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Editorial

Dear authors, reviewers, and readers

It has been a month since I was given the privilege to serve as the Chief Editor of the International Journal for Innovation Education and Research (IJIER). It is a great pleasure for me to shoulder this duty and to welcome you to **THE VOL-8, ISSUE-4 of IJIER** which is scheduled to be published on **01st April 2020**.

International Journal for Innovation Education and Research (IJIER) is an open access, peer-reviewed and refereed multidisciplinary journal which is published by the International Educative Research Foundation and Publisher (IERFP). IJIER aims to promote academic interchange and attempts to sustain a closer cooperation among academics, researchers, policy makers and practitioners from a wide range of disciplines, which contribute to state of the art in science, education, and humanities. It provides a forum for the exchange of information in the fields mentioned above by welcoming original research papers, survey papers, and work-in-progress reports on promising developments, case studies, and best practice papers. The journal will continue to publish high-quality papers and will also ensure that the published papers achieve broad international credibility.

The Chief Editor, appointed by the Associate Editors and the Editorial Board, is in charge for every task for publication and other editorial issues related to the Journal. All submitted manuscripts are first screened by the editorial board. Those papers judged by the editors to be of insufficient general interest or otherwise inappropriate are rejected promptly without external review. Those papers that seem most likely to meet our editorial criteria are sent to experts for formal review, typically to one reviewer, but sometimes more if special advice is needed. The chief editor and the editors then make a decision based on the reviewers' advice.

We wish to encourage more contributions from the scientific community to ensure a continued success of the journal. We also welcome comments and suggestions that could improve the quality of the journal.

I would like to express my gratitude to all members of the editorial board for their courageous attempt, to authors and readers who have supported the journal and to those who are going to be with us on our journey to the journal to the higher level.

Thanks,

Dr Eleni Griva

Ass. Professor of Applied Linguistics

Department of Primary Education

University of Western Macedonia- Greece

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Industrial waste in the food science and technology area: a bibliometric study from 1990 to 2019

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Abstract

In recent years, due to the potential of its properties, the use of industrial waste has generated interest of study in the academic community in the area of Food Science and Technology (FST). The goal of this work was investigate the importance of food industrial waste by bibliometric tools in articles, reviews and proceeding papers published in the last 28 years. It was verified that the research on industrial residues in the area of FST has evolved over the years, being more remarkable from the year of 2006. The research found 1453 documents published in 183 journals. The 7 most productive countries were analyzed, with Brazil being highlighted due to greater predominance of publications in the area. It was observed that antioxidant activity, extraction, optimization, by-products and purification have attracted great attention to food and/or cosmetic industries.

Keywords: waste; industry; food; bibliometrics; reuse.

1. Introduction

With industrial growth, great amounts of waste and an excessive ecological footprint have caused great

damage to the environment and to the quality of life of great part of the world's population. Some of this waste remains in their production or extraction sites, with no associated economic or social advantages to local producers, with most of this waste being located in developing countries [1].

This is usually low value-added industrial waste, being commonly heterogeneous. Furthermore, it can cause great harm, namely in terms of water pollution, endemic diseases, also contributing to a lower quality of the air, besides leading to social and economic problems. These consequences become even greater when large industries discard residues in highly vulnerable regions, with not enough resources available for their treatment [2].

In order to prevent such issues, industries should carry out an adequate treatment of these residues. Nevertheless, most treatments do not completely remove all waste generated. Thus, an alternative lies on reusing these residues, which has been employed for reducing their disposal to the environment. Taking into account that most residues can contain substances with high added value, the application of appropriate technologies result in new products or in feedstock to be used in other processes [3].

This concept is the backbone of sustainable industries, aimed at reaching a zero-waste society, with an economy which uses waste as feedstock for the production of new products and applications. Closed systems are the base for industrial symbiosis, using residue from a certain sector to be applicable in others [4].

In the food processing and agroindustry, the generation of waste and by-products is considered a great issue, having raised the attention of researchers, regulatory bodies, industries and consumers. New scientific researches have shown ways and opportunities of reusing this waste or by-products by developing innovative value-added products with high economic importance [5].

The complex organic content present in these residues are a great source for the development of biotechnological processes, through the introduction of new treatment methods and policies. The conversion of waste generated from food processing has been of great attention, as this waste content represents a valuable resource for forming new useful products, mainly due to its low cost, accessibility and high nutrient content [6,7].

Agroindustrial and food waste has been potentially applied within the Food Science and Technology (FST) area, mainly for the development of new products. The use of processing technologies enables the extraction, fractionation and recovery of ingredients of high added value, with important biological activities, such as antioxidant, anti-cancer and anti-hypertensive activities [8]. Sepúlveda et al. (2018) [9] highlight the sustainable character of the use of food by-products, which can be used not only for obtaining value-added products (such as chemical products and materials, as well as fuels), but also in the reduction of environmental impacts and in the improvement of economic growth.

Some agroindustrial residues or by-products have already been used in the production of new compounds. For instance, waste originated from apple and citric fruit processing has been applied in the production of dietary fibre. Nevertheless, the composition and physicochemical properties of these fibres depend on the characteristics of the material and on the processes employed [10]. Other examples include the production of lactic acid, biosurfactants and bioethanol, as well as the fermentation of shells of citrus fruits [11]. Moreover, tomato processing waste, such as tomato skin and seeds, can be used in the extraction of carotenoids [12]. The production of olive oil also generates a great amount of residues, which are rich in

phenolic compounds, being of great biological and pharmaceutical interest [13].

With this in mind, the present work is aimed at analyzing the scientific production of industrial waste in the Food Science and Technology area, based on a bibliometric study. With this study, it was possible to identify how this type of waste has been used in this academic field, as well as which countries and entities have published the greatest number of researches, also assessing their respective impact through a citation analysis.

2. Materials and Methods

The bibliometric research was carried out with the data collected from the Web of Science (WoS) database, published by Thomson Reuters, as it is considered a reference for this type of analysis [14]. This study was performed using the following keywords: “industrial and waste” or “industrial and residue”, with a filter being selected for the Food Science and Technology (FST) area. The study period ranged between 1990 and 2019, covering the most important years of scientific research publications. This study was carried out in August 2019, with 1,466 documents being collected.

The data were analysed and presented using Microsoft Excel® version 2010 and VOSviewer® for drawing the maps, graphs and tables that demonstrate the different results of scientific production. In addition, HistCite was employed in the data collection from Total Global Citation Scores (TGCS) and Total Local Citation Scores (TLCS). The impact factor for the scientific journals in the last five years was collected from Journal Citation Reports (JCR) 2019.

3. Results and Discussion

Among the publications found in the WoS, 10 documents were found. Most publications were classified as articles, with approximately 83.97%, followed by reviews (11.11%) and proceeding papers (7.09%). The remaining types included meeting abstracts, new items, retracted publications, notes, editorial materials, correction additions and book chapters, which represented a total of only 0.88% of all publications. For greater relevance of the search performed, only articles, reviews and proceeding papers were considered for the analysis of this work, with a total of 1,453 documents.

Figure 1 shows a gradual increase in publications on industrial waste in the area of Food and Science Technology (FST). Between the period from 1990 to 2006, only a few publications on this subject could be found, with an almost stable period, being mostly dominated by developed countries, such as Japan, the United States and Germany (Figure 2). From 2006, there was a rapid increase in the number of publications, growing from 19 to 169 documents in 2018. This upsurge was favored by the start of publications from countries such as Brazil and China, which, until then, had no document published, as well as Spain, which also intensified their studies from 2006. This trend demonstrates that researches regarding industrial waste in the FST area started to become more important to researchers due to the relevance of the topic and the alternative of reusing this type of waste, with a positive effect on the number of works published over the last years.

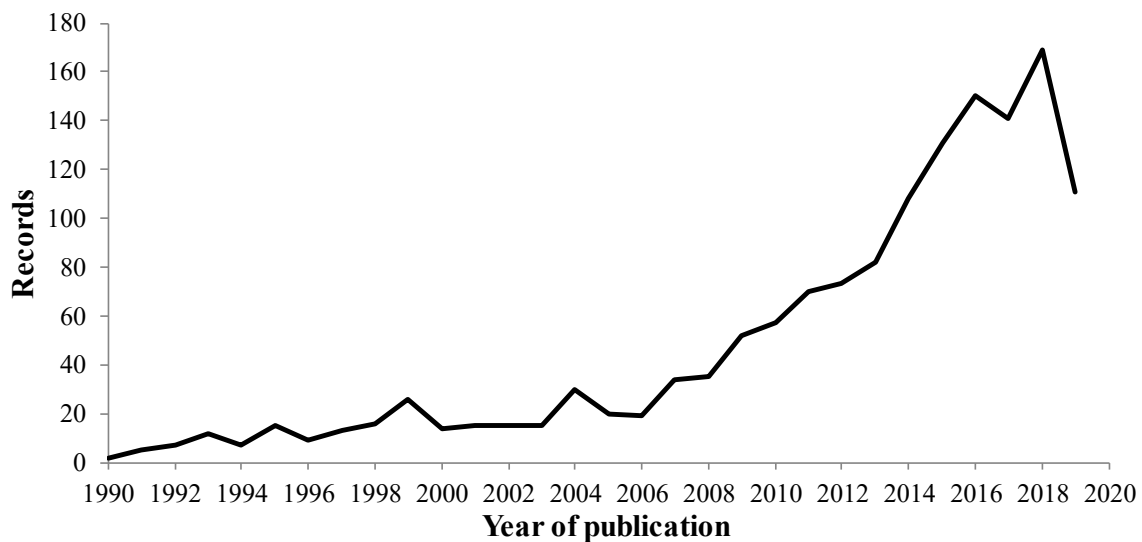


Figure 1. Chronological distribution of publications on industrial waste in FST.

Figure 2 shows the seven countries with most publications on industrial waste in the FST area. Among these, it can be observed that 4 countries are classified as developed countries (Spain, Japan, USA and Italy) and 3 being developing countries (Brazil, China and India). Brazil was the country which published the greatest number of studies in the area being analysed, with a total of 194 documents, followed by Spain and China, with 157 and 121 documents, respectively. Thus, Brazil is considered to have a greater research influence in this subject, in terms of the number of publications. It is worth noting that, from 1990 to 2005, the USA and Japan were among the most influential countries in terms of studies published. However, after this period, countries such as Brazil, Spain and China observed a significant increase in the number of publications.

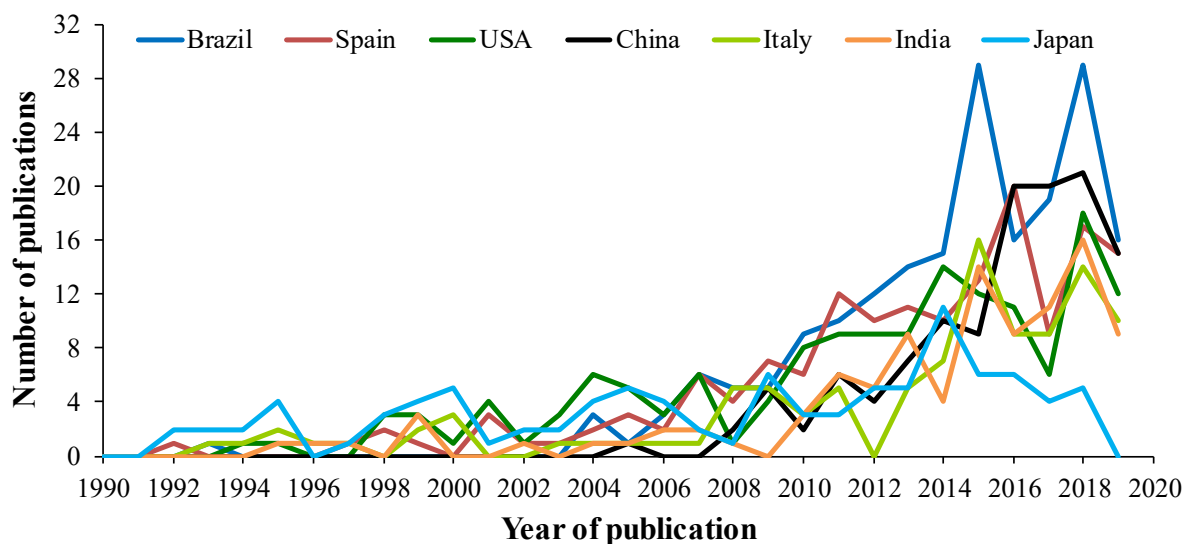


Figure 2. Ascending trends of publications from the seven main countries from 1990 to 2019.

Approximately 200 institutions have publications on this subject, with the 12 most productive institutions being presented in Table 1, as well as their respective citation indices. A citation index is an important

analysis tool, as it an indication of the quality of the articles produced, according to the citations in the scientific community (Chen et al., 2017) [15].

Table 1. Most productive institutions in the period between 1990 and 2019.

Institution	RECS	TLCS	TGCS	TLCS/ RECS	TLCS/ TGCS (%)
State University of Campinas, Brazil	32	15	827	0.469	0.018
Superior Council of Scientific Investigations, Spain	28	6	565	0.214	0.011
University of Vigo, Spain	27	31	1606	1.148	0.019
University of Sao Paulo, Brazil	24	2	524	0.083	0.004
National Institute for Agricultural Research, France	14	3	454	0.214	0.007
State University of Maringa, Brazil	13	3	59	0.231	0.051
University of Minho, Portugal	13	16	518	1.231	0.031
National Council of Scientific and Technical Research, Argentina	12	6	125	0.500	0.048
Aristotle University of Thessaloniki, Greece	11	20	391	1.818	0.051
Federal University of Rio de Janeiro, Brazil	11	7	92	0.636	0.076
Federal University of Rio Grande do Sul, Brazil	11	7	300	0.636	0.023
Jiangnan University, China	11	3	158	0.273	0.019

RECS: Records; TLCS: Total Local Citation Score, represents the number of times a given article is cited by other articles within a local collection; TGCS: Total Global Citation Score, represents the frequency of citations based on the WoS count at the time the data were collected.

The institutions with the greatest number of publications regarding industrial waste in the FST area are from Brazil, Spain, France, Portugal, Argentina, Greece and China. In Brazil, the State University of Campinas (UNICAMP) produced most documents in terms of the number of publications (2.2%), followed by Spain, with the Superior Council of Scientific Investigations (1.9%). Regarding the citation indices Total Global Citation Scores (TGCS) and Total Local Citation Scores (TLCS), the University of Vigo appeared in the first position, with the highest scores. Aristotle University of Thessaloniki, the University of Vigo and the University of Minho exhibited the highest (TLCS/TGCS) indices, thus demonstrating that these institutions produced articles with greater visibility in the subject when compared to the remaining institutions. On the other hand, Brazilian Universities, such as the Federal University of Rio de Janeiro and the State University of Maringá, presented the highest number of citations in this subject, when considering the total citations in the WoS.

Nevertheless, it could be observed that the most productive institutions had lower (TLCS/TGCS) indices, indicating that they are more cited in other fields of knowledge.

The main journals and their corresponding citation indices and factors of impact are shown in Table 2. The greatest number of publications was observed in the Innovative Food Science & Emerging Technologies Journal, followed by Food Chemistry and the Journal of Agricultural and Food Chemistry, which represented

19.89% of all publications in the 183 journals analyzed. When considering the TLCS indicator, Food Chemistry and Innovative Food Science & Emerging Technologies exhibited the highest values. In turn, Food Chemistry and the Journal of Agricultural and Food Chemistry obtained the highest values of TGCS. The journals with the greatest impact factor are Innovative Food Science & Emerging Technologies and Food Chemistry, being considered the most influential journals, as both also have a high number of publications, as well as high TLCS and TGCS.

Table 2. Most productive journals from 1990 to 2019.

Journal	RECS	TLCS	TGCS	FI
Innovative Food Science & Emerging Technologies	109	45	2325	4.41
Food Chemistry	99	93	4664	5.488
Journal of Agricultural and Food Chemistry	81	29	2397	3.911
Journal of the Science of Food and Agriculture	46	12	608	2.733
Food Research International	42	28	1026	4.437
Journal of Bioscience and Bioengineering	41	11	969	2.244
Food and Bioproducts Processing	38	24	837	3.518
European Journal of Lipid Science and Technology	34	6	393	2.207
Biotechnology Progress	31	4	2192	2.488
International Journal of Food Science and Technology	31	15	278	2.201
LWT-Food Science and Technology	31	14	478	4.0
Journal of Food Engineering	30	20	627	4.051
Journal of Food Science and Technology-Mysore	26	8	150	2.391
Analytical Methods	25	0	212	2.145
Food and Bioprocess Technology	25	29	1178	3.449
Journal of Food Process Engineering	25	1	111	1.441

RECS: Records; TLCS: Total Local Citation Score, represents the number of times a given article is cited by other articles within a local collection; TGCS: Total Global Citation Score, represents the frequency of citations based on the WoS count at the time the data were collected; FI: Factor of Impact.

The chronological distribution of the publications in the five journals that received most publications are presented in Figure 3. Between 1990 and 2006, it was observed that only 5 journals published researches, including Food Chemistry and the Journal of Agricultural and Food Chemistry, with a maximum number of 2 publications a year. From 2006, there was a promising increase in the number of publications in the area of FST, especially in the first three journals presented in Table 2. Subsequently, in the year of 2006, the journal Food Science & Emerging Technologies gained distinction in this scenario for the number of documents published. These journals have similar interests, comprising the areas of food chemistry, food science and agriculture. Most publications are related to the use of industrial waste originated from agriculture or food industries for the production or synthesis of new chemical substances for food purposes, energy production and for products for human or animal consumption.

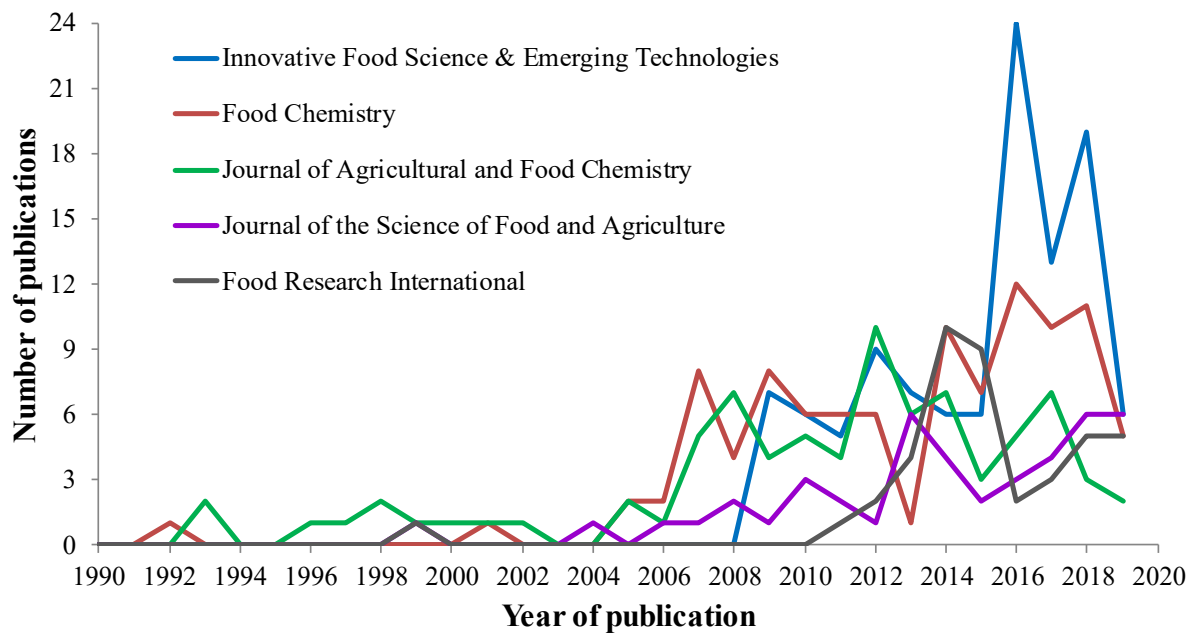


Figure 3. Ascending trends of publications from the main journals between 1990 and 2019.

The documents were mostly published in English (95.93%), followed by German (1.72%), Japanese (1.03%), among other languages (1.16%), especially Portuguese, Italian, Polish, French and Spanish. The preference for the English language can be associated to the greater visibility of publications within the academic community [16]. Although Brazil is among one of the countries with the highest number of publications in the field studied, Portuguese was not the language used by the respective authors, as English is the language with the greatest acceptability in the academia.

The impact analysis of the articles was based on the number of times each article is cited (Figure 4). Up until when the data was collected, approximately 16% of the articles published had not been cited, with 26.8% having between 1 and 4 citations. Approximately 83.82% of the 1,453 documents on industrial waste in the FST area had been cited. The total number of citations was of 27,582, with an average of 18.98 citations per article, with the article with the most citations having 1,549 citations. In addition, the mode obtained was equal to 0, with a median of 6.

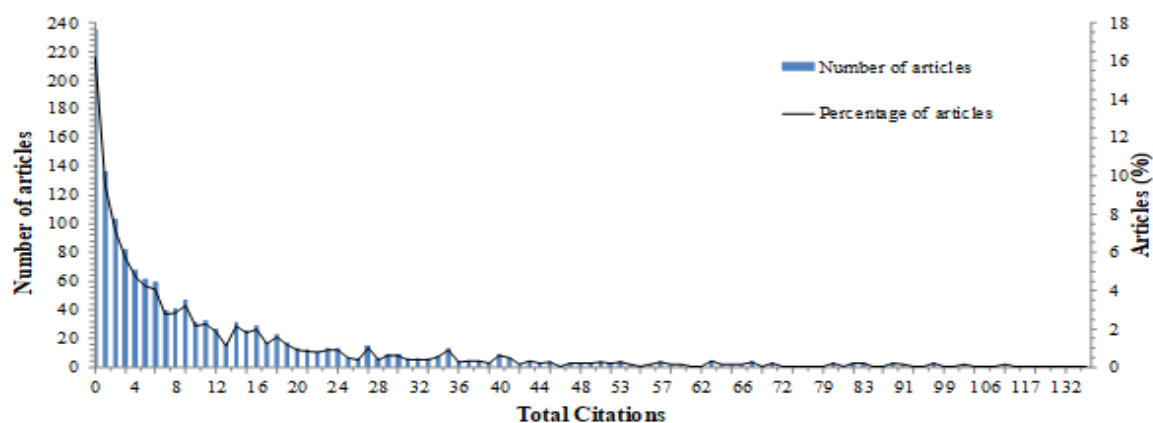


Figure 4. Distribution of the number of citations per article between 1990 and 2019.

The analysis of the keywords used by the authors was carried out aimed at verifying the trends of research on industrial waste in the FST area. Accordingly, 7,975 keywords were used in the period between 1990 and 2019. Moreover, 86.51% of the keywords were used only once or twice, while the keywords used 3 or more times represented 13.49%, totalling 1,076 words. This shows that the researches are not concentrated in only certain areas of knowledge, being, instead, quite diversified.

