effect of harmonic filters as reactive power compensators. The positive results, from the analysis of several practical examples, show the advantages of the developed method.

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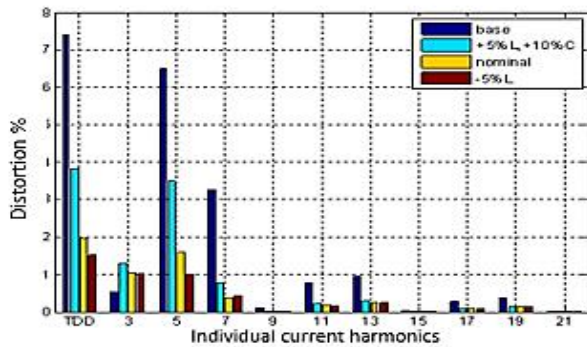


Fig.10: Current distortion in the PCC (case 1).

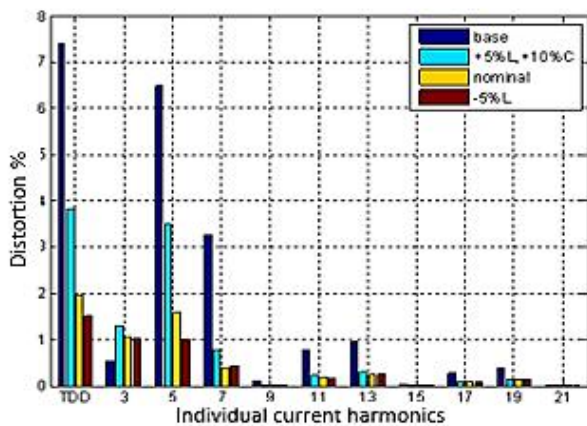


Fig.11: Distortion of the tension in the bar N10 (case 1).

However, a frequency sweep study in bar N10, shown in Figure 12, comparing the impedance characteristics vs base case frequency (without filters) and the response obtained for all scenarios and with capacitance depreciation (0 to + 10%) and the inductance (-5% to + 5%), shows that the impedance peaks occur in low order harmonics in the nonlinear loads in the problem. Thus, this behavior is repeated in the figures N8 and N4, and it can be concluded that the selected filters will perform satisfactorily.

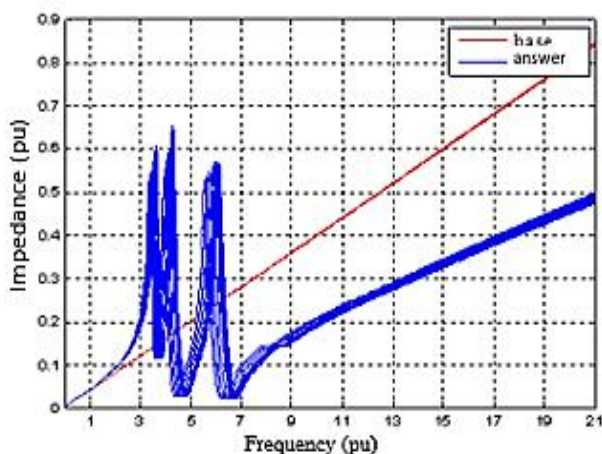


Fig.12: Frequency sweep in bar N10 (case 1).

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Embedded System for Real Color Composition in Experimental Physics

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Abstract—Software can be considered educational when properly contextualized in a relationship of teaching and learning. This paper describes an embedded system and an educational software developed and applied in experimental physics to real and virtual colors composition. The educational system developed allows student interaction by voice commands, which makes the assimilation process of red/green/blue (RGB) color formation concepts more didactic and playful. The application of educational software in experiments also allows to verify, in real time, the influence of programs change on the physical phenomena and stimulates the logical reasoning development and consequently the autonomy of the students, to the measure that can raise hypothesis, make modifications in the programming and take off conclusions from the practical results obtained.

Keywords—Android, Educational software, Experimental physics, RGB colors.

I. INTRODUCTION

On the interpretation of light phenomena interaction with matter and color perception by human eye, it is possible to consider three differences: the color perceived by the refraction of light on an object, like a yellow shirt that refracts a beam of light, with specific length; a color perceived as a determined electromagnetic wave emitted, as a yellow beam, with the wavelength of approximately 580 nm; and the color perceived by the interaction between eye and brain [1], that is, an object that emits light in the bands around green (wavelength around 520 nm) and around red (wavelength of 700 nm) can be interpreted as yellow by the sensation brain-eye. It's important to emphasize that the colors purple and gray, among others, are not spectral colors, that is, has no

specific wavelength, because they occur of multiple of others spectral colors as red, green and blue (RGB).

The human eye is capable of processing all of light's spectrum, continuous, since 400 to 700 nm, approximately. In that sense, Newton proved that white light when trespasses a crystal prism divides itself into multiple colored beams and determined that seven of those as the luminous visible spectrum, however only red, green and blue colors are the primary spectral colors that the eye-brain interaction physiologically captures. All the other colors are combinations formed by the brain from the average obtained by the proportion of these three colors [2].

Thus, for the human eye to perceive white light, the eye needs to receive all the visible light beams, as the sunlight, or simply receive the three primary spectral colors, RGB, in the same proportion. This principle is also utilized in other electronic device such as TV monitors, projectors, scanners and digital cameras.