Figure 5 illustrates the most frequent keywords in the field of knowledge studied. The lines between the words and their proximity represent the overlaps between these words, with the academic subject clusters being represented in different colours. As observed in Figure 5a, there are three clusters, with the largest consisting of 10 keywords and the smallest with 8 keywords. The words with the highest incidence include: antioxidant activity (114), extraction (108), optimization (108), by-products (93) and purification (93). The words that have a greater association with other words include antioxidant activity, extraction and optimization. According to Figure 5b, these keywords were mostly used after 2013, especially those regarding bioactive compounds and antioxidant capacity. The discovery of antioxidants with benefits to human health is of great importance to scientists worldwide, having been of increasing interest in the last two decades [17].

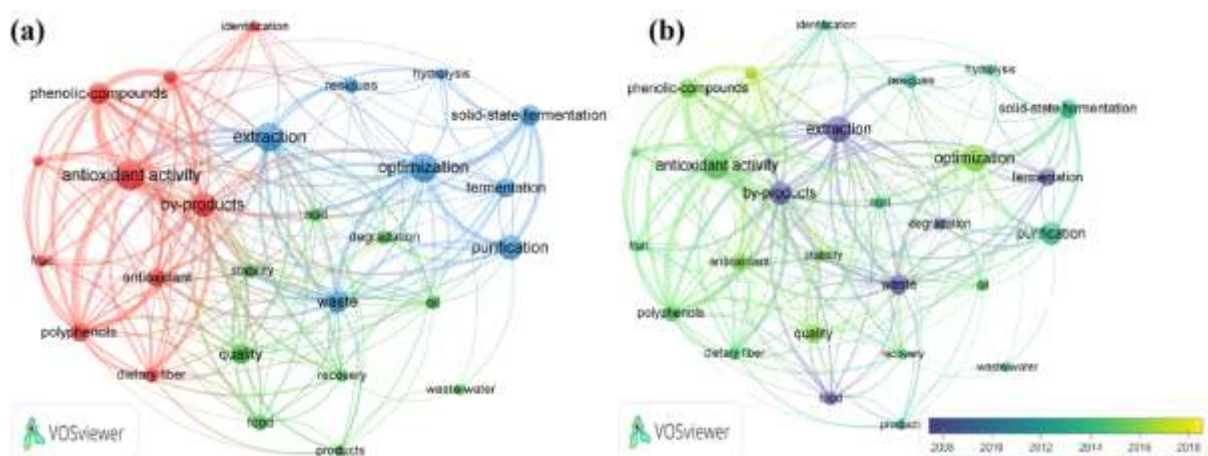


Figure 5. Incidence of the main keywords (a) Academic subject clusters and the relationship between keywords; (b) Incidence of keywords between 2000 and 2019.

The trends of researches on bioactive compounds and their antioxidant capacity lies on the fact that these compounds are extremely relevant for the scientific community due to their medicinal properties and benefits to human health [18]. Moreover, there is great interest in exploring the antioxidant capacity of several phenolic compounds originating from natural sources, aimed at replacing synthetic antioxidants from food products [19]. Several types of waste from food processing or the agroindustry exhibit great quantities of these compounds, thus, being of great interest to scientific research, such as in the case of seafood waste and wine production waste. The use of these types of waste enables the development of food or comestic products, besides reducing environmental pollution [20, 21].

This demonstrates the relationship between the most cited keywords (antioxidant, polyphenols and by-products) and agroindustrial waste. Consequently, it also shows the main fields of interest in terms of the application of agroindustrial waste in the FST area, allowing greater knowledge regarding the alternatives

for reusing these residues.

4. Conclusion

The present bibliometric study performed with 1,453 documents from the Web of Science database provided a systemic view on the current trends of research on industrial waste in the area of Food Science and Technology, with some important aspects being pointed out.

The subject studied is considered recent, having observed a rapid increase of interest after 2006. From 1990 to 2006, developed countries (USA, Japan and Germany) were more predominant in terms of the number of publications. After 2006, countries such as Brazil, Spain and China became more prominent, with Brazil having the greatest number of publications in the field. In addition, it was verified that, despite the Brazilian State University of Campinas having the greatest number of publications, the Spanish University of Vigo obtained higher citation indexes of Total Global Citation Scores (TGCS) and Total Local Citation Scores (TLCS). The most influent journals were Innovative Food Science & Emerging Technologies and Food Chemistry, with both having the highest number of publications and factor of impact, as well as high citation indicators.

As anticipated, the most commonly used language for publication was English, accounting for 95.93% of the articles cited. The most frequent keywords used by authors were antioxidant activity, extraction, optimization, by-products and purification, indicating a trend of researches on industrial waste, which focuses on the development of products with applications in the food and/or cosmetic industries.

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Highlights

- increasing number of publications involving the use of industrial waste.
- bibliometrics tools to prospect main areas of research on industrial waste.
- recovery is directly related to cleaner production, waste minimization and recycling.
- Institutions from Brazil and Spain stand out in the publication on industrial waste.

Cost Management: Bibliometrics In the Annals of The National Production Engineering Meeting

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Abstract

The National Meeting of Production Engineering (ENEGEP) is an event organized by the Brazilian Association of Production Engineering (ABEPRO) in which brings together the academic community of researchers working in the sector of Production Engineering and constitutes one of the leading promoters of technical and scientific production in the area. Among the various topics transiting the meeting, cost management is one of those who has relevant interaction. This article aims to analyse the academic contributions published in the Annals ENEGEP from 2008 to 2018 and trends in the area of Economic Management, Cost Management subarea. Methodologically it made the use of bibliometric analysis techniques, analysing, quantitatively and qualitatively, 219 articles, considering the following variables: quantitative evolution of publications; authoring features per article; authors; educational institutions; keywords; and themes. The main results identified an average of twenty papers per year with the cost management issue, the vast majority of publications were carried out with two or more authors, in relation to the authorship, 71% of authors had only one article, the southern region is the one most representative authors of publications, and as to the keywords which is evident most frequently are "Cost Management" and "costs".

Keywords: Costs; Cost Management; Bibliometrics.

1. Introduction

Faced with a scenario in which the domestic market is undergoing a significant stagnation related both to the political crisis, as the economic recession of 2015-2016, the factors are associated with an economic policy enacted from the end of 2014 and the downturn in the economy since 2010 (Santos & Aruto, 2018). To the holders of knowledge fits enjoy the best of their potential, pulling up data, abstracting information to generate awareness, and through this make vital decision seeking a better marketing performance. In a crisis scenario and intense competition, it is natural that organisations focus their efforts on cost-based management because it is a tool to make decisions, which uses the cost to develop competitive strategies (Gollo, Bazi, Mazzioni, & Kruger, 2017).

Now, it is salutary to know the possibilities of cost management in the organizational context, through an analysis of scientific literature that deals with the subject since researching this subject can inspire new information and generate knowledge on the subject (Pasa, Nascimento & Correio, 2017).

The Cost Accounting has as its primary function the generation of accurate and timely information for decision-making and use their technique to identify, measure and report the cost of goods/services (Aparecido Crepaldi & Simões Crepaldi, 2018). Under the same point of view and increasing the

understanding, it is emphasized that the modern cost accounting goes far beyond the numbers. Cost accounting is fundamental in managerial decision-making. Their study provides a better understanding of the activities of managers and accountants within an organization (Horngren, Datar & Foster, 2004).

In a highly competitive environment, which is the case of business organizations, the costs should be treated not from the perspective of traditional analysis, where the focus was to measure stocks and the calculation of the cost of goods for tax purposes, but with an approach geared more to the strategic company. Strategic positioning is the key to creating and sustaining a competitive advantage, and strategic cost management is the way it uses the cost data that will produce this sustainable advantage (Hansen & Mowen, 2013) help organizations in the continuous improvement of competitiveness.

In science, it is necessary to disseminate knowledge coming from the work carried out by researchers and scientists in this context scientific communication is born. One of the outlets for the academic community is employing scientific publications. No communication is not science and therefore, could not add up the individual efforts of its members in pursuit of knowledge (Oliveira, 2002). The primary means of communication used by researchers to disclose the results of their research are academic journals (Urbizagastegui, 2016). Know the main topics researched and explore trends in published scientific productions can contribute to the emergence of new management models, methodologies and innovative organizational practices.

Recent studies point to the interest of researchers for bibliometric studies in accounting (Voese & Mello, 2013; Cavalcante, Granja, Sousa & Bernardes, 2017; Oliveira, Luz, Albuquerque, Cirne & Sampaio, 2017), as they are relevant and is helping more and more to understand the scientific production in the areas of accounting (Magalhães & Araújo, 2017).

The National Meeting of Production Engineering (ENEGEP) is an event organized by the Brazilian Association of Production Engineering (ABEPRO) and is in its 38th edition. It is an event that brings together the academic community of researchers and professionals working in the sector of Production Engineering and constitutes one of the leading promoters of technical and scientific production in the area. Among the various topics transiting the meeting, cost management is one of the protagonists of this interaction.

Given this context, this paper presents a literature review on cost management, with the guiding research question: What are the main issues and trends related to the field of Economic Management, subarea published Cost Management in National Meeting Proceedings Engineering Production (ENEGEP), the last eleven years?

The overall objective of this research was to analyze the academic contributions published in the Annals ENEGEP from 2008 to 2018. This study also aims to identify issues and research trends in the area of Economic Management, Cost Management subarea; quantify the production of authors per article, and

measure the impact of disseminated publications in academia.

This work is split into five parts, the first this introduction. In the second part of the theoretical framework on cost management will be presented. The third part concerns the field of research and the methodological procedures that guided the completion of data collection, and then the fourth part describes the results of the search. Finally, the conclusions and contributions of this study will be presented.

2. Brief contextualization of the ENEGEP

The National Meeting of Production Engineering (ENEGEP), is an event that follows since 1981, the organization was independently sponsored by the institutions that hosted the event. Later, in 1986, it came to be organized by the Brazilian Association of Production Engineering (ABEPRO, 2018). The ABEPRO is a representative institution of teachers, students and Production Engineering professionals, which was established on October 9, 1987, in the case of an organization classified as a legal entity of private, non-profit, for an indefinite time and based in the capital of the State of Rio de Janeiro.

The association has been operating for over 30 years and his efforts began in 1981 when the first ENEGEP - Undergraduate Studies Meeting in Production Engineering, later in 1986, during the VI ENEGEP, already under the name National Meeting of Engineering production, there was the founding General Meeting of ABEPRO - Brazilian Association of Production Engineering. The ABEPRO born of these meetings and was conceived as a national discussion forum for discussions of academic, scientific and technical policies (Meirelles & Assumption, 2016).

The entity brings together professionals, researchers, students, and teachers interested in the development of production engineering in Brazil and among its functions assumes the role to clarify the duties of the production engineer in society and its market. It performs the task of being an interlocutor with governmental institutions related to the organization and evaluation of undergraduate courses; close relationships with funding agencies as well as private organizations and non-governmental organizations that deal with research, teaching, and extension of engineering.

Organized by the Brazilian Association of Production Engineering (ABEPRO) National Meeting of Production Engineering (ENEGEP) is in its 38th edition and is a reference for the academic community of researchers and professionals working in the sector of Production Engineering. It constitutes one of the leading promoters of technical and scientific production in the area.

The scientific production of ENEGEP is classified into various classes of production engineering problems, distributed in eleven areas: Production Management; Quality management; Economic Management; Ergonomics and Safety; Product management; Operational Research; Strategic and Operational Management; Organizational Knowledge Management; Environmental Management of Production Processes; Education in Industrial Engineering; Production Engineering, Sustainability and Social

Responsibility, which unfold in fifty-nine subareas and a guided session. Cost Management, the subject of this research, is a subfield of Economic Management.

3. Cost Accounting

The Industrial Revolution began in England in the mid-eighteenth century. It was a period that was characterized by the transition from manufacturing to mechanized industry, in which the tools gave way to machines; human power has been replaced by motive power. The shift occurred between feudalism and capitalism, and the production method is no longer becomes domestic and industrial.

Before the Industrial Revolution, the products were handcrafted. Shortly there was a figure of the industry, much less concern about the factors related to the cost of products. With the advent of mechanized industry, the concept of production is no longer manufactured to be machinery. Comes the idea of assembly line and manufacturing activities are now substantially repetitive and large-scale.

Until then it used the General Accounting also Financial Accounting call, to determine the results for the year and its main application was given in the commercial segment, but with the growth of productive activity comes the need for cost estimate for stockpiling (Ferreira, 2007; Viceconti & Neves, 2013; Martins, 2018). Accounting drifting costs, so the general accounts and manifests itself at the time that organizations feel the need to monitor more efficiently the resources allocated in the productive process of the company. There arises the Cost Accounting, which traditionally focused on determining the cost of inventory and goods produced (Hansen & Mowen, 2013).

The results for the year were obtained, the cost of goods sold was subtracted from revenues; thus, it came to gross profit. From the gross profit, other fees were deducted and thus met the profit or loss for the period. In the commercial segment, the cost of goods sold was more natural to calculate, since its composition consisted of the amount paid for the goods, more taxes, freight, insurance, and other expenses. If this happens, some variation in stock applied the formula involving, initial inventory, purchasing and final stock to meet the Cost of Goods Sold (COGS).

$$\text{COGS} = \text{Initial stock} + \text{Purchases} - \text{Final stock}$$

However, in the industrial sector to produce consumer goods, the process is more complicated. The manufacturer buys materials and transforms them. In addition, this transformation is paid labor, and a myriad of other costs (energy, water, etc.). To work around this situation and account for Cost of Goods Manufactured (COGM), the way computing income in the industrial business was similar to that used in business accounting, namely: the starting and ending stocks are valued, and the shopping account is replaced by expenses incurred in the production (Viceconti & Neves, 2013).

$$\text{COGM} = \text{Initial stock} + \text{Expenses in Production} - \text{Final stock}$$

With the same purpose of measuring the produced inventory and determine the outcome of the exercise, but with a higher level of difficulty, there is the cost accounting. The degree of complexity in calculating

the cost of significantly increased with industrialization.

With industrial development, cost accounting has undergone considerable evolution. Due to the need to improve the mechanisms of planning and control of the companies, there was a more significant concern in determining the outcome of production enterprises. It was this development that the merchant, the industrial and the service began to know how much they were earning effectively.

The knowledge and art of managing are critical factors in the success of any business, especially in highly competitive markets. As a result, we can not relegate the management costs to a secondary plane, as they form auxiliary of proper administration tools in that sense there is no way to conduct business without knowing, understand and control their costs. This is vital for the enterprise, regardless of the type - commercial, industrial or service provider - and size - small, medium or large (Megliorini, 2012; Cortiano, 2014).

Cost accounting is a field of accounting that has as the primary purpose of generating management information related to the cost of goods/services subsidizing decision making. To create information is necessary to collect, classify and record operational data of the various activities of the entity, following the generally accepted accounting principles and is focused on the organization's spending analysis in the course of its operations (Aparecido Crepaldi & Simões Crepaldi, 2018).

It is worth noting the importance of cost accounting as a management tool for better planning and control of business activities, emphasizing the decision-making process due to the growth and complexity of companies. Thus, cost accounting has to be seen as an efficient technique to assist in the performance of this new mission, management (Martins, 2018). In this context, Horngren et al. (2004) assert that modern cost accounting is much more than numbers. They stand out as being an essential management process in decision-making.

Over the years, the need for reporting for administrative purposes increased, and thus accounting turned service managers (Ferreira, 2007). The primary purpose of cost accounting is the calculation of the cost of goods sold. However, another critical aspect of the business costs of the analysis is to serve as a tool in support of the management process, especially when it comes to planning, control, and information. The planning will allow the company to identify the alternatives and then choose the best option that can thus maximize the profit of the company.

The control serves for the company to know precisely what it has concerning its stocks, as gains concerning its sales, which is the star product at the time of sale, etc. As for information, this will be useful for the company to position itself in making strategic decisions such as quantity to be produced/sold, if the company should buy or manufacture, etc.

In addition to these objectives the analysis of the costs of a company provides a variety of information that allows support decision making, such as determining the cost, and the results, products, goods, and services;

determining the profitability and efficiency of their products; allow to analyze the performance of various sectors of the company; seeks to optimize results; creates parameters for fixing the selling price; raises the maximum discount percentage to be granted; among others. (Sebastião Leone & José Leone, 2010; Megliorini, 2012; Aparecido Crepaldi & Simões Crepaldi, 2018).

The initial concern of accountants, auditors, and tax on the use of cost accounting was to solve the problems related to the monetary measurement of inventories and results. There was no intention to turn it into a management tool (Ferreira, 2007). Thus, in recent decades, accounting costs increased from mere aid in the assessment of global stocks and profits to play an essential role in the control and management decisions (Martins, 2018). In this context, the cost analyst is assuming a new role, a role with broader implications, and a less narrow definition. It is in this scenario that accounting is evolving to cost management (Hansen & Mowen, 2013).

Table 1 shows the evolution of cost accounting in three perspectives: financial, operational, and strategic and changes that have been happening over time.

Table 1. It shows the evolution of cost accounting in three perspectives

Note. Source: Compiled from "Cost Accounting" of JAS Ferreira, 2007 Sao Paulo: Pearson Prentice Hall, 2007. p. 9.

	Financial Perspective	Operational perspective	Strategic Perspective
Purpose	Register	Run	to plan
Time dimension	Yesterday	Today	Tomorrow
Users of information	external agents	Management of operations	investors Strategic plan
Function Information	financial	Value Analysis Management of activities	Cost target prices contracts
Information aggregation level	aggregated information	Detailed information	specific information
Frequency Reports	spaced	immediate	when necessary
Type measures	financial	Physics	Financial and Physical

In designing Ferreira (2007), there was a marked evolution of cost accounting at the time it was realized that there was a considerable mismatch between the concepts and practices about the calculation of costs and the reality of the companies themselves. The term Strategic Management Accounting (SMA) was first created by Kenneth Simmonds, who, in general, defined as an analysis of information from a company and its competitors to use in the development and monitoring of business strategy. This interface between strategic management and accounting implies a higher contribution from counters to the formulation and implementation of the plan, suggesting that accountants move away from purely financial concerns going to broader business issues, thus maintaining the role of the counter in the center of activity business (Tayles,

2011).

Strategic Cost Management (SCM) is a tool-making decisions using the costs for the development of competitive strategies, is an instrument that systematically analyzes the company's value chain, from procurement of raw materials to the arrival of the product to the final consumer (Gollo, Bazi, Mazzioni & Kruger, 2017). These two movements, SMA and SCM, emerged almost simultaneously. The first in England and the second in the United States. Both the SMA, the SCM have some similarities with each other, therefore, can be considered synonymous, the first of which is considered to be broader than the latter (Sedevich-Fons, 2018).

Strategic Cost Management (SCM) is essential to the success of any business, as it can make the most efficient production processes and thereby increase profitability and business profitability. In accordance to Drucker (2017), we now have the knowledge society, the information age, the network society, among other expressions, in an attempt to define the transition from an industrial condition to the speed of culture and technological economy.

The Ministry of Education has advanced in pursuit of quality education. There are several strategies used by the government to make HEIs fit the indicators. The new models of on-site assessment and through the National Student Performance Examination (ENADE) have brought society closer to the Higher-Education Institutions, because before it was not chosen a course by the evaluation that it received from the MEC, but this factor became to be a competitive differential in the market.

In this sense, according to Silva Júnior *et al.* (2014), the regulatory processes to which higher education institutions are submitted evaluate the Institutional Development Planning (PDI) where planning is the act by which the future of the institution is decided and the monitoring of what is under construction.

4. Method

The purpose of this research was to analyze the academic contributions, the main issues and trends related to the field of Economic Management, Cost Management subarea ENEGEP published in the Annals of the period from 2008 to 2018, for it was adopted bibliometric analysis techniques.

The bibliometric is a research methodology in the field of library and information science. A statistical analysis of quantitative and academic achievement includes not only descriptive statistics but also network analysis of keywords, text, quotes, authors, institutions, frequency and its connection (Liang & Liu 2018). Researchers use this type of methodology to explore the publishing trend, knowledgebase, citation standard, author network, player usage, impact and importance of the matter.

The research analyzed 219 articles published in the Annals of the Brazilian Association of Production Engineering (ABEPRO). Quantitatively and qualitatively analyzed the following variables: quantitative

evolution of publications; authoring features per article; authors; educational institutions; keywords; and themes.

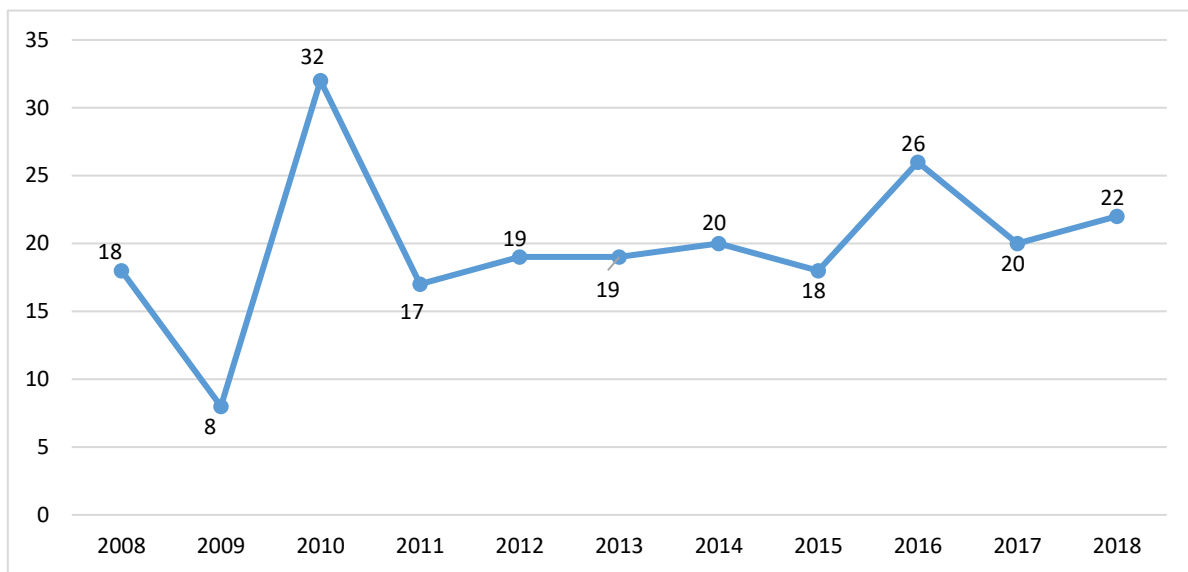
Data were collected on the website of ABEPRO and drew up a spreadsheet using Excel software from Microsoft, which was structured with the following fields: year, title, author, number of authors, educational institution, keywords, and subject line. Graphical representations were made using Excel software from Microsoft® and the cloud of keywords Pro Word Cloud®. The processing of data served as input for analysis, resulting in information that will be presented later.

5. Results

The purpose of this study was to analyze the academic contributions published in the Annals ENEGEP from 2008 to 2018. Therefore, we collected a total of 219 articles, in which the data analysis is to examine how quantitatively given the evolution of publications, authors, and their educational institutions, keywords, topics, among others.

It is worth noting the critical study of Alfred James Lotka, published in 1926, in his article The Frequency Distribution of Scientific Productivity that is a reference to the science of bibliometric. In his Lotka research (1926) shows that the number of authors who make “ n ” contributions in a particular scientific field is approximately " $1/n^2$ " of those who make a single contribution and asserts further that the proportion of those who make an individual input is around 60% (Machado, Souza, Santos & Palmisano, 2016; Maz-Machado, Madrid, Jiménez-Fanjul & León-Mantero, 2017; Ribeiro, 2017). This study became known as Lotka Law of Inverse Square Law.

Graph 1 is exposed to the quantitative development of publications that occurred from 2008 to 2018. In the 11 years interval observed an average of twenty (20) publications per year with a standard deviation of approximately six (6) and publications draw attention the years 2009, with 8 posts, below the standard deviation. Already in the year 2010, with 32 papers and 2016 with 26 releases were above the standard deviation, in other years, remained a standard close to twenty annual editions.

Graphic 1. Quantitative development of publications*Note.* Source: Survey data (2019)

It is also observed in Graphic 1, the thematic studies on costs have maintained an average of 20 articles per year in the last 11 years, with a significant drop in 2009, with 8 published materials, and the considerable increase in the following year with 32 publications, however, since the thematic studies on costs have maintained an average of 20 articles per year in the last 11 years.

The average index of articles published opposite the articles submitted to all areas and sub-areas of ENEGEP, in the eleven years surveyed, is 0.55. By confronting the graph 1 data with the general data of issues, Table 2, it is clear that in 2010, the ratio was 0.60, but to analyze in terms of absolute numbers, this was the year with the second-highest amount of articles submitted, reaching 2,294 articles. These suggest that the sharp increase of publications in 2010, the cost area (32 articles), is directly linked to the total amount of articles submitted and converted into publishing that year.

Table 2: Articles submitted and published articles

YEAR	Submitted articles	Published articles	Index
2008	1,670	945	0.57
2009	2,198	788	0.36
2010	2,294	1,366	0.60
2011	1,776	1,072	0.60
2012	1,686	1,035	0.61
2013	1,491	832	0.56
2014	1,836	1,009	0.55
2015	2,091	1,062	0.51
2016	2,007	1,118	0.56
2017	2,081	1,301	0.63
2018	2,747	1,435	0.52
Average	1,989	1,088	0.55

Note. Survey data (2019)

In a literature review study on the Lotka Law, Potter (1981), we conclude that when the covered period is ten years or more and the authors of community is defined broadly, author productivity to approaches the various distribution Lotka noted. This research was conducted in a period of eleven years, from 2008 to 2018; in this sense, it is worth considering some evidence based on the Lotka Law.

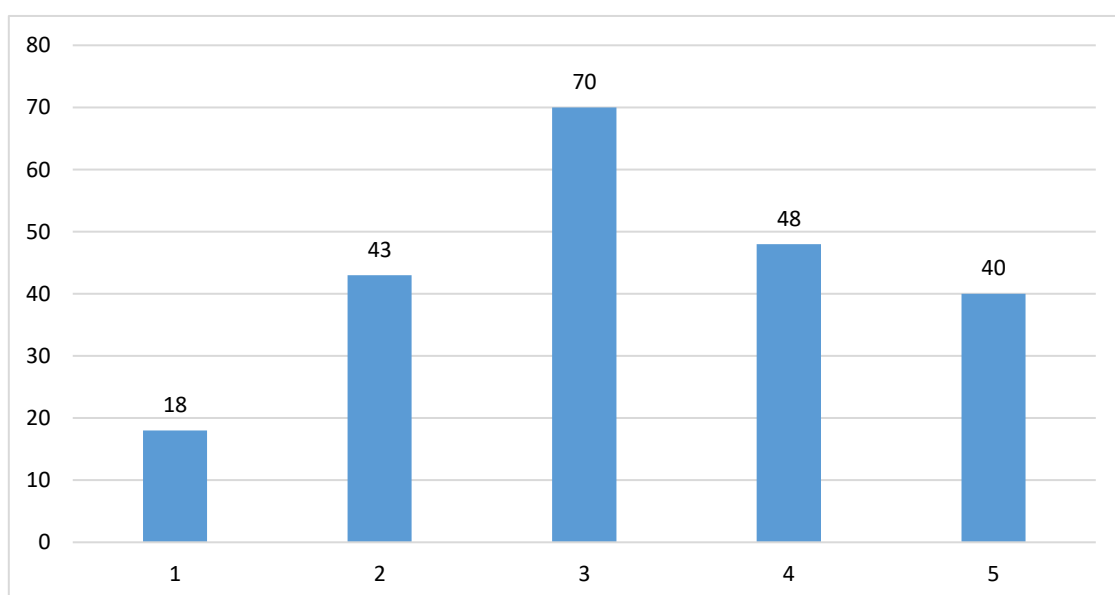
Regarding the amount publications regarding the number of authors for articles, as Graphic 2, it is observed that most publications, 70 articles were written by three authors, equivalent to 32% of all articles published in the period. Only 8.2% of the articles are written individually, while others, 91.8%, are collective compositions, ranging from two to five authors.

In research that deals with the ethical aspects of co-authorship in scientific publications, Hilario, Grácio, and Guimarães (2018) assert that the "scientific collaboration is a working strategy adopted by researchers to enable, facilitate and enhance the conduct of scientific research, especially those empirical and experimental nature. "Overall, this collaboration consists of guidance and suggestions for the improvement of research activities.

However, often related to "scientific collaboration" and "co-authoring" as synonyms; however, co-authorship is only part of the scientific collaboration, since you do not measure cooperation in its entirety and complexity (Vanz, 2009). The joint work of researchers characterizes scientific collaboration with the common goal of producing scientific knowledge. It has a broader connotation. In co-authoring, authors are intensely involved in the construction of research and take center stage of its contents, jointly signed the work, so that they can present, defend and be responsible for the original idea of the work (Hilario et al., 2018). In this case, it is assumed that there is an intense interaction within the scientific activities.

Graphic 2. Number of publications regarding the number of authors for articles

Note. Source: Survey data (2019)



One of the advantages of writing collaboratively is the issue of increasing the visibility of the results. It is understood that co-authoring improves the visibility of products, enhances both the professional growth and the development of knowledge, in addition to increasing the quotation thereof, this is due more exposed to a more significant number of researchers, thanks to the higher number of personal contacts (Batista, González & García, 2018; Chrisóstomo, Serrano & Fernández, 2018; Grácio, 2018), at this juncture, the research points (Graphic 2) to a reliable collaboration indicator of scientific works.

This is a relevant fact, as emphasizes the importance of writing so that each author can collaboratively contribute to the literature, to the research itself, with the construction and dissemination of knowledge. There is however severe criticism of hyper authorship in scientific production, for assigning many researchers authorship of research, one can cast doubt on the credibility of the study, questioning the useful intellectual contribution of all the authors in the development and construction of the text (Hilário et al., 2018).

Concerning the number of authors for articles, research shows (Graphic 2), in which 91.8% are collective compositions, and there is variability from two to five authors. However, the focus of research aimed to identify the hyper authorship ratio.

The data collected from the survey show that 706 authors published 219 articles. Table 3 shows the number of articles published by authors. The majority of writers, 502 authors, have only one publication in the period studied, this represents 71.1% of the total. Two editions were 45 authors, which is equivalent to 12.7% of total authors of publications in the period studied. This study is proven the principle of Lotka Law, as the proportion of those who make a unique contribution is about 60% (Ribeiro, 2017).

Table 3: Number of articles published by authors

Qty. Authors	Qty. Publications
1	11
1	8
2	7
6	5
6	4
9	3
45	2
502	1

Note. Survey data (2019)

Table 4 shows Among the authors who had three or more publications in the period, stands out Fabiano Maury Raupp, with eleven published articles, so the most productive in the studied period of time.

Table 4: Authors who have published in the period

authors	Qty. Art. Pub.
Fabiano Maury Raupp	11
Abraham Scott Junior Freires	8
Antonio Artur de Souza	7
Maxweel Veras Rodrigues	7
Adail Marcos Lima da Silva	5
Altair Borgert	5
Joanir Luis Kalnin	5
Reinaldo Pacheco da Costa	5
Rodney Wernke	5
Sandro Rogério dos Santos	5
Antonio Cezar Bornia	4
Antonio Zanin	4
Aparecida Claudia Mattos	4
Cristiane Mosque Tabosa	4
Josenildo Brito de Oliveira	4
Roberto Ribeiro Portes	4
Aldo Shimoya	3
Andreas Dittmar Weise	3
Fabio Walter	3
Getulio da Silva Abreu	3
Joisie Antonio Lorandi	3
Jose Luiz dos Santos	3
Livia Carolina Matos Lima	3
Paulo Roberto Pinheiro	3
Paul Schmidt	3
SUBTOTAL	114

Note. Survey data (2019)

The Law of the Inverse Quadrant holds that a small number of researchers produce much in a particular area of knowledge, while a large volume of researchers critical little (Machado et al., 2016). This is another point of proof of Lotka's Law on scientific productivity.

It also proves Price's Elitism Law, which states that every population of size **N** has a productive elite of size \sqrt{N} and that the number of members of that elite corresponds to the square root of the total number of authors, and half of (Cintra, Amâncio-Vieira & Munck, 2017 and Santos & Cavalcante, 2018).

The number of members of this elite, totalling 27 writers, which is the square root of 706 authors and half

of the total studied scientific output corresponds to 110 articles. Analyzing the research data, it appears that the authors published 25 114 articles (Table 4), so that the elite research, according to this concept, is productive and confirms Elitism Act Price.

Regarding the institutional link, the research identified 639 writers related to national educational institutions and an author linked to the Chemnitz University of Technology, which is a public university in Chemnitz, Germany, authored by Charles Albino Schult.

Of the 80 authors who published in 2018, it was possible to identify the institutional link only 20%, i.e., 16 authors. Until then, along with the author's name came to define the institution to which he belonged, it was observed that this year, in the article body, did not reveal the binding Institution of Higher Education (IHE). The appointment of these 16 authors was measured when identified by institutional email.

Among the educational institutions, ten more had their authors with publications, depicted in Table 5, and five are in the Northeast, four in the South and the Southeast.

Table 5: **Institutional linkage of the author**

name IHE	locale	Region	Qty. Authors
Federal University of Ceara	Fortaleza / CE	Northeast	39
Federal University of Santa Catarina	Florianópolis / SC	South	38
The University of Caxias do Sul	Caxias do Sul / RS	South	33
Federal University of Minas Gerais	Belo Horizonte / MG	Southeast	32
Federal Rural University of Semi-Arid	Mossoro / RN	Northeast	28
Federal University of Paraiba	João Pessoa / PB	Northeast	27
Federal University of Santa Maria	Santa Maria / RS	South	26
Federal University of Campina Grande	Campina Grande / PB	Northeast	25
Federal University of Rio Grande do Norte	Natal, RN	Northeast	25
State University of Santa Catarina	Florianópolis / SC	South	18

Note. Survey data (2019)

The amount of authors by state, Table 6 shows that the Midwest is fewer authors have published 18 authors (2.5%), followed by North, with 38 authors (5.4%); the Northeast, with 161 authors (22.8%); then the Southeast, authors 177 (25.1%); and South, the most representative, has 245 authors (34.7%). Authors who have not been identified as an institutional affiliation or not belonging to national institutions, representing 9.5%.

Table 6: Number of authors by Federation Unit

Region	UF	Federation unity	Qty. Authors
North	AM	Amazonas	20
	PA	Pará	18
Midwest	DF	Brasília	6
	GO	Goiás	5
	MS	Mato Grosso do Sul	5
	MT	Mato Grosso	2
Northeast	EC	Ceará	44
	PB	Paraíba	52
	PE	Pernambuco	8
	RN	Rio Grande do Norte	53
	SE	Sergipe	4
Southeast	ES	Espírito Santo	10
	RJ	Rio de Janeiro	21
	MG	Minas Gerais	82
	SP	São Paulo	64
South	PR	Paraná	22
	RS	Rio Grande do Sul	137
	SC	Santa Catarina	86

Note. Survey data (2019)

Graphic 3 shows the distribution of authors by institutional affiliation in the country. Of the seven states of the North, only two (Amazonas and Pará) present authors with a publication. There are no publications of authors linked to the institutions of the countries of Alagoas, Bahia, Maranhão, and Piauí. The Midwest Region is the one that has the smallest representation in terms of publications, and the southern region is where you will find the largest concentration of higher education institutions with publications.

Mapa temático do Brasil mostrando o número de artigos publicados por estado. A cor varia de bege (2 artigos) a azul escuro (137 artigos). O Rio de Janeiro e São Paulo apresentam o maior número de artigos.

Qtd Artigos

137

2

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The key words presented in the study were at least three and no more than five per article. 760 were identified keywords, among them 485 different. That total was elaborated on a keyword cloud by applying the Word Pro Cloud® to highlight the words that were more often in Figure 1. A word cloud is an illustration is intended to show the degree of frequency of words in a given text. Thus, the more the word is used, the more striking is the representation of that word on the chart.



Source: Survey data (2019)

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representing 4.3% of the total; tied third words "ABC Costing" and "Costing Method", with 10 repetitions, representing 1.32% of the total; in fourth place the words "Cost Accounting" and "absorption costing", with 9 repetitions, representing 1.18% of the whole; and fifth words "contribution margin" and "Decision Making", with 8 replicates, corresponding to 1.05% of the total.

Another law of great importance to the science of bibliometrics is the Zipf's Law, which describes the frequency in the use of words in a given text, ie, it highlights the occurrences of terms used in published studies (Santos & Cavalcante, 2018). George Kingsley Zipf observed that the frequency of occurrence of words is not uniformly or regularly distributed, but inversely related to the frequency rating. In other words means that the most common word appears twice as often as the second most frequent word, three times more than the third, and so on (Lestrade, 2017; Corominas-Murtra, Seoane & Solé, 2018).

Note that the second term "costs" with 33 repetitions, was discordant concerning Zipf's Law, but the other terms present significant proximity to the analysis of that research, demonstrating the empirical observation Zipf in respect of the frequent occurrence of a word and its frequency rating

6. Discussion and Final Remarks

The purpose of this research was to analyze the academic contributions published in the Annals ENEGEP from 2008 to 2018, intending to also identify issues and research trends in the area of Economic Management, Cost Management subarea. To do so, they were analyzed quantitatively and qualitatively, 219 articles published in the Proceedings of the Association of Industrial Engineering (ABEPRO).

Bibliometric analysis techniques and research findings were used state the applicability of this strategy to dissect a particular subject of study, in the specific case of "costs" because it was possible to deepen the knowledge addressing on several angles: authorship, both in appearance quantitative, as the relational aspect, researched themes, spatial distribution, institutional linkages, among others. That said, ratifies, macro way, that the use of this search feature contributes significantly to understand the object of study better, analyzing the correlational factors and dissemination of scientific knowledge.

Still, in the field of bibliometric, research has revealed necessary evidence of scientifically accepted studies. Confirmed the Lokta Act or Inverse Square Law, which describes the productivity of the authors, indicating that a small number of researchers produces very particular area of knowledge, while a large volume of researchers produces little. With this result, it was observed that, of all publications ENEGEP, less than 2% are related to management costs, representing a small percentage of research in the area. What can be inferred is that there is a gap in the agendas of scientific research in the context of cost management, revealing potential opportunities for studies on the topics unexplored.

Even with a limited amount of productions on the subject, this study raises in academia, continuing the search for scientific discoveries related to organizational cost systems. Validated the Zipf's Law, which

portrays the regularity in the use of words in a given text highlighting the occurrences of terms used in published works. That said, research has shown the empirical observation Zipf regarding the frequency of occurrence of a word and its frequency rating.

The Price of Elitism Law states that the number of members of an elite corresponds to the square root of the total number of authors and whether this elite or not productive, it must be considered half of total production. In the present study, survey data point to a productive elite. It has also shown that collaborative writing emerges as a strong presence in the construction of new knowledge. For the most part, the publications were held in a collective form of writing. The hyper authorship is a healthy sign because it allows the more experienced researcher to stay productive while approaching and encourages young scientists to produce science.

The study may contribute to the area costs from the time that broadly favors understanding better how are the academic standards of production of articles on the main topics and trends related to cost management area and presented an overview of the publications of the National Production Engineering Meeting (ENEGEP), the last eleven years. However, this study can cooperate not only for academia, as it produces a mapping of content and research aspects in the cost area, but also brings the practical application of the material for the organizational environment and dissemination of knowledge.

It should be noted the importance of the matter for the operational management of the organizations, since the data point to the fact that the keyword "Cost management" being the most frequent. This interrelation, cost management, and operational control are inherent in the production process because the costs are part of the production targets.

As a limiting factor, the research only focused on the ENEGEP publications, however it is worth noting that this is a specialized event in the field of production engineering and among the various topics transiting the meeting, cost management is one that has a significant interaction, this station, for future research, it is suggested further study with qualitative research in order to identify the main issues related to cost management; We can also explore other areas of ENEGEP publications, as are 59 sub-areas, distributed in 11 regions; and it suggests, finally, that are mapped to relational links between the authors, since the study showed that approximately 92% of the publications were written collectively.

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Climate and Energy Policies in Brazil: a dialogue on CCS activities to promote carbon dioxide emissions reduction

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Abstract

Considering the interaction between climate and energy policies, this paper analyzes the activities of Carbon Capture and Storage in the Brazilian context of public choices. The methodology of the work consists of normative and bibliographical revision, using the qualitative and deductive methods. The hypothesis of this research corroborates the thesis that the governance of Carbon Dioxide Capture and Storage activities in Brazil is found in the already existing configuration proposed for public policies directed to climate and energy changes in the country.

Keywords: Climate Change; Energy Policy, Carbon Capture and Storage; GHG Emission Mitigation; Greenhouse Gases

1. Introduction

According to the International Energy Agency (IEA, 2016), power generation is currently one of the main carbon-emitting sources in Brazil, accounting for 43.6% of CO₂ emitted by stationary sources. Carbon Capture, Transport and Storage (CCS), Carbon Capture, Transport and Storage activities are among the alternatives for mitigating greenhouse gases in Oil and Gas production and exploration activities (COSTA et al., 2018). Thus, we propose a reflection on its subsumption to national policies related to climate change and its dialogue with National Energy Policy.

2. The National Energy Policy

As discussed in Costa (2003; 2004), throughout the 1990s, changes were perpetrated by the legislator in the 1988 Federal Constitution regarding the viewpoint of the Constitutional Economic Order.

The original wording of the Constitution, which established a legal system based on the state's intervening presence in the economy through the exclusive monopoly of Petróleo Brasileiro SA (Petrobras), changed to a regime that accommodates the entry of other companies in the oil and gas sector.

State monopolies were relaxed by the Amendment n.5 at the paragraph 2 of article 25 of Federal Constitution, dated 8.15.95, by allowing the operation of the public service of distribution of piped gas to the private sector; Amendment n. 6/95, which modified the art. 176, caput, which allowed the exploration

and mining of mineral resources and the exploitation of the potentials of electric power to be granted or authorized to companies incorporated under Brazilian law, without the requirement of control of national capital; Amendment n. 7, 15.8.95, providing for the opening to foreign capital in cabotage navigation; Amendment n. 8, dated 8.15.95, on the participation of economic agents in telecommunications and sound broadcasting and sound and image services; and finally, Amendment no. 9, dated 11.19.1995, which changed the legal regime of the oil and gas sector in the country and allowed the entry of private companies (COSTA, 2003; 2004).

Due to this context of the constitutional amendment, the so-called Petroleum Law, Law no. 9,478, of August 6, 1997, which deals with the National Energy Policy and activities related to the oil monopoly, as well as establishing the National Council for Energy Policy and the National Agency of Petroleum, Natural Gas and Biofuels.

In its art. 1, Law 9.478 / 1997 presents the Principles and Objectives of the National Energy Policy (PEN), which are emphasized: I - preserve the national interest; II - promote development, expand the labor market and energy resources; III - protect consumer interests regarding price, quality, and supply of products; IV - protect the environment and promote energy conservation; V - guarantee the supply of petroleum products throughout the national territory.

And, pursuant to § 2 of art. 177 of the Federal Constitution; VI - increase, on an economic basis, the use of natural gas; VII - identify the most appropriate solutions for the supply of electricity in the various regions of the country; VIII - use alternative sources of energy, through the economic use of available inputs and applicable technologies; IX - promote free competition; X - attract investments in energy production; XI - increase the country's competitiveness in the international market; XII - increase, in economic, social and environmental bases, the participation of biofuels in the national energy matrix; XIII - guarantee the supply of biofuels throughout the national territory; XIV - encourage the generation of electricity from biomass and biofuel byproducts, due to its clean, renewable nature and complementary to the hydraulic source; XV - promote the country's competitiveness in the international biofuels market; XVI - attract investments in infrastructure for transportation and storage of biofuels; XVII - foster research and development related to renewable energy; XVIII - mitigate emissions of greenhouse gases and pollutants in the energy and transport sectors, including the use of biofuels. In this last item, CCS technology is considered as a possible north.

Given the above principles and objectives of PEN, there is an intrinsic relationship between the perception of the end-use of energy with the needs of preservation and environmental conservation, including options based on diversification towards alternative and renewable sources, rational use of fossil fuels, increasing natural gas, adopting mitigation measures and, above all, based on national interest and promoting development.

Accordingly, the same law establishes the National Energy Policy Council (CNPE), linked to the Presidency of the Republic and chaired by the Minister of Mines and Energy, with the task of proposing to the President of the Republic national policies and specific measures, among the following. These include: promoting the rational use of the country's energy resources; periodically review the energy matrices applied to the various regions of the country; define the strategy and policy for economic and technological development of the oil, natural gas, other fluid hydrocarbons and biofuels industry; and, define the strategy

and the policy of technological development of the electric power sector.

Also, worth mentioning are the ANP's attributions, which in general will try to implement, in its sphere of attributions, the national policy of petroleum, natural gas and biofuels contained in PEN, "with emphasis on guaranteeing the supply of derivatives. of petroleum, natural gas and their derivatives, and biofuels, throughout the national territory".

Through this incursion into the Petroleum Law, founder of PEN's guidelines and institutions, it is observed that a dialogue between climate change policies must be made when specific sectors such as energy are inferred. And in this sense, topic 3 presents data that concretely allows this reflection.

2. The Contribution of CCS Activities to the Energy Sector

The year 2020 marks the beginning of NDC implementation. In the same year, the deadline for the fulfillment of the goals set in the law of the National Policy on Climate Change (PNMC - Law 12.187 / 2009), which determined that the country reduces its emissions from 36.1% to 38.9% in 2006, will expire. a trend scenario (which, according to the Law, would be instituted by the second Brazilian Inventory of Greenhouse Gas Emissions and Removals not Controlled by the Montreal Protocol at that time expected for 2010). However, more recent reports have shown that the current trend of Brazil's greenhouse gas emissions and national climate governance point to the impossibility of meeting the targets, warning that from 2013 there was a reversal of trends, with emissions rising. motivated by increased deforestation in the Amazon and increased use of fossil fuels in the energy matrix (SEEG, 2018).

Therefore, notwithstanding other factors, such as deforestation of the Amazon Rainforest, which has emerged as an increase in Brazilian emissions, it must be considered that the increased use of fossil fuels becomes an element to be observed by Brazilian environmental and energy policies.