On the experiment of the RGB formation, each color is defined by the red, green and blue proportions that composes it, as illustrated in Figure 1. For convenience, most digital systems today, as the educational software proposed, utilizes integers between 0 and 255 to specify those quantities. The number 0 indicates the lack of intensity and the number 255 indicates the maximum intensity of each color. Figure 1 illustrates the three primary colors of emission and the respective secondary colors yellow, magenta and cyan, obtained by the combination by pairs and equal to the proportion of primary colors and the color white obtained by the association of the three primary colors.

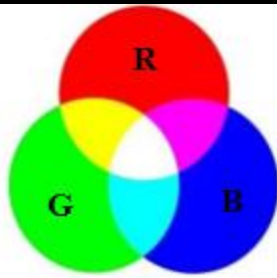


Fig 1: Process of primary colors formation by emission

On the other hand, it is currently common to develop low cost physics experiments [3] and using embedded systems [4] or microcontrollers [5] to facilitate the teaching-learning process. In this sense, the developed physics experiment aims to prove the composition of colors obtained in a virtual way. The emission of colors is done through the screen of an Android device, and at the same time, the colors are reproduced in a real way through voltage modulation applied to an RGB LED through the fundamental color ratios sent from the Android device to the microcontroller embedded system via Bluetooth. The proposed embedded system builds the same color emitted by the educational software screen on the Android device through an RGB LED.

II. MATERIALS AND METHODS

What designates a software as educational is the application on the teaching-learning process, in the sense that a software can be considered educational when adequately contextualized in a relationship of teaching-learning. The educational software is framed in educative and applicative [6].

2.1 Educational Software

Among the main characteristics of an educational software is the didactic character, that allows the construction of knowledge on certain area with or without the mediation of a professor. Alongside the significant increase in the number of students that seek professional education, there is also the increasing on the need for laboratories and didactic resources, as well as others physical resources to satisfy the learning of the students. Due to the incompatibility of the existing physical resources in relation to the demand, universities and educational institutions, didactic environments of simulation of real physical components are implemented [7]. That way, the professional learning is based mainly on the computational modelling of real systems, that posteriorly will be experienced in professional life. With that, the professional education is increasingly dependent on educational software.

An educational software can be conceptualized as a program that has resources projected with the

intention and purpose of being used in contexts of teaching-learning, being designed specifically [8]. These programs are applicable in different purposes beginning with concepts definition and going through skills development and ending with issues resolution.

On the category of educational software, comes those that are not developed with educational purposes, but are utilized for it. These are programs for general use utilized on teaching context and cognitive development, like for example, databases, compilers, text processors, electronic spreadsheets and graphical editors.

The educational software applications can be applied also for technological purpose [9]. In software applications with the technological purpose, the importance is given to the concepts related to practical application. The educational software proposed on this project can be utilized either with technological purpose or educative.

On this context, the experimental physics can be an efficient way for the application of interdisciplinarity and the Piagetian theory: the student is led to think on the essence of the problem, assimilating it, to posteriorly, accommodate it in his perspective of knowledge. The professor also stops being the only provider of knowledge to become the partner in the process of learning.

2.2 Developed Educational Tool SanUSB

On the intent of stimulating the construction of real automatic systems like the utilized on experimental physics, it was developed a free educational software called SanUSB to facilitate microcontrollers programming in educational projects and to stimulate the reflection and the development of student's autonomy on the elaboration of real projects.

SanUSB allows USB burning and execution of a C compiled program on a microcontroller, as also provides serial communication through the emulation of a serial COM port in a fast and efficient way from the moment that the microcontroller is connected directly to a computer via USB, as shown on Figure 2.

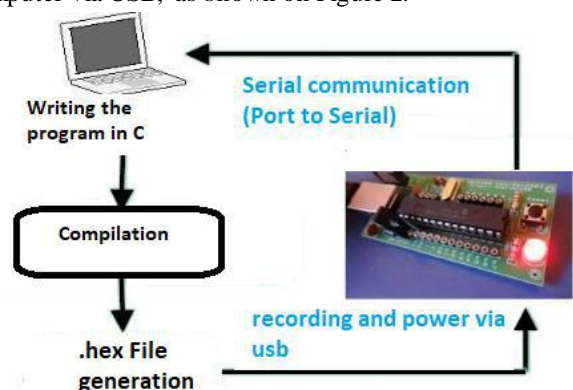


Fig 2: Programming process of the educational software SanUSB

A microcontroller is a low cost chip that contains internally peripherals of a dedicated computer such as a microprocessor, data memory, program memory, input and output pins, also as, USB interface in the case of more recent models, among others [10]. There are many advanced and creative ways of using them, keeping it low cost [11].

The educational software application SanUSB is part of a tool composed by the software and basic circuits of a microcontroller PIC18Fxx5x, as illustrated on Figure 3.

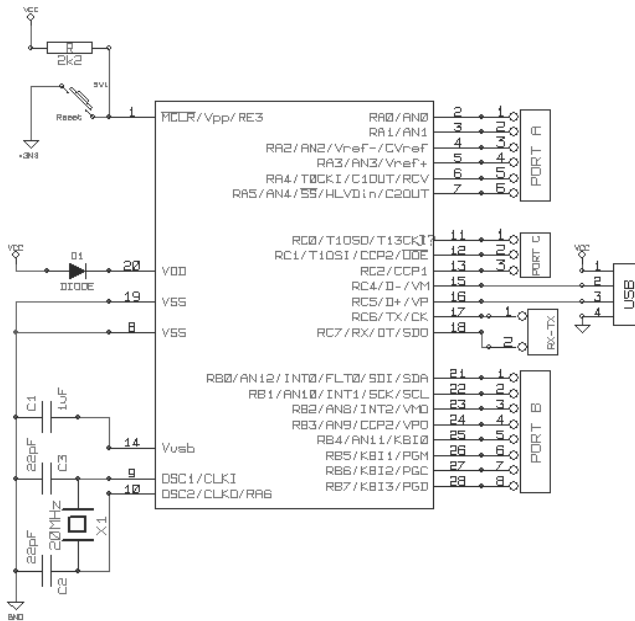


Fig 3: Basic microcontroller circuit of the educational tool SanUSB

SanUSB is registered by the Brazilian National Institute of Industrial Property (INPI) through the number 088503 as free software and is executable on Linux, Mac OSX and Windows™ operating systems, which are available for download and installing on the SanUSB group files [10].

This tool is composed of a pre-programmed bootloader on the microcontroller and an educational software application to burn the compiled codes on the memory of the microcontroller via USB.

The sending of the codes to the microcontrollers are normally made through specific commercial recording hardware. Through SanUSB, it is possible to burn and reburn the microcontroller directly from the USB port of any computer (even Raspberry Pi) accessing the free SanUSB Java interface as shown in Figure 4.

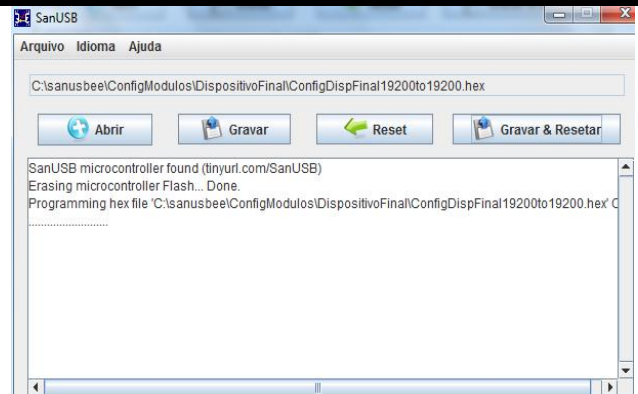


Fig 4: Free SanUSB Java interface for microcontroller burning

To program SanUSB circuit, it is only needed to press the button on pin 1, to connect the microcontroller to the computer through a USB cable, open the interface of the educational software application (Figure 4), select the “.hex” compiled file and burn the microcontroller with the code for the RGB color application experiment.

During project development, the power supply of the microcontroller comes from the USB port (5V). In the case of the microcontroller system be embedded, for example, in a robot or a system for data acquisition, it is necessary an external power supply, that can be a common battery of 9V or a cell phone charger.

Equipment projected and built for specific applications and for didactic purposes tend to be less expensive, having a better cost-benefit, for example, a Raspberry Pi, that even though it has more advanced capabilities like the interaction with more devices and data [12], it is more expensive and do not provide an environment as easy as the more specific one for assimilation and operation purposes.

The SanUSB tool is based on free software, that are developed from voluntary contributors through the Internet by a community that include developers across the world. This software offers performance enhancing, incentives creativity, allows dedicated applications and enables to locate and correct code mistakes faster than on proprietary software [13].

On that way, the utilization of free code programs represents a significant advantage for the continuous improvement of projects, without the dependency of a determined manufacturer or provider of the project. The free tool SanUSB also allows deuration directly through serial emulation (Communications Device Class - CDC protocol) via USB. This can be created in a quick and efficient way on the moment that the microcontroller is plugged directly to a PC, through a USB interface. That way, SanUSB is capable of suppressing:

- A specific equipment or circuit for burning a program

in the microcontroller, that is, it is not necessary either to take the microcontroller out of the embedded circuit to burn a new code or to use a conventional burner;

- TTL/RS-232 converter for serial bidirectional communication, because utilizes serial emulation via USB through the CDC protocol, that also allows the depuration of the program through printing via USB of the firmware variables;
- Power supply, as the power for the microcontroller comes from the USB port of the PC;
- External analog-to-digital converter (A/D), having in mind that the microcontroller has internally an A/D converter with up to 13 channels of up to 12 bits, depending on the chosen PIC18F model.
- Simulation software, considering that the practical application of the SanUSB coding and hardware mounting can be done in a fast and effective way on the development circuit board or on a matrix of contacts (breadboard).

In resume, among the features of the SanUSB free computational tool it is possible to emphasize the advantages:

- Programming in C language using different compilers;
- Free online support group to programming and projects development in Portuguese;
- Works on Linux, Mac OSX and Windows™ operating systems;
- The layout board allows the user full domain on the circuit, being able to easily realize maintenance, because no component is a surface mounted device (SMD);
- Reaches publics from beginners to high level designers;
- Didactic material provided allows self-learning [10].

The communication in experiments using free educational software can be realized not only via USB, but also with wireless communication protocols, like Bluetooth and WiFi. On the present proposed experiment, Bluetooth protocol was chosen. The name 'Bluetooth' has the origin from a Viking conqueror, called ^{VI-VIII} CATHODE (-) Bluetooth, that unified Denmark and Norway in the X century, symbolizing the union of different groups of people [14]. The idea of Bluetooth is to substitute the various proprietary solutions for communication with a pattern that can be adopted at a worldwide level. On Bluetooth transmission, the communication is made applying a spectral scattering technique with frequency leaps, denominated Frequency Hopping Spread Spectrum (FHSS).