A study from the IES-Brazil 2030 Project (LA ROVERE et al., 2015), coordinated by COPPE / UFRJ's Climate Center, within the Brazilian Climate Change Forum (FBMC), with support from the Brazilian government through the Ministry of Environment (MMA), and the International Mitigation Actions, Plans and Scenarios (MAPS) project, showed the feasibility of a significant reduction in Brazil's emissions by 2030 without compromising economic growth and the population's quality of life. Their findings were presented to the MMA and other ministries, and to the FBMC plenary, providing valuable input for the preparation of the Brazilian NDC presented to the Climate Convention (UNFCCC) and ratified by the National Congress (FBMC, 2018).

There are already some initiatives under consideration or planned for Brazil to contain GHG emissions, such as the Sectoral Transport and Urban Mobility Plan for Mitigation and Adaptation to Climate Change (PSTM), the National Plan for Logistics and Transport. (PNLT), the 2026 Ten Year Energy Expansion Plan (PDE), the 2050 National Energy Plan (PNE 2050), RenovaBio and Rota 2030, successor to the Inovar-Auto program, and initiatives for the industrial sector focused on optimization and efficiency of production systems and reduction of energy intensity, and the universalization of waste collection and effluent treatment (FMBC, 2018).

For the energy sector, the assumptions considered were summarized as follows (FBMC, 2018):

Oil and gas projection: extraction of 7.7 million barrels/day in 2060;

Fossil sources in the electricity sector: no share of non-renewable sources in 2060 except self-generation and nuclear;

Nuclear power plants: Angra I reach the end of life over the horizon. In 2060, only the Angra II and III plants remain (2.7 GW);

Renewable in the electricity sector: moderately expanding hydroelectric plants, greater diversification (wind, solar photovoltaic and heliothermal), plus biomass thermoelectric (bagasse and planted forest), compensating for the absence of fossil fuels;

Ethanol production: total production of 44.6 billion liters in 2060;

Although the position of the scenario concerning the exclusion of gas-fired power plants is questionable (see the forecast of no participation from non-renewable sources in 2060, except self-generation and nuclear), it presents the forecast of emission reduction measures in the gas sector. oil and natural gas, but it does not clearly state what measures would be taken by the NDC in this regard.

Emissions from the energy sector between 1970 and 2016 increased almost fourfold, including fuel and electricity production and consumption, and represent the third-largest source of gross GHG emissions in Brazil, with 19% of the 2016 total (423.4 million tons of CO₂e), behind agriculture and land-use change (SEEG, 2018).

Since the National Climate Change Policy (2009) was approved, energy emissions have increased by 23%, especially due to the increase in gasoline and diesel consumption, as well as the increase in thermoelectric generation in Brazil, especially between 2010 and 2014 due to the water crisis. fuel price policy that discouraged ethanol consumption. In contrast, emissions from the energy sector fell by 7.3% between 2015 and 2016, driven by the slowdown in electricity generation, which declined by 23% due to the economic slowdown, increased share of renewables and reduction in industrial consumption (5.3% decrease in emissions) and agriculture (3.2% decrease) (SEEG, 2018).

Although the decrease in consumption is explained by the factors mentioned above, the sector's emissions volume shows a predominance of oil (70% in 2015), followed by natural gas (17%) and coal (6%), with proportional growth. emissions from natural gas production and consumption, which almost six-fold the emissions between 1990 and 2016.

Because of the amount emitted, CO₂ is the gas that has the greatest contribution to global warming. The residence time of the gas in the atmosphere is at least 100 years. This means that today's emissions have long-lasting effects, which can result in impacts on the climate regime over several centuries (ABNT, 2018).

It is important to note the participation of different GHGs in Brazilian emissions in 2005 and 2016 (total% in CO₂e) since much focus is given to carbon dioxide (CO₂) and the tendency to increase emissions from other gases, especially methane (CH₄).

The amount of methane emitted into the atmosphere is much smaller, but its “greenhouse power” (warming potential) is twenty-one times higher than that of CO₂. In the case of nitrous oxide and chlorofluorocarbons, their concentrations in the atmosphere are even lower. However, the “greenhouse power” of these gases is 310 and up to 7,100 times greater than that of CO₂ (ABNT, 2018).

Thus, the data show the relevance of the implementation of mitigation technologies in the energy

sector, which, due to their productive characteristics, provides greater conditions for emissions sequestration.

Gas capture and storage activities, specifically carbon dioxide within the context of International Climate Change Agreements, are relevant in this scenario.

Thus, the capture of anthropogenic carbon emission sources consistent in the process of directing this gas to a certain structure containing it avoids its dispersion in the atmosphere through storage, which is generally geological (COSTA et al., 2018).

This type of CO₂ storage can be done in several geological units in the national territory and depends on the economic, technological and logistic vectors. Due to the expected increase in the production of gaseous hydrocarbons in the Brazilian coastal region, it would be possible to produce, separate and inject gas portions of carbon dioxide and methane (COSTA et al., 2018).

3. CCS Compliance in Brazilian Climate Change Policies

Given the lack of legal provision for such activities, the announcement of the need for CCS's specific regulatory framework in Brazil assumes that it will likely include several existing regulations that will require joint coordination between the various ministries and stakeholders. ALMEIDA et al., 2017).

Law no. 12,187 of 2009, which establishes the National Policy on Climate Change (PNMC), provides for principles, objectives, guidelines, and instruments, understood as mitigation: technological changes and substitutions that reduce resource use and emissions per unit of production, as well as the implementation of measures that reduce greenhouse gas emissions and increase sinks. The concept broadly contemplates CCS (Carbon Capture and Storage) technologies.

Besides, Law no. 12.187 / 2009 understands as “adaptation” initiatives and measures to reduce the vulnerability of natural and human systems to the current and expected effects of climate change. Leaving the legal concept of adaptation appropriate to the Brazilian academic understanding of the issue, such as Di Giulio (2018) “Adaptation to climate change is understood here as real adjustments, or changes in decision environments, which can improve resilience. or reduce vulnerability to observed or expected climate change.”

The same law provides that the National Policy on Climate Change will aim at the implementation of measures to promote adaptation to climate change by the three (3) spheres of the Federation, with the participation and collaboration of the interested and beneficiary economic and social agents, in particularly those particularly vulnerable to its adverse effects (Article 4 (V)) and the encouragement and support for the maintenance and promotion of low greenhouse gas practices, activities, and technologies (Article 4 (XIII)).

It provides as instruments of the National Policy on Climate Change, among other things, a National Plan on Climate Change; the National Fund on Climate Change; the resolutions of the Interministerial Commission on Global Climate Change; fiscal and tax measures designed to encourage the reduction of greenhouse gas emissions and removal, to be established by specific law; credit and financing lines and research lines by funding agencies; specific appropriations in the Union budget and those under the United Nations Framework Convention on Climate Change and the Kyoto Protocol.

Of great importance in the law is the provision that existing or forthcoming measures that stimulate the development of processes and technologies that contribute to the reduction of greenhouse gas emissions and removals, as well as adaptation, may be benefited by the establishment of preference criteria in public tenders and tenders, including public-private partnerships and the authorization, permission, grant, and concession for the exploitation of public services and natural resources, in proposals that provide greater energy, water, and other savings. natural resources and the reduction of greenhouse gas emissions and waste.

Besides, the law proposes, considering the specificities of each sector, the existence of sectoral climate change mitigation and adaptation plans aimed at consolidating a low carbon economy, including through the Clean Development Mechanism (CDM). and Nationally Appropriate Mitigation Actions (NAMAs).

Among the institutional instruments for the performance of the National Climate Change Policy are the Interministerial Committee on Climate Change; the Interministerial Commission on Global Climate Change; the Brazilian Forum on Climate Change; the Brazilian Network of Global Climate Change Research - (Climate Network); and the Meteorology, Climatology and Hydrology Activities Coordination Commission.

The Interministerial Committee on Climate Change (CIM) is permanent and was established by Decree No. 6.263 / 2007 with the role of guiding the elaboration, implementation, monitoring, and evaluation of the National Plan on Climate Change.

According to the decree, the CIM is composed of 16 Ministries and the Civil House, which coordinates the Committee, composed of a representative, holder, and alternate, of each body, indicated below: I - Civil House of the Presidency of the Republic, which coordinate; II - Ministry of Agriculture, Livestock and Supply; III - Ministry of Science, Technology, Innovations, and Communications; IV - Ministry of Defense; V - Ministry of Education; VI - Ministry of Finance; VII - Ministry of National Integration; VIII - Ministry of Health; IX - Ministry of Cities; X - Ministry of Foreign Relations; XI - Ministry of Mines and Energy; XII - Ministry of Agrarian Development; XIII - Ministry of Development, Industry, and Foreign Trade; XIV - Ministry of the Environment; XV - Ministry of Planning, Budget and Management; XVI - Ministry of Transport; and XVII - Center for Strategic Affairs of the Presidency of the Republic. It is important to note that the Brazilian Climate Change Forum will be invited to the CIM meetings.

The Executive Group on Climate Change was set up within the framework of the CIM to elaborate, implement, monitor and evaluate the National Climate Change Plan under the guidance of the CIM. The Executive Group on Climate Change shall be composed of one representative, holder, and alternate, from each of the following bodies and entities: I - Ministry of Environment, who will coordinate it; II - Civil House of the Presidency of the Republic; III - Ministry of Agriculture, Livestock and Supply; IV - Ministry of Science, Technology, Innovations, and Communications; V - Ministry of Foreign Relations; VI - Ministry of Mines and Energy; VII - Ministry of Agrarian Development; VIII - Ministry of Development, Industry and Foreign Trade; and IX - Brazilian Forum on Climate Change. See here the express presence of the Brazilian Climate Change Forum in the composition.

4. Institutional Level for the Climate Change Policies

From dialogue between the PEN and PNMC, it is worth considering that with the MME it is an important representative of CNPE and the ANP itself, since the data show the context of implication of the final use of energy, especially in cities, due to local impacts on the various energy consumption sectors, such as transportation, for example.

Also, one of the highlights of the institutional apparatus in climate governance in Brazil was the reactivation of the Brazilian Climate Change Forum. The Forum, created in 2000 and relevant during the presidencies of Presidents Fernando Henrique Cardoso and Luís Inácio Lula da Silva, linked to the Presidency of the Republic, was demobilized in the Dilma Rousseff government and deactivated after impeachment. 11 thematic chambers in 2007, which met for a year to produce an initial proposal for the implementation of the Brazilian NDC, which was delivered to presidential candidates and is the result of consultations with more than 500 actors from academia, civil society, government and private sector (SEEG, 2018).

At the institutional level, it is important to cite Ordinance no. 150 of 2016, which establishes the National Climate Change Adaptation Plan and other measures, which, with the theme of adaptation, aim to promote the management and reduction of climate risk in the country, “because of the adverse effects associated with climate change, to seize emerging opportunities, avoid loss and damage and build instruments that allow the adaptation of natural, human, productive and infrastructure systems”.

The objectives of the National Climate Change Adaptation Plan are: I - To guide the expansion and dissemination of scientific, technical and traditional knowledge by supporting the production, management, and dissemination of information on the risk associated with climate change, and the development of climate change measures. training of government entities and society in general; II - Promote coordination and cooperation among public agencies to manage the risk associated with climate change, through participatory processes with society, aiming at the continuous improvement of the actions for risk management associated with climate change; and III - Identify and propose measures to promote adaptation and risk reduction associated with climate change (article 2).

The National Climate Change Adaptation Plan shall be implemented by the Union in cooperation with States, the Federal District and Municipalities, civil society organizations and private sector entities.

Ordinance 150/2016 establishes the Permanent Consultative Technical Group on Climate Change Adaptation, to promote articulation between public and private bodies and entities, to promote the implementation, monitoring, evaluation, and review of the National Plan. Adaptation to Climate Change.

Among other things, it is responsible for promoting articulation with federal, state and municipal agencies, with private entities and civil society, aiming at the execution of joint actions, the exchange of experiences and training. The Technical Adaptation Group consists of I- Ministry of the Environment, who will coordinate it; II - Ministry of Science, Technology, Innovations, and Communications; and III - Brazilian Forum on Climate Change. It is an observed absence of a chair with a representative of MME and/or CNPE.

The Brazilian Climate Change Forum will nominate representatives of civil society and the private sector, whose participation should be regulated in the Internal Regulations of the Technical Adaptation

Group. Participating in the meetings, invited by the Technical Adaptation Group, experts and representatives of public or private bodies and entities that carry out activities related to climate change adaptation (art. 6).

5. Conclusion

Some elements favorable to governance in Climate Change Policies in Brazil that effectively incorporate the participation of public and private actors, individual or collective, can be perceived in the prediction of their inclusion in norms and component planning studies for the theme, as seen for example. National Policy on Climate Change, the National Climate Change Adaptation Plan and research contributions to the Brazilian Nationally Determined Contribution (NDC).

It is not yet foreseen how the government will incorporate the recommendations into the development of the NDC implementation and financing strategy (SEEG 2018), or how it will make it possible to integrate the principles and guidelines of the National Climate Change Policy into all federal government policies, federal public policies and major development plans for each sector of the economy - particularly energy and concerning emissions from oil and gas production and exploration. It is recognized that the task of multidisciplinary governance is the multi-institutional approach presents challenges, however, it must be noted that it is necessary to overcome and put in place effective instruments within a comprehensive plan. The importance of transposing the absence of chair in the Technical Adaptation Group representative of MME and/or CNPE is verified.

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Psychological, Situational, Religious and Behavioral Factors Influencing Happiness in Living: A SEM Approach

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Abstract

Can anyone living based on religious orientation in the tempted environment be happy? The world's renounced "Sufficiency Economy" lifestyle bestowed by His Majesty King Bhumibol Adulyadej The Great of Thailand is the important promotive practice. This study investigated direct and indirect effects of traits, situation, religious belief and practice, and behavior based on "sufficiency economy philosophy" on happiness especially hedonic and eudaimonic types. Samples were 323 Booniyom community members, from Santi Asoke, a cult in Buddhist religion. Results from path analysis indicated the model fit that supported the interactionism model with suggestion to add path relationship between group of antecedents. It was found that happiness was directly accounted for 83 percents by the sufficiency economy relating behaviors, as well as, religious belief and practice. Discussion, further analysis, and suggestions were offered.

Keywords: Interactionism, Sufficiency Economy, Buddhism, Booniyom, Thailand.

1. Introduction

Within the past 100 years, most of the world's population have been believing that capitalistic system can improve their well-being and happiness. However, terrified diseases, disasters, and crisis have been continuously unfolding to the world. In Thailand, a tiny group of Buddhist monks named as "Santi Asoke", leading by Samana Bodhirak, had introduced the distinctive concept of simple and austere living, called "Satharana Pokee" in 1970s to counter the mainstream system. They have also accepted and followed His

Majesty King Bhumibol Adulyadej The Great's Sufficiency Economy Philosophy [1] and set and commune-like living system.

This communal consumption system under "Boonniyom system" [2] is self-reliant community, emphasizing on fair economy, e.g., taking less, giving labor, knowledge and skills for free or sacrifice, most of the earnings of the community go into the central fund which is used to exchange for everyday life necessities. Many followers of Boonniyom system have increased in numbers and locations in Thailand. For laypersons, Boonniyom system requires the austere way of living, e.g., vigilantly observe Buddhist precepts on the regular basis, abstain from base vices (e.g. bad peers, laziness, and idleness), work for community enterprises in work stations for free either full-time or part-time, and being vegetarian. Many of the Boonniyom laypersons join morning sermon before start working, listen to preaching before meals, and join the evening sermon and meditation again before going back to their residence which could be in or outside in the Buddhist center, around the Buddhist center.

Living in the strict and simple way of life like in "Boonniyom" communal community, but surrounded by the tempted environments, raises the question of happiness in living of the clan members. Thus, this study investigates the influences of psychological, situational, religious, and behavioral factors in terms of direct and indirect relationships to happiness in living of these members.

2. Literature Review

The conceptual framework of this study was based on the interactionism model [3] which guided the relationships among several types of independent and dependent variables.

2.1 Concept of Happiness

Happiness in individual level has been studied and defined in various ways [4]. Many constructs and traits have been associated with happiness, e.g., pleasant emotions [5], subjective well-being [6] life satisfaction [7]. In this study, happiness was measured in two dimensions, namely, 1) individualistic happiness referred to hedonic happiness and 2) ethical-living happiness referred to eudaimonic happiness.

2.2 Religion Relates to Behavior and Happiness

In many ways, individual has to uphold oneself to some philosophy, principles, or religion. Scholars have been studying the relationships between religion in many aspects, including beliefs (attitude) and practices (behavior), and happiness or subjective well-being, as well as behaviors, but still in controversial results [8]. However, many studies found the direct positive relationship between these constructs [9]. In addition, based on "Sufficiency Economy Philosophy" of The King Rama 9 which was adapted into psycho-behavioral science [10], it was suggested that ethics and morality could indirectly affect subjective well-being via appropriate behaviors. This empirical evidence was found [11].

2.3 Situation Relates to Religion and Behavior

Social situations in this study consist of 3 factors, i.e., amount of involvement of communal consumption system, role model and social support which could associate with religious belief and practice, as well as,

appropriate behavior. In the past, some studies revealed the possible partial mediating role of religious-related constructs (e.g., mercy, and kindness) on the relationships between social situations (e.g., social support, and role model) and appropriate behaviors [12][13].

2.4 Psychological Trait Relates to Religion and Behavior

Based on the psychological theory of moral and work behavior [14], three psychological traits are mental health, locus of control, as well as future orientation and self-control. In more recent studies, there were empirical evidence confirmed by path analysis indicated that these psychological constructs directly related to appropriate behaviors and indirectly related to various important behavior via religious relating constructs [15] [16].

3. Research Methodology

3.1 Samples

Data were collected from 477 Boonniyom members in Bangkok and outer provinces. Only 323 completed data were used for path analysis. The samples consisted of 82 males (25.34%) and 241 females (74.60%) with the age range from 15 to 86 years (\bar{x} = 54.30 years, SD = 12 years). The average years of education was 13 years with median of 16 years (or Bachelor's degree) (SD = 0.50).

3.2 Measures

The five groups of variables. Table 1 indicated item discrimination (t-ratio) which reflected item quality, and test's confirmatory factor analysis reflecting construct validity, as well as, reliability for each measure were presented. Most of the summated rating measures each consisted of 10-15 items. Each item was in the form of a single sentence accompanied by 6-point rating scale ranging from "absolutely true" to "absolutely not true".

Table 1. Item and measurement quality

Measure	No. of items	Range of t-ratio	Reliability (α)	Confirmatory Factor Analysis						
				χ^2	df	p-value ($p > 0.05$)	RMSEA (≤ 0.06)	CFI (≥ 0.95)	TLI (≥ 0.95)	SRMR (≤ 0.08)
1. Individualistic happiness (IN)	15	3.73-6.26	0.77	95.47	78	0.08	0.04	0.96	0.95	0.07
2. Ethical-life satisfaction* (ES)	10	4.53-10.79	0.78	36.35	31	0.23	0.03	0.98	0.97	0.05
3. Moderate-living behavior* (MB)	10	2.19-8.26	0.62	32.20	28	0.26	0.03	0.97	0.96	0.05
4. Wisely-living behavior* (WB)	12	2.60-6.69	0.72	53.38	45	0.18	0.03	0.97	0.95	0.06
5. Safely-living behavior (SB)	11	2.75-7.17	0.68	44.47	40	0.28	0.03	0.98	0.97	0.08
6. Booniyom belief *(BL)	12	2.58-9.99	0.80	60.95	49	0.11	0.04	0.97	0.96	0.06
7. Booniyom practice* (PR)	12	4.93-10.13	0.81	55.92	49	0.23	0.03	0.98	0.97	0.05
8. Mental health (MH)	12	2.89 -10.04	0.88	61.90	47	0.07	0.05	0.97	0.96	0.04
9. Locus of control (IC)	12	4.00-7.50	0.75	53.59	45	0.17	0.04	0.97	0.95	0.06

Measure	No. of items	Range of t-ratio	Reliability (α)	Confirmatory Factory Analysis								
				χ ²	df	p-value	RMSEA	CFI	TLI	SRMR		
						(p>0.05)	(≤0.06)	(≥0.95)	(≥0.95)	(≤0.08)		
10 Future orientation and self-control (FO)	11	2.19-8.20	0.68	36.26	31	0.23	0.03	0.97	0.95	0.08		
11 Good role model* (MO)	12	3.83-7.62	0.69	48.99	40	0.15	0.04	0.97	0.95	0.06		
12 Social support* (SS)	12	4.65-11.26	0.86	51.76	38	0.06	0.05	0.97	0.95	0.05		

Note: * Constructed by the researcher.

The first group of variables was happiness in living. It consisted of two variables, namely, 1) Individualistic happiness (IH) referred to overall satisfaction towards family and society, assessed by happiness measure [17] and 2) Ethical life satisfaction (ES) referred to self-pride and satisfaction from helping others, observing precepts, and self-development.

The second group of variables was sufficiency economy lifestyle based on Sufficiency Economy Philosophy of His Majesty King Bhumibol Adulyadej The Great which UNESCO presented “Human Development Lifetime Achievement Award” in 2006 [18]. It consisted of three variables, namely, 1) Moderate living behavior (MB) referred to economical carefully managing and acquiring the resources from communal center at a minimum level. 2) Wisely living behavior (WB) referred to exploring information and doing everyday life activities based on critical thinking and rationality. and 3) Safely living behavior (SB) involved risk management and readiness for changes and impacts.

The third group of variables was religious belief and practice. It consisted of two variables, namely, 1) Boonniyom belief (BL) based on Buddhist religion belief with the emphasis on special important beliefs, e.g., believing in an austere way of living, and serving common interests. and 2) Boonniyom practice (BP) referred to practicing Dharma, e.g., austerity practicing awareness of the precepts, keeping oneself under restraint, taking less and offering more.

The fourth group of variables was situational factor. It consisted of three variables, namely, 1) Amount of involvement with communal consumption system (Satharana Pokee) (SA) which consisted of three conditions: frequency of giving general services, length of working for common good, and using the central accommodation. 2) Good role model (MO) defined as the report of perceiving significant others practicing the Sufficiency Economy Philosophy and Boonniyom principles. and 3) social support (SS) defined as receiving emotional, informational, and material supports from family members and co-workers for following the Sufficiency Economy Philosophy and Boonniyom principles.

The fifth group of variables was trait characteristics. This psychological group consisted of three variables, namely, 1) Mental health (MH) defined as having appropriate amount of anxiety, and emotional stability. 2) Locus of control (IC), based on Rotter [19] referred to the belief in internal control of reward rather than external control. and 3) Future orientation and self-control (FO), based on Mahoney and Thorenson [20] referred to ability to expect and prefer important future consequences of one's action, and regulating one's behavior to achieve that expected result. Measurement of variables in this group were from Bhanthumnavin, Vanindananda, and others [21].

3.3 Data Collection and Criteria for Path Analysis

Questionnaires were distributed to Booniyom members in Bangkok and outer provinces, e.g., Nakornprathom, Ubonrajthani, Srisakate and Kanchanburi during June to August 2019. Before that in May 2019, questionnaires were tried out on another group of 120 members. Item discrimination, confirmatory factor analysis, and reliability were computed for each measure to reduce items and test of measurement quality (See Table 1).

Path analysis were performed to investigate the direct and indirect influences of the possible antecedent factors on happiness in living. The fitted model should meet at least three out of five of the following criteria, i.e., 1) The chi-square test of model fit (χ^2) should not be significant [22]. 2) The Root Mean Square Error of Approximation (RMSEA) [23] should be less than 0.50. 3) The Comparative Fit Index (CFI) [24] should more than 0.95. 4) The Tucker-Lewis Index (TLI) [25] should be moving toward 1.00. and 5) the Standardized Root Mean Square Residual (SRMR) [26] should be less than 0.50.

4. Results

According to Table 2, correlational matrix of each pair of variables were performed and revealed the range of -0.22 (ns) to 0.604 ($p < .01$).

Table 2. Correlational matrix and basic statistics of variables in the study

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1.IN	75.16	7.62	1												
2.ES	47.71	6.08	.523**	1											
3.MB	42.72	5.86	.368**	.432**	1										
4.WB	52.46	6.53	.428**	.421**	.415**	1									
5.SB	48.27	5.90	.469**	.381**	.462**	.581**	1								
6.BL	61.66	6.95	.189**	.472**	.308**	.263**	.279**	1							
7.PR	55.86	6.40	.491**	.604**	.440**	.494**	.478**	.458**	1						
8.MH	52.92	9.14	.507**	.540**	.462**	.403**	.470**	.343**	.526**	1					
9.IC	54.66	7.18	.331**	.420**	.380**	.471**	.389**	.516**	.442**	.482**	1				
10.FO	48.77	5.82	.366**	.340**	.565**	.460**	.509**	.265**	.471**	.479**	.476**	1			
11.SA	1.50	.50	.223**	.240**	.130*	.062	.041	.196**	.134*	.087	.065	-.022	1		
12.MO	47.96	6.40	.374**	.293**	.239**	.285**	.358**	.215**	.325**	.290**	.334**	.250**	.094	1	
13.SS	54.11	7.65	.487**	.268**	.189**	.341**	.283**	.147**	.366**	.223**	.335**	.267**	.147**	.568**	1

Note: * $p < .05$; ** $p < .01$

Path analysis (as Figure 1.) was performed to investigate the influences of trait, situational, belief and practice, and behavioral factors on life satisfaction. The results revealed the good fit findings of the hypothetical model based on interactionism model ($\chi^2=47.86$, $df = 35$, $p\text{-value} = 0.072$; RMSEA = 0.03; CFI = 0.99; TLI = 0.99; SRMR = 0.06) with one additional path from trait factor to situational factor.

5. Discussion

According to the results presented, there were numerous findings that can be discussed. However, only important and worthwhile findings will be presented. First, most of the path directions from each latent factors supported the interactionism model [3], except the additional path from psychological trait to situation factors. This kind of path direction was also found in many recent Thai studies [27][28][29]. These findings suggested a possible addition of the important relationship between trait and situation. However, it should be pointed out that most of situation variables measured in these studies were self-report of one's perception of the situation which could be influenced by psychological characteristics of the respondents.

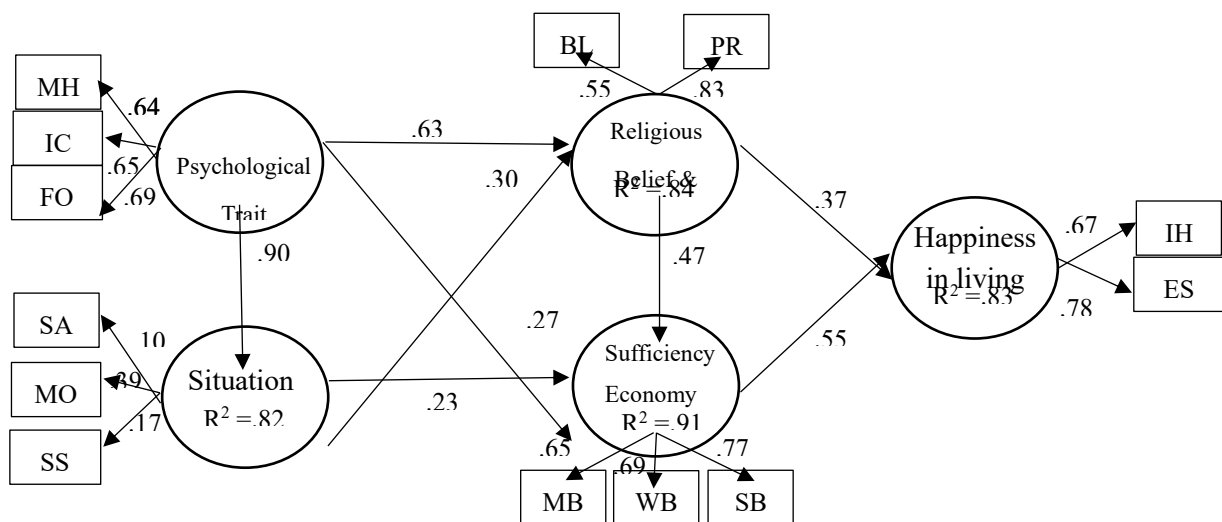


Figure 1. Latent path model of happiness in living

Note: all coefficients are significant.

Second, it could be said that this study was a few studies to empirically revealed that sufficiency economy lifestyle directed affect happiness in terms of hedonic and eudaimonic. It was also found that religious belief and practice were also directly affected happiness, and indirectly affected happiness via behavior.

Third, psychological trait group seems to be the earliest antecedents in this model. The highest factor loading for this latent was FO. According to the correlation matrix, the findings also revealed that FO was positively and significantly related to happiness, behaviors, and religious believe and practice. Studies in the past also point out the positive consequences of future orientation and self-control [30].

Limitation of the study were 1) common source of the important variables. Thus, objective measures of independent variables should be included. 2) correlational study is not sufficient to pinpoint causal relationship. The experimental study should be done to confirm the findings. 3) Samples in this study were only the Booniyom members. Comparisons of members with non-members should be carried out.

6. Conclusions and Recommendations

Based on the findings in this study, it can be concluded that this research model supported and added to the interactionism model. Furthermore, this study also strongly supported the King Rama 9th's Sufficiency Economy Philosophy. It can be concluded that moderate living, taking less, giving more, and practice

religion can lead to happiness. In addition, this study also revealed the antecedents of sufficiency economy lifestyle in terms of religion, situation, and psychological characteristics which could shade light for policy planning and social interventions.

In order to increase happiness in living, sufficiency economy lifestyle should be promoted. One of many important world policies to be followed to make it gradually happens, such as, the United Nation's SDG goals [31]. Furthermore, religion, especially Buddhism, is also a part to facilitate the path to happy society. However, research in this topic should be done to confirm the findings in other types of individuals as well. Psychological trait had stronger influence on behavior rather than religious belief and practice. It is suggested to increase future orientation and self-control to promote the appropriate behaviors which lead to happiness.

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Methodological Procedure for Applying Dmaic Model of Six Sigma Methodology in A Beverage Company: A Case Study

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Abstract

This study aimed to describe the DMAIC model of the Six Sigma methodological procedure and demonstrate the practical application and results obtained in the process of palletizing loads in a Beverage Industry of the Industrial Pole of Manaus. This case study was carried out using a bibliographic survey of the concepts, methods, and procedures of the quality tools, Six Sigma. As a procedure for collecting information, secondary data were used. A Six Sigma application model based on the DMAIC methodology in the palletizing process was presented. The results obtained and the contributions to the improvement of the quality and efficiency of the processes were analyzed. It is concluded that through the application of the methodological procedure of the DMAIC model it was possible to determine and quantify the main defects and wastes, analyze the causes and establish improvement actions in the palletizing process in the Company, resulting in a 40% reduction in handling of the supply operators in the company's shipping area, the elimination of the lack of pallets in the shipping process, the elimination of solid waste disposal in the environment and the reduction of expenses with pallets by 56% in the Company in question.

Keyword: Six Sigma, Reverse Logistics, PIM

1. INTRODUCTION

Transport logistics is a strategic factor for any company in the business world. Due to these considerations, Company Y, a beverage industry in the Manaus Industrial Pole (PIM), constantly seeks to improve its processes, excellence in customer service, and the reduction of costs so that it remains competitive in the market.

Concerning the logistical costs of the city of Manaus, it is worth mentioning that they are higher than the national average due to the distance from the large centers that supply raw materials, as well as consumers of finished products (Silva *et al*, 2103).

In the line of analysis, which talks about creating competitive advantage in the business, there is a high cost in the logistics processes, the focus is on reducing these costs at some point in the logistics process and, this is considered as an objective in a company (BALLOU, 2001).

To improve the competitive advantages of organizations, several strategic models have become popular in the organizational world. The opportunity opens for the adoption of a specific and deterministic methodology *that* is exactly the focus of Six Sigma (Evans & Lindsay, 2015). According to this author,

Six Sigma (6σ) improves processes without losing sight of the strategic dimension of the business. This article seeks to describe the DMAIC model of the Six Sigma methodological procedure, to demonstrate the application of this DMAIC model in the cargo palletizing process through a case study in a Beverage Industry of the Industrial Pole of Manaus (PIM), as well as to demonstrate the results obtained through the practical application of the DMAIC methodological procedure.

This research consisted of obtaining secondary data from an exploratory case study that used as a specific procedure the data collection from the DMAIC model of Six Sigma methodology within the logistics process in a Beverage Industry installed in the Pole Of Manaus.

Then, a collection of data and information about the process of palletizing cargo for transportation was carried out in the studied company. The statistical and quality tools applied to the DMAIC model were analyzed. In this way, the practical results of the application of this procedure were analyzed and, finally, the compilation of this research was carried out with the presentation of the results obtained.

Every job is a process, every process has variability and every process has data that explains its variability, according to Barone and Franco (2012). According to this reasoning, it can be admitted that the transport process and its sub-processes can also be considered as business processes that can enjoy the benefits of using Six Sigma, which was relevant to the increase in operational efficiency achieved through the implementation of this Six Sigma methodological procedure at Company Y, which aimed to increase productivity (increase by 1600 min/day availability of the forklift operator of that process), reduce supply delays (eliminated the occurrence of pallets by 100%) and reduce waste (56% reduction in pallet costs and elimination of wood waste to the environment).

2. PRESENTATION OF THE SIX SIGMA METHODOLOGICAL PROCEDURE

In the context of implementing a Six Sigma project, the study of applicability can be a relevant resource, not only for improving the performance of production processes but also of business processes. For Smętkowska and Mrugalska (2017), they understand that although many of the tools for diagnosis and quality improvement that are also used in DMAIC are already well known in the literature and disseminated in manufacturing environments, there are still many problems about knowledge the applicability of the tools.

The DMAIC Diagram shown in Figure 1 incorporates the following phases: define, measure, analyze, improve and control. For Srinivasana et al (2014), an organization identifies a problem area, measures it, identifies its root cause, implements solutions to address these causes and finally evaluates and controls improvements.

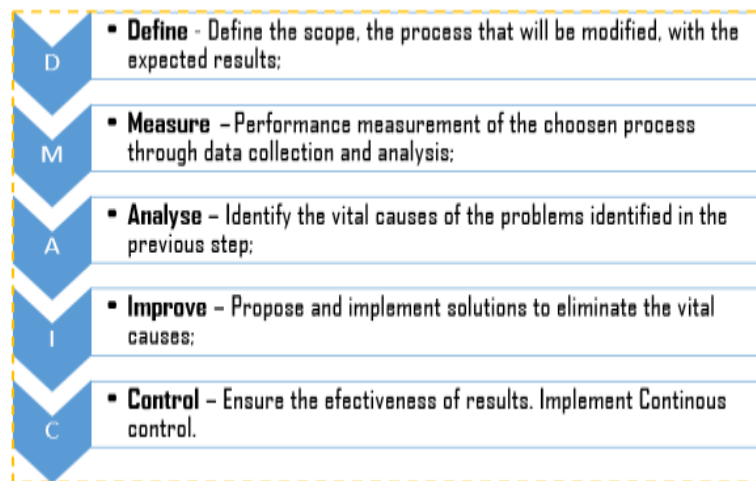


Figure 1- DMAIC diagram model

Source: Adapted from Neubauer *et al* (2019, p.768).

According to Eckes (2001), the DMAIC model is a version of Six Sigma for process improvement that widely uses the traditional statistics of quality control in five well-defined phases. Applying these phases, the present article presents a methodological procedure and its application as a solution to a specific problem in a process that already exists in the Company.

The purpose of this procedure is to facilitate the use of the DMAIC model in a company or any type of business organization. According to Brassard *et al* (2002), the common elements of the Six Sigmas initiatives are:

- Leadership commitment and involvement;
- Improvement activities are aligned with business objectives;
- Defects are defined based on customer needs;
- The focus is on reducing defects and variation;
- The use of disciplined improvement methodologies;
- Disciplined methodology to sustain gains;
- Data-based decision-making;

Following is the methodological process.

2.1 Define Step

According to Eckes (2001), in this phase, the customer, his CTQ (Critical to Quality) and the team's procedures must be defined, in addition to mapping core business processes. That same author affirms that in this phase the objective, the scope and the main, stages of the project must be defined, as well as delimiting the problem.

According to Brassard *et al* (2002), the most common tools used in the define phase are affinity diagram, charter, communication plan, control charts, CTQ tree, data collection, kano model, Pareto graph, trend graph, SIPOC, Revision (tollgate), $Y = f(x)$.

2.2 Measure Step

For Brassard et al (2002), in this stage, the main goal is to measure the current performance of the process and to reduce the problem area. The measure phase starts with a detailed process map. The project team collects data regarding defects, analyzes them and then narrows the problem area. This phase ends with the development of the Final Problem Definition, which includes the target for improvement and the financial impact (Evans & Lindsay, 2015).

2.3 Analyze Step

According to Brassard et al (2002), in this phase, the data and maps of the process must be analyzed to determine the root causes and opportunities for improvement. A tool widely used in this phase according to Unin and Bearing (2015) Brainstorming, also known as "storm of ideas", is a very useful tool for problem solving. It can be used to generate ideas. Then, as stated by Srinivasan et al (2014), the cause-effect diagram, also known as fishbone, or Ishikawa diagram, can be used to identify, explore, and graphically display, in ever greater detail, all the possible causes in a problem or condition, to discover its true root or roots.

2.4 Improve Step

At this stage, according to Brassard et al (2002), improvements must be created, selected and implemented, this author says that at this stage solutions must be implemented that eliminate the root causes of the problems. For Srinivasan et al (2014), one must identify and select solutions, analyze the cost/benefit, observing the risk, develop action plans for total implementation, develop a pilot plan, quantify pilot results, update exit indicators in ways that meet all customer needs to improve operational efficiency.

2.5 Control Step

Brassard *et al* (2002) say that at this stage, the improvement must be institutionalized and continuous monitoring must be implemented, the gains obtained with the implementation of improvements must be controlled, the control methods are standardized, and those responsible for maintaining the improvement of these processes must be established. At this stage, according to Zu *et al* (2008), the goal is to control the process to maintain the gains and the transition to the full implementation of the actions defined in the previous steps.

Below follows, the methodological procedure divided into five phases and presented in figure 2 in a summarized form in boxes to better understand its sequencing and also to facilitate its application in any process or sub-process with an opportunity for improvement in an industry or any other type of activity or business.



Figure 2 - DMAIC in steps

Source: Author (2020)

3. CASE STUDY

This topic presents a case study detailing a methodological procedure for using Six Sigma, that is, how the Company uses the model's tools to solve a specific problem.

The nature of this research is of an applied nature, that is, it aims to generate knowledge for practical application aimed at solving specific problems. It involves a real situation and it is intended to solve problems of interest to the industrial sector.

The case study method is appropriate in this work, as this research seeks to describe and analyze what are the impacts that must be observed in the application of the Six Sigma methodology and its impacts on the operational indicators of the company in question.

3.1 APPLICATION OF THE METHODOLOGICAL PROCEDURE - THE SIX SIGMA METHODOLOGY IN COMPANY Y.

The introduction of Six Sigma came to support the initiatives of the Integrated Management System, which is well consolidated in the company. This system is structured with international standards implemented and certified, such as ISO 9001 (Quality Management), ISO 14001 (Environmental Management), OHSAS 18001 (Occupational Health and Safety Management), ISO 22000 (Food Safety Management), in addition to of accreditation by the National Institute of Metrology, Standardization and Industrial Quality (INMETRO) of the ISO/IEC 17025 standard (Competence Management of Testing and Calibration Laboratories).

The Six Sigma methodology implementation initiative took place through a global project to improve the company's operational excellence. It was a strategy to improve the quality of processes and services and increase customer satisfaction, seeking to meet goals and sustain results, eliminating results that do not add value to daily work, reducing operating times and adding good results to the corporation.

In the implementation of the Six Sigma program, Company Y's indicators were reassessed to identify the company's main operational indicators. All indicators were aligned with the company's macro objectives.

The selected indicators are those that most influence the business of Company Y so as not to spend efforts on programs that do not bring significant results to achieve all corporate goals.

3.1.1 Six Sigma team formation

A multidisciplinary team was created so that all departments had representatives. This choice was based on the ability that each person has to influence, disseminate and apply the Six Sigma concepts in their work centers, as they functioned as multipliers and maintainers of the Six Sigma methodology in Company Y (Chart 1).

Table 1 - Relation Position & function in the Six Sigma group

Position at Company Y	Qt	Team Role	Responsibility
Managers, Directors	12	Leadership Team	Select, allocate resources, review progress and quantify project impacts
Managers	11	Sponsor	Supervise an improvement project, removing obstacles
External Consultant	2	Master Black Belt	Technical leadership in preparing Six Sigma
Supervisors, Coordinators	14	Black belt	Coordinate tasks, train <i>green belts</i> , and guide them in conducting the work
Supervisors, coordinators, analysts	39	Green belt	Assist <i>Black belts</i> in data collection, develop experiments and lead small improvement projects in their area of expertise

Source: Company Y, 2006.

As shown in Chart 1, the relationship between the positions in the company and the functions in the Six Sigma working group can be observed. It can also be seen that Company Y has 79 employees on its staff trained to perform activities related to Six Sigma initiatives. It is worth mentioning that people from strategic areas formed this team.

3.1.2 Choice of projects in the Company

With the team formed, with the associates trained in the tools proposed by the Six Sigma methodology and with the support of top management, analyzes were made regarding the company's processes that presented some opportunity for improvement and that could impact its results. This analysis linked the operational or process management indicators with the company's high-level indicators, which are the indicators with the greatest impact on the company's macro objectives.

A tool used for project selection was the Prioritization Matrix; its model can be seen in table 2.

Table 2 - Prioritization Matrix

Problem Area	Client (s)	Client Voice (A)	Process Voice (B)	Business Voice (C)	Overall Rating (D)
Delayed delivery					
High Waste					
Increased Complaints					
Slow Product Development					
Consider only problems under the team's responsibility and control	Anyone (internal or external) who receives a product or service	Rating based on the direct impact on customer satisfaction	Classification based on the difference between current and necessary performance to satisfy customer requirements	Classification based on alignment or relationship with strategies and policies	Multiplication result $A \times B \times C$ Investigate the best rankings
Classification:	1-Very Light	2 – Light	3 – Moderate	4 – Severe	5 – Extreme
Note: The voice of the business usually includes financial impact (\$)					

Source: Setec, 2006.

At the Company, a problem was observed that was related to the process of palletizing costs in the company, after identifying this opportunity for improvements and thorough analysis of the decision tree, the leadership team decided to start a Six Sigma project using the DMAIC model to improve the palletizing process in the finished products shipping area. The decision tree (Figure 2) is a flowchart for choosing the type of project.

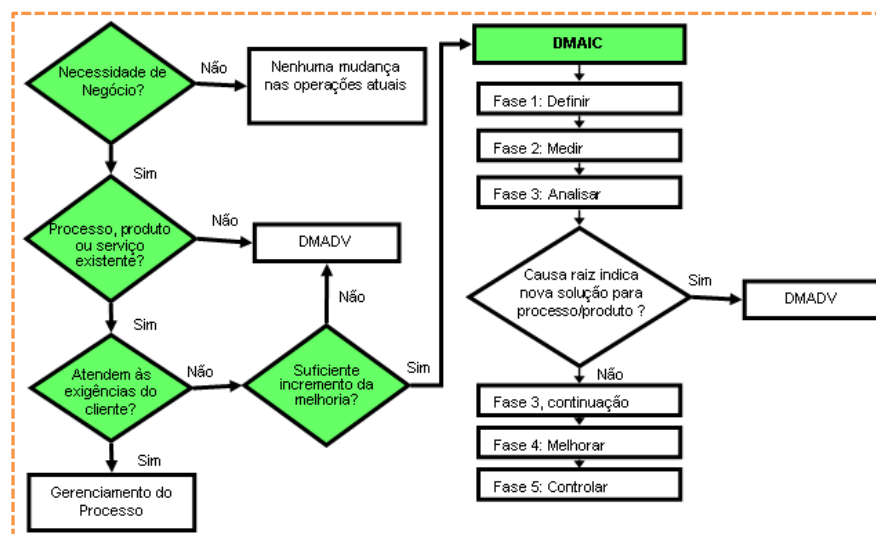


Figure 2 - Decision Tree

Source: Setec, 2006.

3.1.3 Application of the DMAIC Methodological Procedure in the process of palletizing finished products

All finished products produced by Company Y are sent to customers by road. It is the responsibility of Company Y to deliver within the agreed period, without damage, and with the documentation related to the cargo following customer requirements and legal requirements. To carry out these deliveries, the company has three transport companies that are hired to meet these requirements. In this activity, the need to develop a Six Sigma project was identified, which after the application of the decision tree it was determined that the project's characteristic would be for the palletizing process and the model used would be DMAIC. The tools of this model were used according to the stages of the project, as described in the following steps of this work.

3.1.3.1 Define Step

Step 1: Identify the opportunity or Gap

The team started the project and it was found that the number of occurrences in the report “Lack of Material” issued by the company referring to pallets, showed an increase of 585% in the period. This means that many loading processes have been impacted by the lack of pallets.

Step 2: Identify the Client's CTQ

After a survey conducted with forty-two customers, the leadership team defined that the Critical Quality Characteristics (CTQ) are:

- Impact on Pallet Cost;
- Availability of pallets according to need in time and quantity;
- Pallets according to quality specifications

Step 3: Delimit the Project:

After analyzing the impacts on the indicators, the team sought to demonstrate the breakdown of the company's main processes up to the sub-processes to be analyzed. It was observed in the analysis that from the “Distribution” process, one arrives at the “Shipment Configuration” sub-process, which will be analyzed according to the model methodology.

Step 4: Identify an indicator needing improvement

The “Snakes and Ladders” diagram is used to identify the limits of a DMAIC project and the Indicators (creating the problem) that need improvement. Follows Diagram of Snakes and ladders used to identify indicators needing improvement.