Thus, the frequency is never the same, minimizing the interferences and making the existence of

another Bluetooth on the same geographical area possible [14]. The main requirements that guided the development of Bluetooth was the low consumption, low cost due to mass production of chips, the range of about 100 m (in the case of the model utilized in this project, the communication reaches up to 30 m) and voice and data transmission. Figure 5 illustrates the connection between SanUSB microcontroller development board and the Bluetooth module using four wires (Tx and Rx for serial communication; and Vcc and Gnd for power).

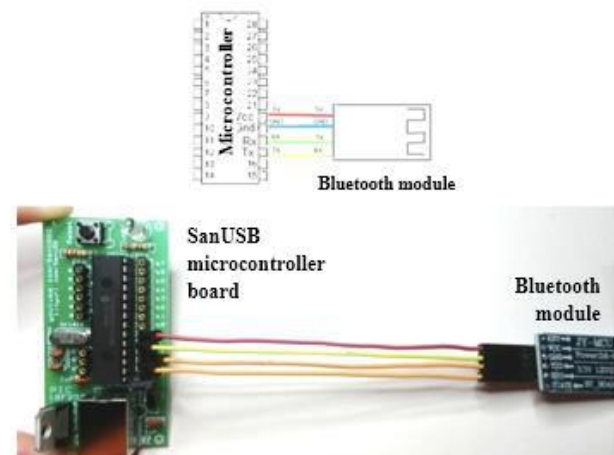


Fig 5: Illustration of the connection between SanUSB microcontroller board and Bluetooth module

On the other side, the RGB module used is built for this experiment, as can be seen on Figure 6 together with a RGB LED, showing the description of the connection pins. The RGB LED has R, G and B outputs that must be connected to digital pins like b0, b1 and b2 of the microcontroller, responsible for modulating in high frequency the width of the pulse (PWM) in each RGB LED pin. Thus, the SanUSB microcontroller board modulates the voltage applied in each of the RGB LED pins and, consequently, the intensity of the brightness for the composition of a desired real color. Figure 6 illustrates the RGB LED module developed for the proposed color composition experiment.



Fig 6: RGB LED module developed for the proposed experiment

For the proposed experiment, a C language (firmware) program was developed to receive information from Android devices via Bluetooth to manipulate the

RGB module pins, as it is shown on Figure 7. The free compiler utilized was the C18 in conjunction with the multi-platform environment MPLAB X. For achieving bigger diffusion of the embedded system proposed, it was also developed a program (sketch) for communication with the Arduino platform that can be accessed directly on the screen of the educational Android application (app), illustrated on Figure 8. Through the updating of the firmware it was also possible to alter the color composition through voice command. The experiment with voice recognition turned the contextualizing of the color formation theory more playful and interactive.

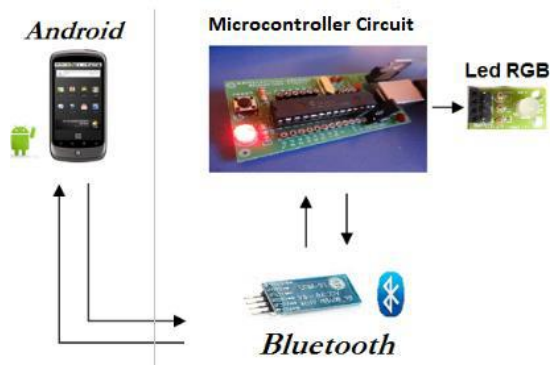


Fig 7: Illustration of the Bluetooth communication between the Android device and the SanUSB microcontroller circuit for RGB color composition

2.3 Educational Application for Android Devices

This subtopic describes how the free educational software denominated BT4SanUSB, developed and available freely for Android devices in the Google Play environment works. The application developed for Android allows to command the RGB color composition via Bluetooth utilizing the application's disc of colors or voice recognition. The voice recognition system utilized was developed by Google. This is based on Artificial Neural Networks (ANN), that is, a system of visual learning inspired by the human brain. On Figure 8 screens of the free educational Android app applied in experimental physics for real and virtual color composition are shown.

This application also does, by PWM control of the RGB LED via Bluetooth connected to the microcontroller, the real change of bright intensity, and permit that a determined color composition of an experiment be stored on the permanent memory of the application, pressing the button "Save". Beyond that, this application allows that the user change the name of the Bluetooth device directly from the Android device, inserting the name on the text box and pressing the button "Send name".

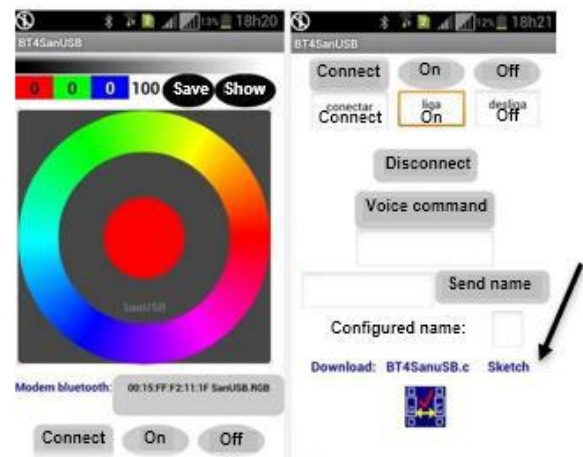


Fig 8: Screens of the educational Android application BT4SanUSB for Bluetooth control of RGB colors

The voice commands stored on the permanent memory of the Android device allows to correct failures on the recognizing software for a determined command. Although the answer found by the Android voice recognition software is different than the pronounced, that answer is still stored either way and when that voice command was pronounced again, there is a comparison with the stored word and in case of equal words, the command is executed.

2.4 Android Devices

One of the advantages of Android is that it is an operational system that works under Linux core, that is, a free software that allows developers to write software on the Java programming language to control the device via libraries developed by Google.

Beyond that, there is two main points: cost and portability. The Android devices are portable and low cost, which creates the increasing preference in relation to notebooks or conventional desktops. To endorse this affirmation, a research made by the CONECTA group and by the Worldwide Independent Network of Market Research (WIN), Brazil leads the use of smartphones and tablets in the world [15].

According to that research, the Brazilian average is 84 minutes a day using smartphones while the worldwide average is 74 minutes. In relation to tablets, the Brazilians use it for 79 minutes a day while the worldwide average registered by the research is 71 minutes. Even with these numbers and having the penetration of smartphones doubled since 2011 and 2012 going of 9% to 18%, Brazil continues far away from the worldwide average registered on the last year: 48% [15]. The research interviewed a total of a thousand people over 16 years old in Brazil, through the panel

CONECTAí. Beyond that, the research heard a total of 54 thousand in 54 countries in the world.

In relation to education environment, the use of notebooks is been switched to tablets either in public schools and private ones [16]. Considering this motivation, it was decided to use the free operating system Android in conjunction with the free software SanUSB.

2.4 Voice recognition

This application is also capable of triggering by voice commands the RGB LEDs or other devices connected to the microcontroller. The voice command can be recorded in the permanent memory of the application by holding the "Voice command" button for two seconds.

To control the BT4SanUSB through voice commands, it was utilized the library developed by Google already present on Android devices. The libraries of voice recognition can be on the Android device or in the cloud. From version 4.1, it is possible to make voice commands offline, that is, without having Internet connection.

Basically, all the applications that have voice recognition are split into two categories: limited vocabulary/many users or broad vocabulary/limited users. On the second, the program counts with a vocabulary of thousands of words and a degree of accuracy bigger or equal to 85% in recognizing. However, it has more accuracy, but for a limited number of users or even one person. This happens because it is necessary to train the application with a certain kind of voice or tone.

When Google developed the 4.1 version of Android mobile operating system, it implemented a series of changes in the way that the software recognizes human voice, based mainly on neural network, that is, a system of virtual learning based on how the human brain works.

In relation to the process of development and the basic functioning of the voice recognition algorithm, the error rate suffered 25% reduction in relation to previous versions of the Android operating system [17], making that more people talk in a more natural way with their smartphones, instead of dictating words as they were talking to robots. When a word is spoken to the Android voice recognition system, the spectrogram is sliced in small pieces and sent to eight computers located on Google servers. These pieces are processed accordingly with the neural networks models [17]. After that, the words are added to the software's artificial intelligence like it had assimilated.

To realize the capturing of the words, are commonly adopted two types of frequency breaks: approximately eight thousand measures per second (digitalization on 8 kHz) or 44.100 times per second (44

kHz). The minor the break is, the bigger the accuracy of the sound captured. So, the Analog-Digital Converter (A/D) transforms these analog sound waves into digital, in a way that it can be analyzed by the device.

Then, the machine initiates the process of sound filtration, to separate noises from phonemes. On this step, multiple procedures happen, like separating the audio captured in different frequencies and do a normalization, that is, letting the same volume level. People also communicate in different speeds and so the computer needs to adjust the received sound to be in the same pronunciation time to be compared with the examples stored on the database.

With the filtered audio phonemes, the next step is for the computer to divide the sound into smaller pieces, with small fractions of time (hundredths or even thousandths of seconds). After, the program searches phonemes on the database libraries that are compatible with the local idiom and with what was recorded.

However, that task is more complex than it looks, because besides of existing approximately 34 phonemes on the Portuguese language (or 40 in English), the phonemes can vary according to regionalism and by the conjunction of a word. The same way, equal letters can have different pronunciations, according to the timing of it. The program needs then to realize an analysis of the phonemes and the context with the others around, following a complex model to compare them with words present in the library.

After recognizing each letter in the process explained earlier, the next step is to make them in order, to produce sentences. The main problem is that it can have a series of sequences that coincide with what was said by the person. The machine has then to analyze these sequences and verify those that make sense.

For this, the system does an analysis taking into consideration the probability of the known words to be positioned as they were understood. Some models also verify the dependency of each term of the sentence to confirm a correct meaning. In the app developed, after pressing the button "Voice command" and pronouncing a word, the word spoken is recognized and showed on the text box below the button.

III. RESULTS AND DISCUSSION

Figure 9 illustrates the operation of the embedded system during formation of real colors on the RGB LED and virtually on the Android device when the colors red, blue, green and all colors (white) are selected on the Android app BT4SanUSB.

The program for the microcontroller and the sketch for the Arduino can be downloaded directly from the screen of the BT4SanUSB application.

During the experiments of RGB colors formation, the educational software proved to be stable in relation to the data received to create the virtual and the real colors. The use of Bluetooth made possible that different users' profiles be able to install the application on Android devices and control it directly after pairing with the Bluetooth module connected to the SanUSB microcontroller board. Considering that the cost of a basic Android device is not so high (around US\$ 50.00 in Brazil), this project can be implemented in multiple educational institutions.