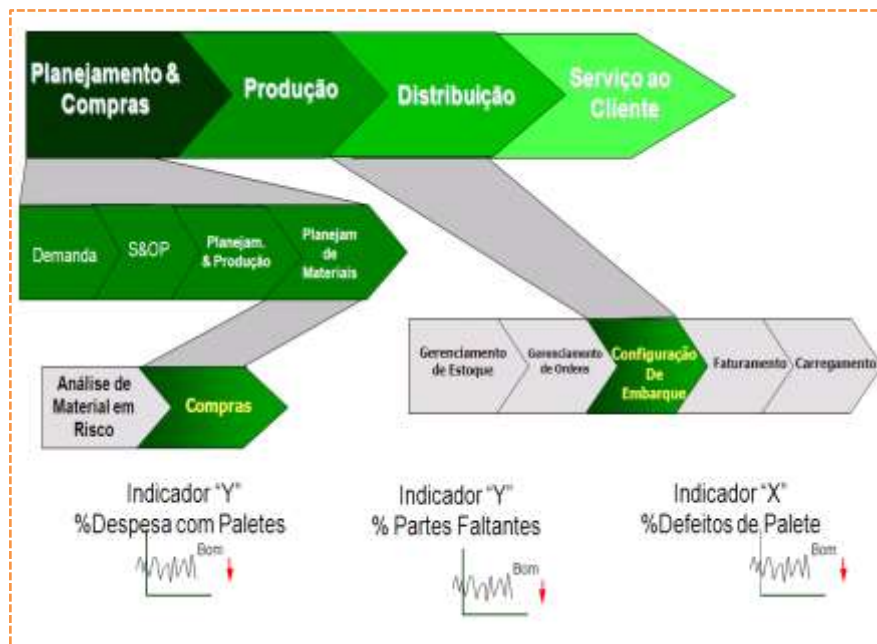


Figure 3 - Snake Diagram – Identification of Indicators

Source: Company Y, 2006.

Figure 3 shows the indicators that need improvement in Company Y, which are the Percentage of expense on pallets, percentage of missing parts and percentage of defects in pallets. All three of these indicators are linked to high-level indicators of Company Y as they are indicators of sub-processes exposed from main processes.

Step 5: Preliminary problem definition

In this stage, the problem to be addressed was preliminarily defined based on the information presented in the previous step. The indicators affected by the problem were identified and an attempt was made to estimate the possible financial benefit of the project. Some data was analyzed before creating the preliminary problem definition, such as total pallet expenditure. The value of the expenses with pallets for two consecutive years was U \$ 605,964.00 and U \$ 693,741.00, respectively. This represented, in the period under analysis, an increase of this expenditure in the order of 14%. Figure 4 shows this information graphically.

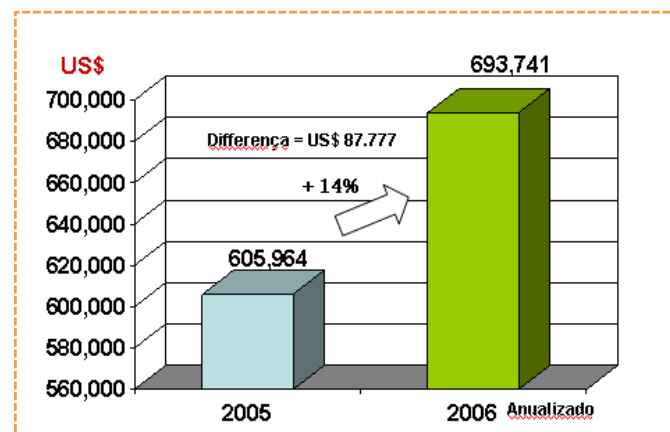


Figure 4 - Expenses with pallets between 2005 and 2006

Source: Company Y, 2006.

After the presentation and studies of the data collected and presented at this stage, the preliminary definition of the problem was established and was presented as follows:

- The number of occurrences in the material shortage report increased by 585% in the period from January to August 2006;
- The number of rejected pallets grew by 419% compared to 2005;
- Total pallet expenses grew 14%, the greatest impact of which is represented by the 1.0m x 1.2m pallets used in the national transportation of finished products.

Step 6: Prepare the Project Planning.

In this step, a documented planning of the DMAIC procedure was made, which consists of a Project Planning Form (Figure 5). A communication plan was made in which the interested parties are communicated, defining what to communicate, when to communicate and how to communicate.



Figure 5 - Project Planning Form

Source: Company Y, 2006.

As shown in Figure 5, the project's schedule and development plan were also created, detailing the scope of the project, the phases, those responsible for each activity, the main quality tools used in each phase, deadline for project completion and business opportunity.

3.1.4 Measure Step

Step 1: Create a detailed process map.

Defects and process data were analyzed using the following tools: control graphs, Pareto graph, and trend graph, to support the Six Sigma methodology it was used the tools Value Flow Mapping (Current State) and Spaghetti Diagram.

Step 2: Collect data on defects and the process.

Data collection is defined according to indicators and measurement points as shown in the indicator table (Table 3).

Table 3 - Summary of the Data Collection Plan

Indicator	Measuring Point	What to Measure
Y1	M1	% Lack of Material Occurrence
Y2	M2	% Expenses with Pallets
Y3	M3	% Fumigated pallet without the need

Source: Company Y, 2006.

According to Chart 3, output indicators were established and subsequently analyzed. After analyzing these indicators, there was an increase in expenditure of 225%. When the same comparative survey was made for data referring to the number of pallets consumed in the same period, an increase of 11% was observed. This information complements the analysis of the Y2 indicator of total expenses with pallets but shows a disparity between an increase in consumption by 11% and that of expenditure, which was of the order of 225%.

Step 3: Analyze the data

The data collected in the period were analyzed at this stage of the procedure using Pareto graphs. The data refer to the consumption of pallets by the customer, or city served in Brazil and other countries served by the company. It can be seen that:

That manufacturers located in Jacarepaguá (RJ), Jundiaí (SP) and Belo Horizonte (MG), represent 33% of the total pallets consumed in the transportation of finished products, and that in export processes, shipments to Colombia and Venezuela represented 94, 2% of all shipments abroad in the analyzed period.

Step 4: Calculate Performance - Process Sigma

Specified by the company's top management that the final definition of the problem would be focused on the cost of pallets, a defect opportunity was established so that the process sigma can be calculated as shown in Table 4.

Table 4 - Calculation of Sigma (I)

Calculating Process Sigma		Pallet Cost
Unit defect opportunities	O =	1
Units processed	N =	57
Total number of defects that occurred	D =	29
Total number of defective units	DU =	29

Defects by opportunity (DBO)	$D / (N \times O) =$	50.8772%
Defects by Defective Unit (DBU)	$(UD / N) =$	50.8772%
Defects per 1 million defect opportunities (DPMO)	$DBO \times 1000000 =$	508771.93
Yield (Flawless Unit)	$(1 - DBU) \times 100 =$	49.12281%
	<u>Sigma =</u>	1.48

Source: Company Y, 2006.

The calculation of the process sigma describes the current capacity of the process. Table 4 shows that the current sigma of the process is 1.48. This calculation took into account 57 weeks from January 2006 to February 2007.

Step 5: Develop the final problem definition.

The last part of this phase was to present a final definition of the problem to be worked on in the next phases of the project, and by the decision of the leadership team of Company Y, the final definition of the problem was focused on pallet costs. Therefore, the final definition of the problem was following the topics below:

- The pallet expenses in 2006 was US\$ 693,741;
- From January to September 2006 consumption of 1.00 x 1.20 pallets represented 83% of shipped pallets and 85% of total pallet spending;
- 65% of the pallets used were used in transport for customers in Brazil. It means a wasted cost of US\$ 288.596;
- Wastage during the boarding process is equivalent to US\$ 88.000, that is, 5.580 pallets (annualized data).

3.1.5 Analyze Step

In this phase, the article sought to analyze the data and maps of the process to determine the root causes and opportunities for improvement.

Step 1: Identify potential root causes.

Brainstorming or even an idea box can be used to generate ideas. This quality tool was used as a method of generating several potential root causes, where it sought to identify through questions, which would be the reasons for the problem of high pallet expenditure.

All ideas were put on a whiteboard and then transcribed to an excel form.

Step 2: Organize potential root causes

In this step, the Cause and Effect Diagram was used to organize the potential root causes identified in the previous step. This diagram was chosen to structure the potential causes so that the root causes could be identified and corrective actions could be taken and thus provide an understanding.

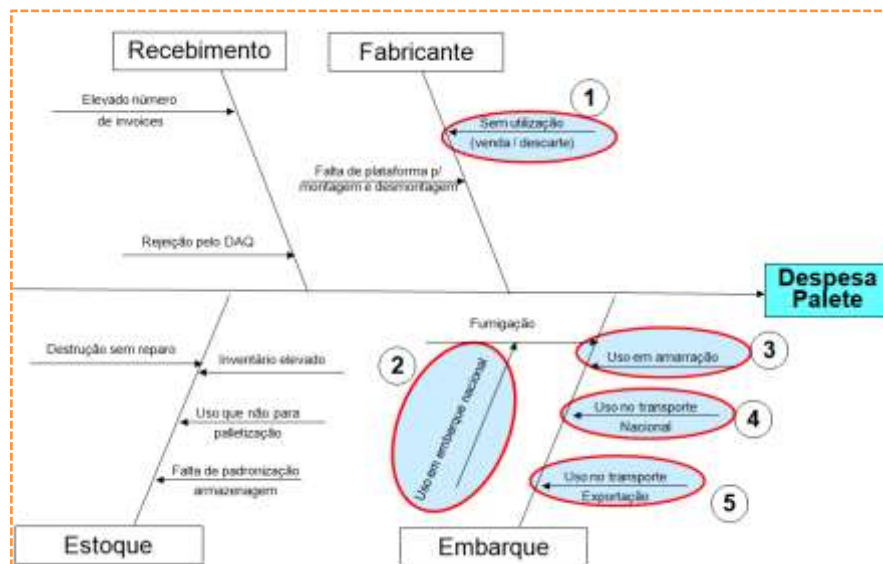


Figure 6 - Cause and Effect Diagram for Pallet Expense

Source: Company Y, 2006.

Analyzing the cause and effect diagram (Figure 6) for the pallet expense problem, five possible root causes for the pallet expense problem were considered. As a criterion for the validation of causes, the work team established a verification method, as follows: causes that had a statistical significance greater than 40% would be considered at this time as the root cause and others that had lower values would not be considered as possible causes. Below is the list of the causes ordered to be validated in the next step, of these only the first 5 were taken to the next step to be valid. They are:

Cause 1 – The manufacturer does not use pallets sent by Company Y;

Cause 2 - Fumigated pallet used for national shipping;

Cause 3 - Use of pallet for securing cargo;

Cause 4 - Pallets used in national cargo transportation;

Cause 5 - Use in Transport for export.

Step 3: Collect data to check root causes

After identifying the five possible causes of the problem, information and data related to these causes should be collected.

The data related to cause 1, use of pallets in customers' inventory and according to the survey carried out with customers based in Brazil, it was found that 64% of these customers use a new pallet to store the finished products sent by Company Y, or due to internal requirements or even physical limitations, that is, 16 manufacturers discard the pallets sent by Company Y.

The data referring to causes 2, 4 and 5, it was found that all pallets (100%) are fumigated, including the pallets used in Brazil, this means an increase in expenses with fumigation of pallets, which is not necessary, since that there is a legal requirement that requires fumigation only for wood sent abroad.

- 83% of the pallets used in the transportation of finished products from Company Y are to serve national customers.
- The use of pallets in exports represents only 17% of the total volume of pallets used in transportation.

For the validation of root cause number 3, referring to the expense with pallets in the cargo lashing process. It is worth mentioning that the use of the pallet for mooring distorts the function of the pallet which is unitization and transport of goods and not for other purposes.

According to the analyzed data of pallet consumption for cargo mooring, average monthly consumption of 465pc was observed, this annualized number represents a total of 5,580 pallets used for mooring and paving loads, that is, 31% of the total pallets consumed in the process. This figure converted into monetary values represents an expense of US\$ 88,000 (eighty-eight thousand dollars) annually. Due to this high financial value, this cause was validated as the root cause.

Step 4: Confirm root causes

At this stage of the analysis step, the root causes identified must be confirmed. Through the data collected in the previous step, four of the five possible causes were validated.

Table 1 shows briefly which causes were validated and which methods were used for these validations.

Table 1 - Root Cause Validation for expenditure with pallet

N° of Potential Cause	Root Cause Description	Method of Verification	Root cause Confirmed (Y/N)
1	The manufacturer does not use (sells/discards)	Historical data Statistical Significance	Yes
2	Fumigated pallet for national shipment	Historical data Statistical Significance	Yes
3	Use in cargo or platform lashing	Historical data Statistical Significance	Yes
4	Use in national transportation	Historical data Statistical Significance	Yes
5	Use in export transportation	Historical data Statistical Significance	No

Source: Company Y, 2006.

As can be seen in Table 1, of the five main causes analyzed, four were validated as the cause of the problem with pallets. For these causes, necessary actions have been taken and will be demonstrated in the next phase.

3.1.6 Improve Step

The solution selection matrix was the tool used to choose the most propitious and feasible actions that would be taken to eliminate the root causes identified in the project's analysis stage.

Step 1: Identify possible solutions to the causes

The quality tool used at this time for problem analysis was *brainstorming*. A form divided into three columns and four lines (referring to the number of participants) was used, each participant puts three ideas, this way the ideas listed below were generated:

- Chep supplier evaluation;
- Acquisition of suitable specification pallet;
- Use of combined pallet (wood and plastic - Coplast);
- Evaluation of recycled wood decks or other materials (ecowood);
- Assessment of pine pallet pallets (cut) outside Manaus;
- Survey of legal requirements;
- Creation and acquisition of the new fumigated pallet;
- New platform development;
- New item creation and usage standardization.

Step 2: Select solutions

The solution selection matrix shows the relationship between the problem definition, the root causes, and the proposed solutions. The prioritization matrix helps to objectively evaluate alternative solutions through the analysis of three factors, the efficiency of each action, the ease of implementation, the costs of this action. The result of the product of these three factors is what will determine whether the action will be implemented or not, the greater the result of this product, the higher the priority for implementing the action.

In this step, the solution selection matrices for the failure modes are presented, according to the pallet expense problem, which is:

1. Manufacturer does not use (sell / discard);
2. Fumigated pallet for national shipment;
3. Use in cargo or platform lashing;
4. Use in National Transportation.

For cause 1, “Manufacturer does not use (sell/discard)”, five solutions were generated, identified through the cause-effect diagram, see Figure 7.



Figure 7 - Solution selection matrix

Source: Company Y, 2006.

As shown in Figure 7, it appears that for the root causes of problem 1, five solutions were established, and after using the solution selection matrix, in which the relationship is made between the cost of implementation, ease, and effectiveness of the action, action plans were validated for two of them, which are “Evaluation of the Pallet Pool” and “acquisition of a pallet of suitable specification”. The other three solutions scored low.

For all other causes, the same methodology was applied, with the generation of a solution selection matrix and in all other matrices, two solutions appeared repeatedly. For this reason, the next step will be presented only with the two solutions highlighted above.

Step 3: Analyze Cost-Benefit Ratio

The cost-benefit analysis was carried out for the two main tasks identified as solutions with the greatest impact on the pallet expense problem, solution 1 and 2. In this phase, Company Y's finance department was involved in the quantification and validation of such actions. The other solutions were identified as being of immediate application, not requiring this type of analysis for their implementation.

The analysis was performed for the solutions as follows:

Solution 1 - New pallet resized for transport only, supplied by a local lumber company;

Solution 2 - Pallet supplied by a national pallet pool.

After this cost survey, it was observed that solution 1 could show a 14% reduction concerning the type of pallet used by the company. However, in this analysis, it was demonstrated that solution 2, that is, pallets supplied by a pool of pallets would provide savings of up to 66% compared to current pallet costs. Therefore, option 2 became the best option for solving the pallet expense problem. Figure 8 illustrates this relationship.

Avaliação: 1. Pallet Redimensionado; 2. Pool de Palletes				
Custo & Benefício				
Tipo Pallet (Fornecedor)	Custo (R\$)			% Redução (R\$ anual)
	Pallet	Médio Mês	Anual	
Pallet Atual (Fornecedor Local)	41	62,954	755,450	
Novo Pallet (Redimensionado)	31	47,585	571,020	- 24 %
Novo Pallet (Pool de Palletes)	21	32,235	256,193	- 66 %

Avaliação Custo baseado consumo 2006

Figure 8 - Cost-Benefit Ratio (Forecast of reduction)

Source: Company Y, 2006.

In Figure 8, the cost ratio based on the consumption of pallets in 2006 is shown only in the national loading processes. It lists the price per pallet, the average expense per month, and the annual value from the value of each pallet. It is worth mentioning that the consumption of pallets at Company Y averaged 1.535 pallets per month.

Step 4: Develop the planning and conduct the pilot project

Solution 2 (Pallet Pool) was identified as the best solution for financial gains. The cost-benefit ratio was favorable for joining the pallet pool (solution 2);

▪ **The pilot of Solution 2 - Pallet Pool Company Assessment.** The time required to comply with this plan was 55 days. The tests were carried out within the stipulated time and the pilot plan was closed. From this moment, deadlines were established for closing contracts between the pool management company, Company Y and the customers involved in the operation. A 30-day deadline was established for closing contracts and implementing a service center in Manaus. With the completion of such steps, the company's top management authorized the start of the operation.

The operational flow of the pool works according to Figure 7, it demonstrates the operational flow of the pallet pool system which starts as follows: The pallet pool manager maintains repair and distribution centers in 14 cities in Brazil. From these distribution centers supplies the companies that hire the rental of pallets (in the case of this study, it refers to the Company Y), these companies, in turn, send their palletized loads to their customers, these customers receive and return the pallets to the pool manager who sends them back to the distribution centers for repairs. Subsequently, the distribution centers make pallets that start moving between companies that are part of this movement and supply system again available to the pool customers.

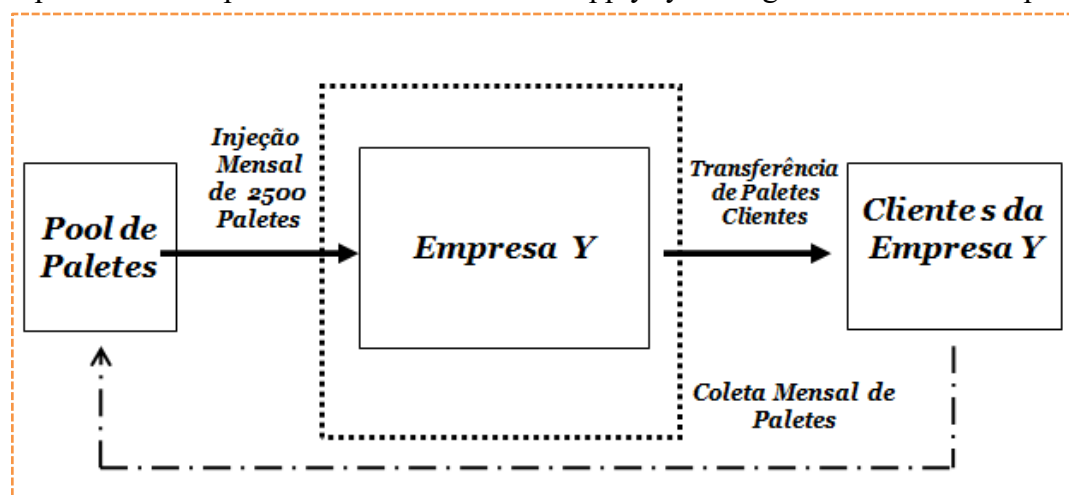


Figure 9 - Operational Flow in the Pallet Pool System

Source: Company Y, 2006.

The benefits of this operation can be:

- 1) Elimination of the lack of pallets, as the pool management company guarantees immediate replenishment of stocks;
- 2) Reduction of expenses with pallets in 66%;
- 3) Elimination of wood waste in the environment. This impact had not been quantified during the execution of the previous phases, however, in this phase, this result was evaluated and will be demonstrated below in the topic referring to the analysis of the results, item environmental impact.

● Choice of Solutions

After completing the pilot tests and evaluating the improvement actions, the Company chose to adopt the Pallet Pool as the main solution to the problems defined in the project's measuring phase, which was to

reduce expenses with pallets and eliminate the lack of pallets in the shipping process. The solutions for creating a new wooden platform and using kanban were also used to reduce the impacts of such problems. It is worth mentioning that, for the full adoption of the use of pallets using a Pool, The Company must sign a lending contract for their use in the process of transporting finished products to customers located in 41 different cities in Brazil. The Company hired to manage this Pool is a multinational company present in 45 countries, has extensive experience and offers guarantees of supply of pallets according to the customer's needs, as it has a distribution and repair center in 14 different cities. This company manages the pallet inventory and collections daily through an automated system that can be accessed via the internet. Its differential is the use of wood from managed forests, which represent a responsible and sustainable source of wood.

3.1.7 Control Step

Step 1: Develop and document the standard practice

Documentation for the new methods was created, with training for the new routines and standard work practices. A work instruction was created by Company Y's quality system to meet and cover new work routines.

These routines were added to the daily process of these people after formal training and started to compose activities according to their job descriptions. This stage is of fundamental importance for the maintenance of the practices implemented by the procedure since all involved will start to carry out their activities according to the established standard.

Step 2: Build the process management control system

According to the procedure, a system to control the process management must be created. The input indicators (X) must control the key subprocesses that impact the output indicator (Y). These, in turn, are directly linked to the company's high-level indicators.

Through continuous measurement, indicators can be controlled and improved. Together, these indicators tell you how well customer requirements are met and predict future performance.

This process management control system has 2 output indicators (Y): "meeting deadlines", and the most important "pallet expense". There is also 1 input indicator (X): Amount of defects recorded.

Step 3: Process Sigma

In this step, the performance and process sigma evolution can be observed. With the full implementation of the improvement that was the use of the pallet pool pallet, the following improvements can be observed: evolution of the yield to 84.61% and a sigma of 2.52. See table 5.

Table 5 - Calculation of Sigma (II)

Calculating Process Sigma		Pallet Cost
Unit defect opportunities	O =	1
Units processed	N =	52
Total number of defects that occurred	D =	8
Total number of defective units	DU =	8
Defects by opportunity (DBO)	$D / (N \times O) =$	15.3846%
Defects by Defective Unit (DBU)	$(UD / N) =$	15.3846%
Defects per 1 million defect opportunities (DPMO)	$DBO \times 1000000$	153846.15
Yield (Flawless Unit)	$(1 - DBU) \times 100$	84.61538%
	<u>Sigma =</u>	2.52

Source: Company Y, 2006.

It is worth remembering that at the stage measuring the process yield was 49% and the sigma in that situation was 1.48. With the numbers presented in Table 5, when compared with the numbers presented in the measure phase, a considerable evolution can be observed in Yield and the process sigma.

Expenses with pallets in 23 weeks showed an average within the expected for the period, which was R\$ 9,200 per month, despite presenting some points above the line, a trend of growth of such expense was not identified.

Another way to monitor the expected financial result was to analyze the value of the savings achieved after the implementation of the Pallet Pool solution, figures shown through Figure 8.