Fig 9: Operation of the BT4SanUSB app during formation of real colors on the RGB LED and virtually on the Android device

The visualization of the experiments through the comparison of real and virtual colors allowed the students to relate easily to what is seen and contextualize with the theoretic subject presented.

The voice command application also allowed to trigger loads through the predefined commands and after saying words like "On" and "Off" it is possible to make it work without pressing buttons on the application.

The SanUSB microcontroller circuits and Arduino are open source both in software and hardware, which facilitates the spreading of use of these tools through a big number of libraries and tutorials available on the Web.

IV. CONCLUSION

The educative software applications developed on this project favored the manipulation of real situations that students could make abstract conclusions through a reflection about the obtained results, contributing for the assimilation of the subjects and development of logical reasoning in a playful way.

Beyond that, the proposed educational software proved to be efficient in relation to programming and control by voice commands. In this sense, the voice

recognition of Android also proved to be efficient with the use of Bluetooth that made possible that different users could install the application on Android devices and control the RGB LED immediately after the pairing with the Bluetooth module.

The experiment of the embedded system for RGB color composition proposed was based on free software, with the goal of low-cost learning and interdisciplinarity of Physics and Computer Science. The use of the Bluetooth technology allowed the integration with the experiment of composition of colors in mobile devices, facilitating the interaction with students. In this way, the simplicity of construction of the experiments with embedded systems and use of free educational software contribute greatly for the creation of new didactic projects for experimental physics.

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Chemical Composition of the Biomass of *Saccharomyces cerevisiae* - (Meyen ex E. C. Hansen, 1883) Yeast obtained from the Beer Manufacturing Process

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Abstract – Brewer's yeast was subjected to analytical studies to determine the chemical composition of its biomass. To this end, traditional methods of analysis were used to determine ribonucleic acid (RNA), mineral elements, amino acids and fatty acids. The results showed that proteins (49.63%), carbohydrates (31.55%), minerals (7.98%), RNA (8.12%) and total lipids (4.64%) predominate in the biomass composition. The amino acid profile of the protein is suitable for human nutrition, exceeding the recommendations from the FAO/WHO/UNU for essential amino acids. It is particularly rich in lysine and could be recommended as protein supplement in cereals. It was also observed that the yeast was an excellent source of some microelements, such as selenium, chromium, nickel and lithium; that it is also a good source of dietary fiber, particularly soluble fibers; and that the content of lipids was low, with a predominance of saturated and mono-unsaturated fatty acids with 10, 16 and 18 carbon atoms.

Keywords - Brewer's yeast, Biomass, Chemical Composition, Protein Value.

I. INTRODUCTION

The spent yeast used in the fermentation for the production of beer is an industrial residue that represents the second largest waste product generated in this sector, second only to brewers' spent grain. This residue has a high BOD (biological oxygen demand), which may represent up to 60% of the value of this indicator in the effluent (Andreis, 2012). Since Brazil is a major producer of beverages and fuels through alcoholic fermentation

(fifth largest beer producer in the world) (Cetesb, 2005), the amount of yeast produced is high.

The micro-organism used in the beer production process is *Saccharomyces cerevisiae*. During the fermentation process, the yeast uses 90% of the available fermentable sugars to produce alcohol, and only 10% for the production of biomass (Cetesb, 2005). From an industrial and national perspective, however, 10% represents a large amount of residue.

The spent yeast used in the alcoholic fermentation process has been used in various sectors, such as the production of animal feed because it is an excellent source of protein (Huige, 2006); as fish feed, potentially offsetting up to 50% of the protein in the feed without any negative effect (Ferreira et al., 2010); and also as input in the biotechnology industry, e.g. for the production of pulp, in the food industry to obtain flavors for certain foods and in pharmaceutical industry (Nasseri et al., 2011; Lin et al., 2013).

Studies with yeasts have stood out not only because they are traditionally associated with the preparation of fermented food and beverages, but also because of their versatility and ability to grow quickly on a wide variety of substrates (Guzmán-Juarez, 1983; Sgarbieri, 1987; Giec and Skupin, 1988). Yeast as a source of proteins has been studied mainly after the 1960s, and so far there is no comprehensive and suitable technology for its extensive application (Nasseri et al., 2011).

The production of protein isolates and concentrates from micro-organisms such as yeast, algae and bacteria, has received considerable attention in recent decades. Due to the high protein content (45-65%), they are considered

great non-conventional sources of protein (Halász; Baráth and Mátéri, 1988).

Brewer's yeast has been poorly studied for nutritional purposes, perhaps because of its bitter taste, which results from the beer fermentation process. Some studies performed with the excess yeast from beer production, used the intact inactive cells for functionality tests, without addressing the nutritional aspects (Roshkova; Dukandjiev; Pavlov, 1986). The two main factors cited as limiting factors for the biological use of yeast nutrients are its high content of nucleic acid (RNA) and the very thick and resistant cell wall, which interferes with its digestibility (Kihlberg, 1972; Nasser et al., 2011).

Considering the nutritional potential of waste arising from the beer manufacturing process, the objective of this work was to evaluate the influence of the mechanical rupture of the cell walls for the biological use of the protein biomass from yeast cells obtained from a craft beer brewery in the southwestern region of the state of Paraná, Brazil.

II. MATERIALS AND METHODS

2.1 Yeast - The yeast *Saccharomyces* sp., from a brewery located in the southwestern region of the state of Paraná, Brazil, was obtained in the form of fresh, already debittered cells suspended in water.

2.2 Analytical Methods - Proximate composition - total protein, moisture and ashes were determined in accordance with the AOAC procedures (1975; 1990). Total carbohydrates were determined through the colorimetric method from Dubois et al., (1958). Total lipids were extracted through the procedure of Bligh and Dyer (1959) and determined gravimetrically. Soluble and insoluble fibers were quantified through the method from Asp et al., (1983).

2.3 Nucleic Acid (RNA) - The nucleic acids in yeast, which consist mainly of RNA, were determined through the method from Hebert et al., (1971). The RNA was extracted with 0.5M perchloric acid at a temperature of 37° C for 2 hours. It was then hydrolyzed with 0.5M perchloric acid at a temperature of 100° C for 15 minutes. The quantification of ribose was done with the orcinol reagent, which produces a greenish color and absorbs at 670 nm. The readings were compared with those of the standard curve made with the purified RNA of yeast (Sigma).

2.4 Mineral Elements - The samples were first burned and left in the oven at 450°C for several days, until they were completely white. They were then dissolved in nitric acid at 5%. Aliquots were injected in an Argon Plasma Emission Spectrometer (ICT 2000 Baird). The operating

conditions were: radio frequency, 40.68 Mhz; concentric pneumatic nebulizer; entry flow of the sample to be nebulized, 4 mL/min; cooling gas flow, 70 mL/min; position of the vertical torch, 9.8 mm; power applied, 100W. The quantification of minerals was performed using the standard curve constructed based on a solution (100 µg/mL) of the BAIRD analytical grade in nitric acid at 5%.

2.5 Amino Acids - Amino acids were determined in a laboratory analyzer with a cation exchange column and post-column derivatisation with ninhydrin. The samples were hydrolyzed in advance with HCl 6N at 110°C for 22h, with the exception of tryptophan, for which the hydrolysis was performed with LiOH 4N for 24 h at the same temperature.

2.6 Fatty Acids - The fatty acid composition was determined by gas chromatography of the methyl esters of the fatty acids, obtained according to the method described by Hartman and Lago (1973). A Variam 3400/3300 gas chromatograph was used with a flame ionization detector (FID), OV 275-15% Carbowax (1/8" x 2m) column. The fatty acids were identified by comparing the retention time with the standards (Sigma) and quantified through the automatic calculation of the area with the Perkin-Elmer-100 integrator.

2.7 Statistical Analysis - The statistical analysis was performed with the SANEST software (Statistical Analysis System), submitting the experimental results to analysis of variance and Tukey's test at a confidence interval of 95% (Gomes, 1982).

III. RESULTS AND DISCUSSION

The proximate composition of the brewer's yeast biomass of *Saccharomyces cerevisiae* is shown in table 1.

For the calculation of the crude protein (49.63%), the conversion factor of 5.8 was used, calculated after subtracting the non-protein nitrogen corresponding to the RNA of the biomass. The composition is characterized by high levels of protein, ashes, RNA and soluble fiber. The total lipid content is low and total carbohydrates represent approximately one third of the biomass.

When the data presented in Table 1 is compared with other studies, one can see that the data is similar to those obtained by Farnun and Cleland (1975); Guzmán-Juarez (1983) and Caballero-Córdoba et al., (1997). The results of these studies are very similar and are very close to those found in the study presented here.

In Table 2, the data of the amino acid composition of the yeast biomass as compared with the reference standard of FAO/WHO/UNU (1985), is presented.

One can see that all essential amino acid profiles of the yeast cells exceed the recommended amino acid quantities by the three organizations of the United Nations. It should be noted that the high concentrations of lysine (LYS) and threonine (Thr) in the yeast biomass, turn it into an exceptional material for the supplementation of cereals, since the protein content of cereals is commonly deficient in these two amino acids and also in tryptophan.

The fatty acids profile of the lipid fraction of the biomass of *Saccharomyces cerevisiae* is shown in Table 3.

After the performed analysis, 11 fatty acids (C8-C18) could be identified, including palmitic acids (34.33), oleic acids (11.02), stearic acids (9.56), capric acids (6.26), linoleic acids (4.37) and palmitoleic acids (2.99). Fatty and mono-unsaturated acids, therefore. The linoleic acid

content (C18:3) was low, as it was only 0.63%. It should be emphasized that the data obtained in this study are in line with the data from Caballero-Córdoba *et al.*, (1997), who analyzed fatty acids levels in yeast using the same methodology, presenting very similar rates, but they are not in agreement with the results from Halász and Lástity (1991), both from a quantitative and qualitative perspective.

According to Halász and Lástity (1991), the lipid content of yeast varies from 7 to 15% and the fatty acid composition is characterized by a high content of unsaturated fatty acids, with the oxygen flow during the cultivation of the cells being the parameter that most influences the fatty acid composition.

Table.1: Proximate composition of the yeast biomass obtained from breweries - *Saccharomyces cerevisiae*.

Components	Yeast ¹	Yeast ²	Yeast ³	Yeast ⁴
Protein	49.63±2.43	48.51	49.80	45-49
RNA	8.12±1.54	7.52	8.40	8-12
Lipids	4.64±0.52	3.44	4.91	4-7
Ashes	7.98±0.76	8.33	5.10	5-10
Total Carbohydrates	31.55±4.32	32.86	-	26-27
Soluble Fibers	9.12±1.22	9.59	-	-
Insoluble Fibers	2.87±0.87	2.60	-	-

Yeast¹ - Conversion factor to protein = at 5.8. Yeast² - Farnun and Cleland (1975). Yeast³ - Guzmán-Juarez, (1983). Yeast⁴ - Caballero-Córdoba *et al.*, (1997).