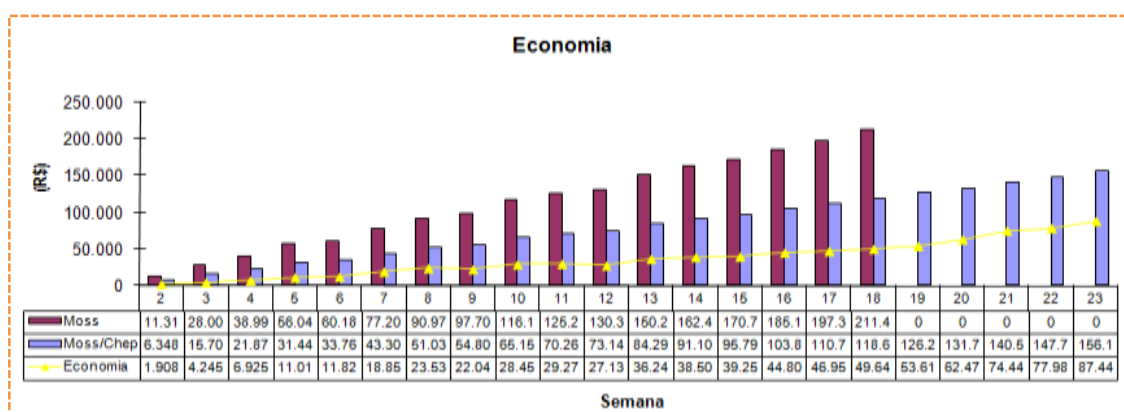


Figure 10 - Evolution of the Project Economy

Source: Company Y

As shown in figure 10, the accumulated savings over 23 weeks was R\$ 87,000. Given this fact, the economic projections were revised and the savings target proposed by the project at the end of a year was R\$ 260,000 and, according to the evolution of the economy shown in the graph above, this goal would be reached at end of 52 weeks.

Step 4: Finish the Project

At this stage, the Six Sigma team officially delivers the results obtained with the implementation of the methodological procedure and passes the responsibility to the area or “owners of the process”, such people will be responsible for the control of the PMCS and the expected results for the area. It is worth mentioning that through the PMCS it is possible to visually control the process, this tool gives focus to the team, and maintains the gains obtained through the improvements implemented.

4. GENERAL CONSIDERATIONS OF RESULTS

The main objective of this work was to demonstrate the use of the six sigma methodological procedure in a beverage company installed in the Industrial Pole of Manaus in the process of cargo palletization through an explanatory work in that company, to test the procedure and present the results obtained through the application of such methodological procedure.

This procedure followed three steps according to the theory studied: Team building, choosing the project and applying the six sigma methodological procedure. The results are described in the items that follow.

4.1 TEAM FORMATION

For the success of the Six Sigma project, the company provided a solid base of specific technical knowledge to a greater number of people in different areas in the company. It was observed that formal training was the basis for the formation of the company's leadership team and for the choice of people with the greatest potential to contribute to the success of the project. The scope and scope of this step resulted in a team of 67 people linked to different departments. This meant the formation of a base in which 42% of employees are qualified to coordinate and execute six sigma projects at Company Y.

4.2 PROJECT CHOICE

The company in question identified opportunities for improvement that could affect the company's results and related them to the high-level indicators that are the company's macro objectives. Following this logic, the opportunity to improve the cargo palletizing process in the transport logistics department was identified as a process of great impact on the company's “Total Manufacturing Cost per unit” objective. Then, using a tool called the decision tree, he established the DMAIC model as the methodology used to improve the palletizing process in the area of finished product shipment of the company under study.

4.3 APPLICATION OF THE DMAIC MODEL

Company Y used DMAIC due to a complex and recurring problem, without a known solution that was identified in the cargo palletizing process, and in the case study of the company under study, the cargo palletizing process presented opportunities for improvement whose solution was not yet known or should be valid according to the proposed methodology. It is concluded through this procedure:

In the define phase (**D**), opportunities were identified within the process, such as financial and environmental opportunities, such as expenses with pallets (R\$ 900,000) and the amount of solid waste

(1200Ton) as opportunities for improvement. In the case study, the tools used were: snake diagram, customer voice or CTQ tree, data collection or historical data graphs.

In the measure phase (**M**), the current performance of the process was measured and the problem area was reduced. In the present case study, six tools were used, as follows: Data collection, spaghetti diagram, value flow mapping, control charts, Pareto charts, project review with the application.

In the analysis phase (**A**), the main objective was to determine the root causes and confirm them with data. In this phase, nine different tools can be used, however, the case study identified the use of only three of them, which were: Brainstorming, Cause and Effect Diagram and Project Review.

In the improvement phase (**I**), the solution with the greatest impact on the problem was selected. The CHEP company presented a better result in the cost-benefit comparison and the implementation of this solution can be validated as follows:

Operating/Financial Results

The operational and financial results planned after the implementation of the solutions presented by the methodological procedure applied in the company can be viewed in summary form in the tables that follow.

Table 6 - Summary of Results (I)

Processes	Before	Projection	Improvement Result
Expenses with pallets (R\$/year)	755.450,00	386.820,00 (Reduction 66%)	423.052,00 (Reduction 56%)
Lack of Pallets	49/month	Zero	Zero (Elimination 100%)

Source: Company Y, 2007.

As shown in Table 6, it can be seen that, with the adoption of the solutions presented by the present work, the reduction of expenses with pallets by 69% was projected, although the reduction occurred, the result achieved was not the same as projected. Even so, this result represented a significant improvement in the indicator “total expenses with pallets”.

In the control phase (**C**), according to Brassard et al (2002), it is necessary to control the gains obtained with the implementation of improvements, standardize the control methods and establish those responsible for maintaining the improvement of these processes. As a result of this phase, standard practice was created for the new process, it was determined that a single person would start to control specific invoices, feed the database for inventory and collection controls, as well as the issuance of monthly reports for process controls. To obtain such results Brassard et al (2002) cites six most used tools, and in the case study four of them were used as follows: control charts, process management charts, trend graph and project review (Tollgate).

5. CONCLUSION

This study aimed to demonstrate a methodological procedure for applying the DMAIC model of the Six Sigma methodology to the cargo palletizing process, aiming at increasing the operational efficiency of transportation at Company Y.

In this way, the methodological procedure was tested through the application of the Six Sigma DMAIC model, explained in the phases to define, measure, analyze, improve and control. In each phase, the most appropriate tools were used according to the existing literature.

Through the application of the methodological procedure of the DMAIC model, it was possible to determine and quantify the main defects and wastes, to analyze the causes of the defects for the establishment of improvement actions in the process of palletizing national cargo in Company Y.

The study provided an opportunity to describe the application of the Six Sigma methodological procedure in a PIM company, enabling a sequential view of the steps to be developed in the planning and implementation of process improvements. With the application of this procedure, waste was eliminated and variations in processes were reduced.

In the define phase, several opportunities were identified, with the high cost of pallets being the central focus of the application of this procedure in that company. Therefore, in the improvement phase, the pallet pool system was implemented, that is, a pallet rental system through a specialized company with the capacity to manage the movement in the entire pallet's logistics chain since shipping from Company Y until the collection of these from its customers.

In the control phase it was possible to observe that the positive results proposed in the improve phase were consistent in the period in which they were measured, that is, it was evidenced in this phase that Company Y obtained a 66% reduction in the palletizing process costs.

This study also demonstrated the reduction of pallet handling time and the reduction of the environmental impact with the elimination of solid waste disposal.

Finally, it is concluded that this methodological procedure can be applied throughout the production chain regardless of the company's business segment, obeying the reality of each company or process.

The results obtained in this study can be seen as a source of consultation by people from both academia and business, as both the concept and the results achieved by its application are of great value for both segments.

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Partnerships for the production of patents through the CT-Petro sector fund

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Abstract

This paper seeks to investigate whether Brazilian public policies to encourage public-private partnerships for patent development through the CT-Petro Sector Fund were effective. This fund was created with the objective of developing the Brazilian petrochemical industry after the breach of the Petrobras monopoly in the late 1990s. Until that time, this state company developed all research in this sector. The structure of this article begins with the bibliographic survey of the agents involved in this production chain and how they organized to maintain the productive level of R&D. Finding out about the transfer of funds through FINEP public notices, researchers and companies were attracted and encouraged to create products and services. Whether competition between companies has resulted in improvements to the development of patents for the industry in question. The aim of this job is to demonstrate the interest of the state in transferring its former predominant role to agents Companies and Universities (and/or Research Centers).

Keywords: *Public-Private Partnerships, Patents, Sector Fund, Public Resources.*

1 Introduction

The Brazilian history of research and exploration of the oil and natural gas production chain occurs practically all at Petrobras, during the forty years of total monopoly in exploration and refining, all resources were released through policies that met the company's demands. Since 1994, other actors have been included in this context, among them the CT-Petro sector fund.

The structure around R&D existing in national territory until the 1990s, within the oil production chain was maintained exclusively with public resources, being justified by the fact that Petrobras has public share capital and holds a monopoly for exploration. With the breaking of the monopoly, an environment was created for companies to develop research in this area. The legal framework with the publication of Law 9.478, of August 6, 1997, which regulates the national energy policy, as well as, on the activities of the oil monopoly, of the creation of the National Energy Policy Council and the National Petroleum Agency - ANP (BRASIL, 1997). It has contributed considerably to expanding the range of partnerships between the agents involved.

These changes created spaces so that not only the State develops research, however, part of these were still in charge of the state itself. After the inclusion of these agents in this productive model, percentages were delimited which should be returned by the exploiting companies to the government so that the resources were directed to companies and research institutions. This link was carried out by means of promotion notices published through agencies, among them the Financier of Studies and Projects - FINEP.

According to Negri & Squeff (2016), there is a very small participation in the use of infrastructures for research and technological development laboratories in the country, around 6%. Thus, it appears that in the country there is no culture of partnership between research institutions and companies, thus maintaining a bottleneck that prevents the true application of Brazilian research within society.

FINEP is an institution focused on the country's scientific, technological and economic development. Acting as a funding agency for C, T & I, a funding agency for innovation and also as a Bank for financing innovation. The present work focuses on the analysis of the resources released by Finep for scientific research and infrastructure through sectorial funds, more precisely, from the CT-Petro sectorial fund. This was the first, created in 1999, being in fact implemented since the 2000s, with a gradual evolution of the release of resources since 2005 (FERNANDES, 2008). In this way, the research will be developed analyzing the data of resources released from 1999 to 2018.

With the breakdown of Petrobras' monopoly in 1995, it can be noted that the opening to private national and international companies in the oil and gas production chain stimulated investments in infrastructure and technologies. As part of the national companies that operated in this area, they did not yet have strong competitiveness with foreign ones, the incentive policy was created through the sectoral fund CT-Petro. Part of what is collected from the exploration returns to society through funding notices, so that new products and technologies are developed that emerge the country in the first levels of the international scenario.

With the implantation of CT-Petro, the National Science and Technology Plan for the Oil and Natural Gas Sector - CTPetro was created. With objectives aimed at the sustainable development of the oil sector,

conservation of the environment, cost reduction, greater participation of the Brazilian scientific community and serving as a basis for diagnosing opportunities for the country in the oil industry (MCT, 1999).

A fundamental aspect of the energy sector is that neither the economy nor its policies are constant: they are subject to technological changes. Technologies that are widely harnessed may disappoint, while entirely new technologies may appear unexpectedly (GUPTA, 2016).

Thus, the Sectorial Funds through the TC, aim to support incisively, companies and society, the production of R&D, seeking to solve technological, social and environmental problems in the country (SANTOS, 2016). Constantly stimulating innovative activities in the Brazilian economic scenario (FURLAN JUNIOR, 2015).

The research is presented by a brief review of the literature in order to solidify the basis for the analysis of the prospected data. Presenting also, the historical context of the laboratory and research structures developed before the monopoly was broken. And after the implantation of CT-Petro, describing the evolution of companies and research institutions that participated in the public notices published by FINEP. Seeking to associate the evolution of partnerships according to changes in Brazilian legislation that aim to encourage greater participation by companies and research institutions for improvements within the aforementioned production chain.

2 Literature Review

2.1 Historical context

The global energy system depends basically on the oil and natural gas production chain, there is an incessant search all over the planet for this type of fuel. Such interest drives the development of new technologies and innovations in the form of exploration in various parts of the globe. In Brazil, it is no different and there are several public and development policies to stimulate the aforementioned production chain. For many years, oil has been coveted by several countries in the world because of its application in the most diverse economic activities, generating, including wars between countries. Creating an extremely fierce geopolitical competition. Being highly valuable assets over which companies and countries maintain constant competition (OVERLAND, 2015; GUPTA, 2016).

In Brazilian territory, the formation of the innovation system in P&G arose through the discoveries and demands of Petrobras. In the 1960s, with the volume of demands of the P&G production chain and the public policies aimed at the economic development of the country, there was creation of the National Innovation System – NIS. The system was created based on the need for innovation networks through triple helix models, observing such models applied in other countries (NEGRI & SQUEFF, 2016). It is worth mentioning that even with the breaking of the monopoly, the state company still owns part of the technology developed for exploration within the territory.

In the 1970s, with the National Development Plan, there were more incentives and public resources to leverage specific sectors of the Brazilian economy. However, it was in the 1980s that what became known as the active learning network emerged. In this network, knowledge was generated through partnerships between Petrobras and research institutions in the country. Such collaborative network worked in research in the exploration of deep waters, creating the sectorial system of innovations, aiming to increase the

technical productive capacity of oil and natural gas (MORAIS & TURCHI, 2016; NEGRI & SQUEFF, 2016).

The research network for P&G was solidified with the collaboration of engineering companies, universities and research centers, from the Procap 1000 and Procap 2000 projects, in the 1990s. Procap 1000 was the first technological training program in information systems. production for deep waters, in its performance period (1986-1991) 109 multidisciplinary projects were developed. Part of all the technologies developed by Petrobras were carried out at the Research Center - CENPE. Procap 2000 was the technological training program in production systems for (ultra) deep waters (MORAIS & TURCHI, 2016).

In the 1990s, with the breaking of the Petrobras monopoly, the creation of the ANP and CT-Petro the cooperation between teaching and research institutions were deepened with the industrial sector. ANP is responsible for managing the amount corresponding to 1% of the gross revenue of companies operating in the exploration of P&G.

“This new orientation was based on the allocation of sources of stable financing, provided by the respective sectors, such as resources from oil royalties, contributions from companies on the result of the exploitation of natural resources belonging to the Union and of billing of companies benefited by the Informatics Law, among other sources of funds. The idea behind this financing model, in addition to allowing the necessary continuity to scientific and technological developments, is to promote interactions between companies and institutions, in order to consolidate sectorial innovation systems” (MORAIS & TURCHI, 2016, p 326).

With the policy of strengthening CT-Petro from the 2000s onwards, the installation of laboratories focused on the oil and natural gas production chain was intensified, aiming to meet the demands not only of Petrobras and other companies operating in the area. After 2006, with the discovery of the pre-salt, a range of opportunities was created for the development of S&T in that area (MORAIS & TURCHI, 2016; NEGRI & SQUEFF, 2016).

It is noted that part of the technological development of this sector occurs considerably in the Southeast region. This is due to the fact that this region has oil production for the year 2013, the percentage of 89% of the country's total production, implying that the greater the production, the greater the demand for new technologies and production processes, as well as part of the money generated from the revenue that goes back to R&D. The Northeast region occupies the second prominent position regarding the infrastructure of the laboratories, thus creating an argument for 40% of the resources released by CT-Petro to be directed to this part of the national territory. (FURTADO & FREITAS, 2009; MORAIS & TURCHI, 2016; NEGRI & SQUEFF, 2016).

2.2 Legislation and agents involved

Brazilian legislation, to direct public policies to encourage the competitiveness and performance of companies and other agents involved in the oil sector, is broad. With the opening of this market, it is clear that for the national industry to be protected, some rules must be clear to anyone interested in exploring this national resource. Oil in different parts of the world has already created conflicts and wars between

countries, as well as, it has an extremely active participation in the stock market within the world economic scenario (OVERLAND, 2015; SARWAR et al, 2019).

Arcuri (2016) states in his studies that part of the countries in the world with good rates of economic and social development, had strong incentives by means of public policies in order to leverage innovation and technology in their respective territories. In the case of Brazil, the National Innovation System - SNI in recent years has implemented policies to promote S&T to improve the SNI. It is essential to implement the triple helix and that all three agents involved perform their role efficiently.

As previously stated, to maintain management and control of what happened in this sector, the legislation needed to make it clear what can and cannot be done by those involved.

In 1997, Law 9,478, which deals with national energy policy, was enacted. In its first article, it deals with the rational use of energy sources, having as main objectives:

- I - preserve the national interest;*
- II - promote development, expand the labor market and value energy resources;*
- III - protect consumer interests in terms of price, quality and offer of products;*
- IV - protect the environment and promote energy conservation;*
- V - guarantee the supply of oil products throughout the national territory, under the terms of [§ 2 of art. 177 of the Federal Constitution](#);*
- VI - increase, on an economic basis, the use of natural gas;*
- VII - identify the most appropriate solutions for the supply of electricity in the various regions of the country;*
- VIII - use alternative sources of energy, through the economic use of available inputs and applicable technologies;*
- IX - promote free competition;*
- X - attracting investments in energy production;*
- XI - increase the country's competitiveness in the international market.*
- XII - to increase, on economic, social and environmental bases, the participation of biofuels in the national energy matrix ...” (BRASIL, 1997).*

Analyzing the last paragraphs of the article, it is evident the concern regarding the promotion of competitiveness, investments, protection of the environment, the labor market and economic use in all forms. After the law was enacted, the State needed to monitor all activities. In this context, the National Petroleum Agency and the National Energy Policy Council appear. Both act as regulators in relations between companies, research institutes and the consumer market.

With regard to the work of the National Energy Policy Council - CNPE, it is worth mentioning that its performance, in addition to meeting the policies aimed at the national energy system, includes monitoring and create guidelines for the exploration of concession blocks or production sharing, creating strategies and policies economic and technological development of the oil industry (BRASIL, 1997).

The National Petroleum Agency - ANP aims to promote the regulation, contracting and inspection of economic activities that are part of the oil, natural gas and biofuels industry. In its article 8, of Law nº 9.478 / 1997 and items it says that the ANP must:

"II - to promote studies aiming at the delimitation of blocks, for the purpose of concession or contracting under the production sharing regime of exploration, development and production activities; (Wording given by Law n° 12.351, of 2010)

...

IV - prepare the public notices and promote the bids for the concession of exploration, development and production, signing the resulting contracts and inspecting their execution;

...

VI - establish criteria for the calculation of pipeline transportation tariffs and arbitrate their values, in the cases and as provided for in this Law;

...

IX - enforce good practices for the conservation and rational use of oil, natural gas, its derivatives and biofuels and for the preservation of the environment; (Wording given by Law No. 11,097, of 2005)

X - stimulate research and the adoption of new technologies in exploration, production, transportation, refining and processing; ..." (BRASIL, 1997).

The ANP as a regulatory agency represents the State in the activities previously performed by Petrobras. With this law it is evident that the breaking of the monopoly opened space for other institutions besides the State to act, however, as oil is a highly requested natural resource it could not leave loopholes in the law which could impact on national sovereignty. Like this:

"Art. 21. All rights to explore and produce oil, natural gas and other fluid hydrocarbons in the national territory, including the land part, the territorial sea, the continental shelf and the exclusive economic zone, belong to the Union, with its administration ANP, except for the powers of other bodies and entities expressly established by law. [\(Wording given by Law n° 12.351, of 2010\)](#)

...

Art. 23. The activities of exploration, development and production of oil and natural gas will be carried out through concession contracts, preceded by bidding, in the form established in this Law, or under the production sharing regime in the pre-salt and strategic areas, according to specific legislation. [\(Wording given by Law No. 12,351, of 2010\)](#)" (BRASIL, 1997).

Historically, the world economy since the discovery of oil has been linked to the oscillations caused by its supply and demand. The country, having a considerable volume of oil, needs to get the most out of its exploration. As at that time, the SNI was not yet fully able to meet all the demands that arose from this chain, it was up to the Government to open space for its exploration but maintaining control, that is, it would be acting only as a mediator, leaving other institutions in charge functions exercised until then. Following the world economic model of the 1990s, of Minimum State (MORAIS & TURCHI, 2016; VEN & FOUQUET, 2019).

With the exploration under new molds, a special fund was created, mentioned in Art. 50-F, of Law n° 9.478 / 1997, which reads that part of the resources will be destined to States, Municipalities and, for areas such as education, infrastructure, health, security, research, science and technology, environment, among many others. Another article makes the ANP's work with companies that are in the exploration activity more specific:

"Art. 72. During the five-year period, counted from the date of publication of this Law, the Union will ensure, through the ANP, to the refineries operating in the country, excluded from the Union monopoly, pursuant to [article 45 of the Transitional Constitutional Provisions](#), operational and economic conditions, based on the criteria in force, applied to the refining activity.

Single paragraph. Within the period provided for in this article, the following will be observed:

I - (VETOED)

II - refineries undertake to submit to ANP an investment plan for technological modernization and expansion of the productivity of their respective refining parks, with a view to increasing production and consequently reducing the subsidies granted to them;

III - the ANP will periodically assess the degree of competitiveness of the refineries, the realization of the respective investment plans and the consequent reduction in subsidies related to each of them" (BRASIL, 1997).

Until then, we have highlighted the importance of legislation, the Government and the ANP. In addition to these, the Financing Agency for Studies and Projects - FINEP is a fundamental part of this oil chain in Brazil. It was created in 1967 by Decree n° 61.056, with the objective of setting up the Brazilian scientific and technological park, acting in the financing of studies and programs necessary for modernization and industrialization. To add to this new scientific structure, in 1969, the National Fund for Scientific and Technological Development - FNDCT "was created with the purpose of providing financial support to priority programs and projects for scientific and technological development, notably for the implementation of the Basic Plan for Scientific Development and Technological - PBDCT" (FINEP, 2019).

After the creation of FINEP, its legal framework underwent changes and repeals of its decrees. Currently, Decree No. 1,808 / 1996 is the one that approves the Statute of the Financier of Studies and Projects. In its first articles it is explained that the public company linked to the Ministry of Science and Technology - MCT exercises the function of Executive Secretary of the FNDCT (BRASIL, 1996).

The purpose of FINEP is to support studies, projects and programs aimed at scientific, technological and economic development in Brazil. Thus, its performance occurs in:

"I - granting legal entities financing in the form of a loan, opening of credits, or even participation in the respective capital, subject to the legal provisions in force; [\(Wording given by Decree No. 2,471, of 1998\)](#)

II - finance studies, projects and programs of interest to the country's economic, social, scientific and technological development, promoted by national companies abroad; [\(Wording given by Decree n° 7,954, of 2013\)](#)

- III - grant a guarantee or surety; ([Wording given by Decree n° 7,954, of 2013](#))
- IV - hire consulting services; ([Wording given by Decree n° 7,954, of 2013](#))
- V - enter into agreements and contracts with national or foreign, public or private, and international entities; ([Wording given by Decree n° 7,954, of 2013](#))
- VI - carry out financial operations authorized by the National Monetary Council; ([Wording given by Decree n° 7,954, of 2013](#))
- VII - raise funds in the country and abroad; ([Wording given by Decree n° 7,954, of 2013](#))
- VIII - granting grants; ([Wording given by Decree n° 7,954, of 2013](#))
- IX - grant to Brazilian legal entities, under public or private law, and to individuals, cash prizes for competitions aimed at recognizing and stimulating innovation activities; and (Included by Decree No. 7,954, 2013)
- X - carry out other financial transactions. (Included by Decree No. 7,954, of 2013)” (BRASIL, 1996).