Table 2: Composition of amino acids (g/100g of protein) of the brewer's yeast biomass - *Saccharomyces cerevisiae*.

Not Essential	BI	Essential	BI	PR
Cys	1.24±0.21	Lys	6.73±1.21	5.8
Tyr	4.12±0.32	Leu	8.75±0.67	6.6
Glu	8.56±0.45	Ile	4.63±0.32	2.2
Asp	10.05±0.56	Thr	6.09±0.57	3.4
Ser	5.45±0.31	Try	0.96±0.04	1.1
Pro	5.11±0.67	Val	5.34±0.43	3.4
Ala	6.89±0.12	Met+Cys	3.55±0.64	2.5
Gly	5.23±0.87	Phe+Tyr	8.36±0.89	6.3
Arg	4.02±0.64	His	2.78±0.06	1.9
Phe	5.57±0.10	Met	3.12±0.21	-

BI = whole biomass; PR = reference standard of the FAO/WHO/UNU (1985).

Table 3: Composition of fatty acids and total lipids of the brewer's yeast biomass - *Saccharomyces cerevisiae*.

Fatty Acids	Structure	Total Concentration (%)
Caprylic	C8:0	0.29
Capric	C10:0	6.26
Lauric	C12:0	1.26
Myristic	C14:0	0.78
Myristoleic	C14:0	0.39
Palmitic	C16:0	34.33
Palmitoleic	C16:1	2.99
Stearic	C18:0	9.56
Oleic	C18:1	11.02

Linoleic	C18:2	4.37
Linolenic	C18:3	0.63

In Table 1, the total lipid content is 4.64% lower than the range of 7-15%, but very similar to the data presented by Farnun and Cleland (1977); Guzmán-Juarez (1983) and Caballero-Cordoba et al., (1997) with values of 3.44; 4.91 and 4 to 7%, respectively.

In the data observed in Table 3, on the other hand, the saturated and mono-unsaturated fatty acids predominated instead of the poly-unsaturated fatty acids. It is likely that this difference reflects the different physiological and nutritional conditions of the different biomasses. In the case of the results reported in this work, the biomass was more spent after several recyclings in the fermentation process. In the example of the literature, the biomass used was grown in ideal conditions for nutrient concentration in the medium and oxygen supply.

The mineral composition of the biomass is presented in Table 4. Considering the high content of nucleic acid in the yeast (Table 1), which limits its daily intake to a

maximum of 20-30 g of dry yeast per day, the yeast will not be able to contribute with very significant quantities of macro-elements. With respect to the micro-elements, it can be considered an excellent source of selenium, manganese, chromium, nickel and lithium, with observed values of 25.12; 14.98; 10.11; 9.05, 8.23 and 6.13 mg for every 100 grams of biomass evaluated.

The data presented here are in line with the data obtained by Caballero-Cordoba et al., (1997) in studies that also considered the yeast biomass of the same species and in which they observed the presence of the same chemical elements in the performed quantifications. In the two works compared here, the macro-elements phosphorus, potassium, sodium, magnesium, aluminum, calcium and iron were observed. The micro-elements obtained in this work are the same observed in the work described here.

Table 4: Mineral composition (macro and micro-elements) of the brewer's yeast biomass - *Saccharomyces cerevisiae*.

Macro-elements	Mg/100g	Micro-elements	Mg/100g
Phosphorus	17.31	Selenium	25.12
Potassium	14.21	Manganese	14.98
Sodium	9.13	Lead	10.11
Magnesium	3.02	Chromium	9.05
Aluminum	1.12	Nickel	8.23
Calcium	0.87	Lithium	6.13
Iron	0.17	Zinc	4.89
		Copper	4.19
		Vanadium	0.56
		Cadmium	0.45

Yeast is considered an excellent source of selenium and chromium, with its intake being recommended as a dietary supplement to prevent deficiencies of these elements, which are characterized by hair loss, growth retardation, reproductive deficiency, heart diseases, necrosis and degeneration of the liver and pancreas (Levander, 1989).

The presence of lithium should also be emphasized, because it has been used in the treatment of various problems associated with neuropsychiatric disorders in the past three decades. It is particularly beneficial for the acute treatment of mania, and usually for the prophylaxis and treatment of depression in bipolar patients. Currently, lithium is the treatment of choice for bipolar disorder, preventing relapses and suicide attempts. Its use is successful in dramatically reducing depressive and manic symptoms in 70% to 80% of patients (Muller-Oerlinghausen *et al.*, 2002).

IV. CONCLUSION

With the data obtained, the conclusion can be drawn that the biomass of the brewer's yeast of *Saccharomyces cerevisiae* - (Meyen ex E. C. Hansen, 1883) obtained from the beer production process is a rich source of protein with good nutritional value, taking into account the various levels of biological evaluation.

With a high content of lysine, this protein source proves to be of special interest as a protein supplement for cereals. The rupture of the cell wall significantly improved the digestibility and use of the net protein from the biomass.

It was also observed that the yeast proved to be an excellent source of some microelements, such as selenium, chromium, nickel and lithium; that it is also a good source of dietary fiber, particularly soluble fibers; and that the content of lipids was low, with a

predominance of saturated and mono-unsaturated fatty acids with 10, 16 and 18 carbon atoms.

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