With the performance of FINEP through the FNDCT, it is expected that the Brazilian scientific and technological park will be able to raise levels, seeking to approach the technologically and economically developed countries (ARCURI, 2016).

According to Turchi & Arcuri (2017), part of investments in S&T in Brazil are public by means of public development policies and, also, by public companies such as Petrobras and Embrapa. With regard to private companies, the investment indicators are very few and the business culture still persists that investment in S&T is cost and not investment.

In this way, the FNDCT's role in structuring the national SNI is evident. Also, according to Turchi & Arcuri (2017), the creation of a national legal framework, followed by the perception of how the SNI of other countries, such as Korea and Taiwan, was implemented, resulted in investments with public resources in the creation of sectorial funds, agencies and policies to promote science. In the case of funds in particular, the creation of these funds from the 1990s onwards did not achieve the desired objectives even with a large volume of projects and expansion of the themes of the public notices.

To better understand this dynamic, it is necessary to understand the performance of the FNDCT and its legal regulations. In 2007, the legal framework of the FNDCT was substantially changed by Law 11,540, which expanded its objective, assigning it the purpose of financing innovation and scientific and technological development with a view to promoting the country's economic and social development. Decree No. 6,938, of August 13, 2009, regulating the FNDCT (BRASIL, 2009; FINEP, 2019).

"Art. 11. For the purposes of this Law, support for programs, projects and activities in Science, Technology and Innovation - C, T & I, comprising basic or applied research, innovation, technology transfer and the development of new technologies for products and processes, goods and services, as well as the training of human resources, scientific and technological exchange and the implementation, maintenance and recovery of research infrastructure for C, T & I" (BRASIL, 2009).

In the article cited above, the main objectives of the FNDCT are evident. The financial resources referring to the revenues of this fund can be: reimbursable - destined to technological development projects of

companies; non-refundable - to finance capital and current expenses; and as a capital contribution - being an alternative to encourage impact projects.

Within the structure of the FNDCT, the structure of the Board of Directors stands out, in addition to being composed of representatives of the Government, there are also representatives of the scientific community, the business sector and workers in the area of S&T (BRASIL, 2009; MELO, 2009).

With Decree nº 6.938 / 2009, article 10 describes the sources of financial resources of the FNDCT, namely:

"I - the appropriations enshrined in the annual budget law and their additional credits;

II - portion on the value of royalties pertaining to the production of oil or natural gas, pursuant to item "d" of item I and item "f" of item II of the caput of art. 49 of Law No. 9,478, of August 6, 1997;

...

VI - percentage of revenue defined in the main paragraph of art. 1 of Law 9,994, of July 24, 2000, aimed at promoting scientific research and technological development activities in the space sector;

...

X - proceeds from the income from its investments in programs and projects, as well as in investment funds referred to in art. 15;

XI - resources from tax incentives;

XII - loans from financial institutions or other entities;

XIII - contributions and donations from public and private entities;

XIV - return on loans granted to FINEP; and

XV - others that may be destined to you" (BRASIL, 2009).

Still within the legal norms that support S&T, Decree 2,851 / 1998 deals with programs to support scientific and technological research in the oil industry. This decree defines how royalties will be distributed, the formation of administrative committees and which regions will have guaranteed percentages,

"... Of the portion of the royalty value that exceeds five percent of production, owed by concessionaires for exploration and production of oil and natural gas, ..., the Ministry of Science and Technology will be responsible for twenty-five percent, for finance programs to support scientific research and technological development in the oil industry, of interest to companies in the sector ..." (BRASIL, 1998).

The route of the financial resource is as follows: the item collected by the National Treasury Secretariat - STN is passed on by the Integrated Financial Administration System - SIAFI to the FNDCT, responsible for managing these amounts, in which it needs to leave at least 40% for the regions North and Northeast in the form of compensation for oil exploration. To meet the legal requirements, FINEP, through the FNDCT, publishes funding notices. In this context, the Sectorial Funds appear. The first of these is the CT-Petro created in that period and, which had its activities started from 2000.

2.3 CT-Petro sector fund and the FNDCT

As previously stated, the National Fund for Scientific and Technological Development - FNDCT is the main mechanism for companies and research institutions to access resources for S&T. Since the 1960s, public policies have been created to facilitate this access. From 1997, in order to strengthen the petrochemical industry, the first sectorial fund, CT-Petro, was created. In the following years, 15 more sectorial funds were created, namely: CT-Agribusiness, CT-Aeronautics, CT-Amazonia, CT-Aquaviário, CT-Biotechnology, CT-Energy, CT-Space, CT-Hydro, CT-Info, CT-Infra, CT-Innovate Auto, CT-Mineral, CT- Health, CT-Transport and CT- Yellow Green (FINEP, 2019, MCTIC, 2019).

The main objective to justify the creation of CT-Petro is that it was necessary to stimulate the performance of several research institutions and companies, this role was previously fully played by PETROBRÁS, being justified because until 1997 there is still a monopoly in the exploration of oil by this company.

The activities considered priority by CT-Petro are: 1- deep waters; 2- new exploratory frontiers; 3- advanced oil recovery; 4- well engineering; 5- ducts; 6- refining; 7- natural gas; 8- petroleum products; 9- new materials; 10- instrumentation, process control and detection methodologies; 11- monitoring and conservation of the environment; 12- conservation and rational use of energy; 13- information and planning (NEGRI & SQUEFF, 2016).

Negri et al (2018) point out that the incentive for the creation of sectorial funds came from the breaking of the oil monopoly in the early 2000s and to prevent Brazil from being held hostage by multinational companies operating in the country.

One of the basic motivations that led to the creation of Sectorial Funds was the need to prevent the process of privatization of large state-owned companies and, the end of the monopoly on oil exploration that occurred at that time, could have a negative impact on scientific and technological development. Brazilian. Significant part of the existing R&D infrastructure as well as some important advances in the development of new technologies and products, which until then, depended directly or indirectly on state-owned companies, such as Petrobras, Telebrás, Eletrobrás and Embraer. Obviously, even implicitly, the creation of Sectorial Funds can also be understood as a recognition that the majority of private companies, with national or foreign capital, still presented a relatively low performance for the development of R&D and innovation activities in the country (FERNANDES, 2008; MIRANDA & ZUCOLOTO, 2015; TIRONI, 2015).

The effective institution of CT-Petro was based on Decree 2,851 / 1998, which dealt with programs to support scientific and technological research applied to the oil industry (BRASIL, 1998; FINEP, 2019). In 1999, the then MCT created the coordination committee and approved the national Science and Technology plan for the Oil and Natural Gas sector - CT-Petro for the period 1999-2003 (FINEP, 2019). With the approval of the plan, the Operational Manual was prepared to guide the actions of this sectorial fund.

The Sector Funds Coordination Committee is provided for in art. 6, of Law No. 11,540, of 2007:

"Art. 6 For the purpose of promoting the integrated operational management of the Sectorial Funds, the Ministry of Science and Technology will establish a coordination committee chaired by its Executive Secretary and integrated by the presidents of the Management Committees of the Sectorial Funds of Science and Technology and of the entities linked or supervised responsible for the execution

and evaluation of the resources allocated to the FNDCT. Single paragraph. The duties and operational procedures of the coordination committee will be established in an ordinance of the Ministry of State for Science and Technology” (BRASIL, 2007).

Regarding the operating manual, it is described that the activities of CT-Petro will be guided by the elaboration of studies directed to P&G under order or induced action. And R&D projects that contain basic research, applied research, experimental development, non-routine engineering, basic industrial technology and technical support services (FINEP, 1999).

It is evident that these actions are coordinated by FINEP, through the FNDCT with the objective of adjusting the country to international S&T trends, seeking to improve the Brazilian peculiarities (MIRANDA & ZUCOLOTO, 2015).

FINEP - Financier of Studies and Projects has three lines of action, namely: Agência de Fomento de C, T & I; Innovation Promotion Agency and Innovation Financing Bank. In other words, it finances various stages of scientific and technological development in the most varied productive areas of the country, with a considerable increase from 2008 on, stimulating partnerships between companies and teaching and research institutions. With regard to CT-Petro, part of the incentives were through economic subsidies, that is, non-refundable in this way, it is understood that if there is no need for reimbursement and these public resources need to return to society in some way (Santos, 2016).

From 2001, after the low adhesion of the companies, FINEP launched public notices and invited companies to participate in these seeking to strengthen the University-Company relationship. Aiming to replace the import of products and processes, to counter the incipient national scenario in S&T. That same year, a public notice was also launched to create a collaboration network in the Northeast region to support R&D. Resulting in the following networks:

- exploratory risk network;
- cooperative research network N / NE of natural gas;
- network for the assessment, prevention and recovery of damage caused in the area of prospecting and transportation of natural gas and oil in the Brazilian Amazon;
- network for the recovery of contaminated areas;
- network for environmental monitoring and areas under the influence of the oil industry;
- mature field engineering network;
- geology and geophysics network of mature fields;
- N / NE's special materials multitasking network;
- computational modeling network;
- instrumentation and control network;
- catalysis network;
- network of fuels and lubricants;
- asphalt research network (QUEIROZ, 2006).

In view of the above, it is worth noting that the FNDCT was created concurrently with FINEP, in the late 1960s. Even so, it went through a period of stagnation in relation to investments to develop its activities. Since it was only with the creation of the Sectorial Funds, which occurred in the last year of the 1990s and

in the first years of the 2000s, that the vitality of the FNDCT was recovered. The period between 2000 and 2008 was marked by an extraordinary expansion of the FNDCT. Between 2009 and 2015, there were five years in which the FNDCT applied amounts close to R \$ 2 billion (in constant values from December 2015) and two exceptional years, 2010 and 2014 with investments close to R \$ 3 billion. In 2015, FNDCT investments decreased to around R \$ 2 billion. The fact that the FNDCT invested only R \$ 383.2 million in the first 9 months of 2016 foreshadowed the possibility of the fund returning to levels similar to those of the 1990s, when its existence and relevance were questioned (NEGRI & SQUEFF, 2016; SENADO, 2016).

In 2016, a committee was created in the Senate to monitor the situation of the FNDCT, as well as that of CT-Petro. The main concern of this commission is to verify the real application of these public resources, because “The oil sector, the main source of FNDCT resources, with its high growth in recent years, stands out as an example, at the same time promising for development of the Country...” (SENADO, 2016, p.94). In the same report from the Federal Senate, the perception of the fragility of the managerial structure of resources aimed at the dissemination of S&T through Sectorial Funds and the FNDCT is evident, even with the entire legal framework, there are loopholes which redirect the resources destined to certain programs and / or greater transparency is lacking in how the financial resources were applied. In other words, there is a question as to whether these resources really contributed to improvements in the production chain for which they were created (QUEIROZ, 2006).

“It is always necessary to keep in mind that the funds' shares are investments and, as such, are only justified by obtaining gains in excess of their costs. It is evident that, especially as it is public policy, the analysis of earnings should not be restricted to direct financial returns only, but to a wider range of direct and indirect benefits that the action can provide, such as the qualification of professionals, job creation and tax collection. Even so, priorities must be defined based on technical and objective criteria and considering that the volume of resources to be invested will always be limited, which implies, in the need to select a finite number of actions, leaving others aside” (SENADO, 2016, p. 143).

It is noted that the predominance of the government in the management committees of the sectorial funds may represent the little participation of the private initiative, it is noticed that the Brazilian academy has many studies for technological and economic development, however, there is no monitoring of what is really coming the society. When the funds were created, they aimed precisely at stimulating research outside the governmental scope, public resources were injected to make this happen. It is necessary to seek to understand the reason for the little private participation, inferring how interesting it would be to manage committees in a participatory way (FABRIS, 2016; SENADO, 2016; NEGRI et al, 2018).

With the new legal framework and the definition of goals for Brazilian science, it is noted that the Government tried in various ways to encourage entrepreneurs to participate in this sector. Reinforcing the performance of the triple helix, in which the Government agent acts as an intermediary between the Company and the University. The publication of the green book, provided an environment for entrepreneurs to define their demands and, at the same time, finance research around them (FABRIS, 2016; NEGRI et al, 2018; QUEIROZ, 2006).

Regarding the importation of public policies to stimulate S&T, it is worth noting that companies will only be interested in developing technologies that immediately meet their demands, however, society is not maintained only with what the market determines. There are several types of demands from the population, which often do not arouse the interest of business organizations in meeting, so it is necessary for the State to act to encourage means to meet such demands and / or supply many of these. In Brazil, there is a strong role of the State in stimulating and releasing financial resources for the development of S&T and, in an economic environment with little liquidity, there is a strong need to establish public-private partnerships, something still new, in the Brazilian financing patterns (NEGRI et al, 2018, FABRIS, 2016; QUEIROZ, 2006).

Another public entity important to the development of R&D in this area is the ANP, because of the legislation it is responsible for monitoring the transfer of financial resources to the Government, as a form of compensation for the exploration of P&G and passing on the entities involved so that they can reach research institutions (ANP, 2015).

“The following institutions are eligible for this fund: i) universities, public or private, non-profit; ii) research centers, public or private, non-profit; and iii) public and private companies in partnership, as partners of the ICTs, in the form of an agreement, for the development of new technology-based products, processes and services” (MORAIS & TURCHI, 2016, p 326).

In the work of Morais & Turchi (2016) they carried out a mapping of the structures around the P&G production chain, from the level of education of the workers, to the structures of the laboratories, developed research, recipes and impact on the economy of the regions involved.

Regarding the infrastructure of the laboratories, after the implantation of the CT-Petro it is noted that these were structured and, in some regions, even created. Since more than half of all the laboratories opened took place between the years 2010 and 2012 (NEGRI & SQUEFF, 2016). This structuring of the laboratories took place through non-reimbursable financing.

The structure of non-reimbursable financing has the character of an economic subsidy and has been applied directly to the promotion and increase of innovation and economic competitiveness activities. It is well known that economically and socially developed countries stimulate innovation, technology and its transfer, as a way of validating innovation and technology created within the modalities of Intellectual Property - PI. It is understood that everything that is created through IP needs to reach society in some way, in the country there are still few studies and / or surveys on this feat (FABRIS, 2016; NEGRI & SQUEFF, 2016).

As of 2008, the Institute for Applied Economic Research - IPEA in partnership with MCTI and CNPq began a study to discover what had been produced by the Sectorial Funds in Brazil. Such funds are one of the biggest incentives for the development of research and technology development, however, until the publication of the first survey report on the subject, little data was available on what had actually been accomplished. It is known that throughout the national territory there are priority areas for the country to develop, public resources have been released for this and, however, it is not really known what has been accomplished (FERNANDES, 2008; SENADO, 2016).

“Studies on the subject have emphasized not only the issue of diversity and complementarity required in the current stage of scientific development, but also the importance of the collective learning process in the generation of new knowledge and its technological applications” (MORAIS & TURCHI, 2016, p. 317).

Brazilian laboratories find partnerships with development agencies and Brazilian companies of utmost importance, to the detriment of partnerships with foreign institutions. Confirming that such cooperation is given to the financing of projects, that is, Brazilian research institutions and laboratories are largely unable to support themselves with their own revenues. Unlike other countries, such as the United States (FABRIS, 2016).

As of 2005, despite budget limitations, advances in the development of S&T could be seen, since there has been a considerable increase in doctors in the country, exchange of students, publication of articles in indexed international journals and prominent papers for Brazilian science. However, as of 2014, associated with all political and economic instability in Brazil, the resources allocated to S&T have been decreasing considerably. It is possible to notice the departure of several researchers from the country, the resources destined to the sectorial funds were directed to other areas, further distancing the possibilities of private initiative companies to enter into partnerships with academia and public entities in developing R&D (SENADO, 2016; QUEIROZ, 2006). This Brazilian scenario is the opposite of what occurs in other parts of the world, it is noted that “The success of the leading countries in the international technology market is directly related to the long-term policies sustained for decades ...” (ARCURI, 2016, p. 584).

It is observed that public policies, despite having legislation to support them, are still vulnerable. When there is a reduction in the collection of public revenues, there is a tendency to withdraw financial resources from funds like these. Directly impacting medium and / or long-term research projects. Queiroz (2006) finds that part of the public resources that should be invested in the fund through the FNDCT are being used as reserves for payment of public debt and investment, resulting from the lack of revenue to be invested in the public budget. This situation is recurrent and, in the case of CT-Petro, the amounts referring to the first years were used for other purposes and can no longer be repaid. In this way, the Government agent for being the key player in the triple helix between Companies and Universities, giving legal and financial support, is allowing these inconsistencies that ends up distancing the participation of companies in establishing public-private partnerships (SENADO, 2016).

Even with this scenario, there are possibilities and progress in relation to the use of the infrastructure implanted in the laboratories with public resources, mainly with those of the FNDCT. Negri & Squeff (2016) carried out a mapping of these structures assembled after the CT-Petro, this work was through the application of a Web Survey questionnaire sent to researchers in order to discover the situation of the laboratories and their respective activities developed.

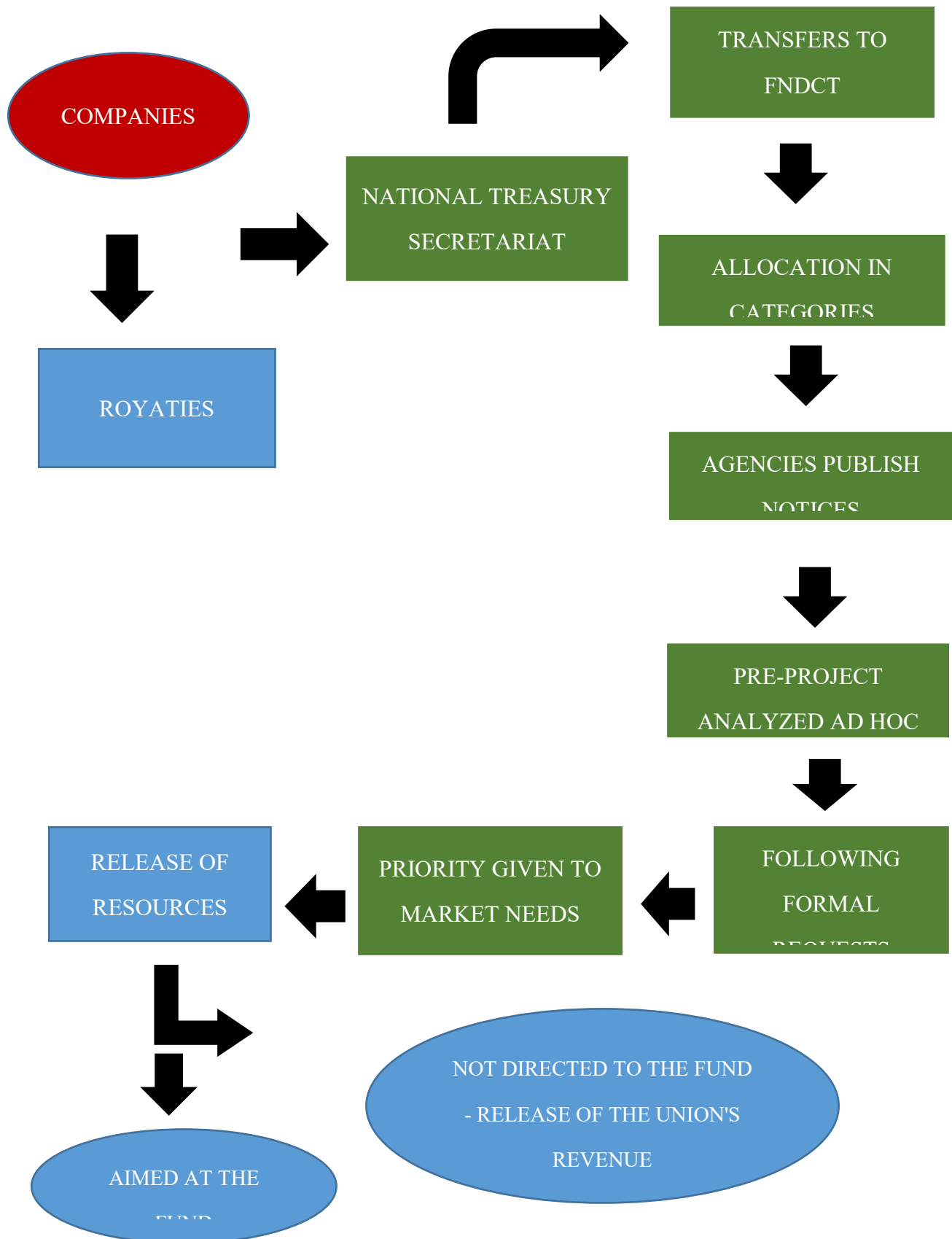
“Although there are a large number of research laboratories that claim to perform service provision activities, this is a sporadic activity among them ...” “... Clearly, and as expected, the laboratories analyzed are mainly focused on research and teaching. The exposed results indicate that the activities of providing technological services, technological extension and the development of new technologies occur

at a much lower intensity in the scope of these infrastructures than the teaching and research activities: 35% of the respondents affirm to carry out technology development on a continuous basis and 18% indicate the provision of technological services at the same intensity ...” (NEGRI & SQUEFF, p. 37, 2016).

Within the structure set up to meet the demands of CT-Petro, the main laboratories operating in the country stand out in developing activities for the manufacture of products, extraction of oil and natural gas, support activities for the extraction of oil and derivatives (NEGRI & SQUEFF, 2016; MORAIS & TURCHI, 2016). From this structure, it appears that the activities developed in laboratories were not purely basic research (even though it is quite important for science), but applied research. And being applied research at some point, it needs to be protected through the modalities of intellectual property and its transfer, through technology transfer contracts (FABRIS, 2016). However, in CT-Petro legislation it is not evident that a product needs to be generated and it needs to be protected by Brazilian industrial property law. The executive secretariat (FINEP) is responsible for monitoring it. In the Senate committee (2016), members highlight this concern when they question whether the approved projects contributed to the generation of jobs, to obtain patents, among others.

This same committee suggests that objective goals be created to better measure the approved projects aiming at mastering technologies, developing better products and obtaining patents.

Figure 1. Flowchart of the outflow of resources from oil exploration companies for R&D



Source: Prepared by the authors, 2019.

The flowchart in Figure 1 shows the current structure of the sector funds. If the last two diagrams are observed, this process is closed, thus missing the follow-up after the resources are directed to the fund. According to the legislation, this is the path to be followed; however, after approval of the project and destination of the resource, there is no information in the Brazilian legal norms about what was actually created with these resources. It appears that if there were a better monitoring of this structure, it would have a positive impact on the participation of companies in improving partnerships. Among the obstacles to the development of R&D in Brazilian science, the fragility regarding the resources allocated stands out. It is noted that even having legislation to stimulate and give legal security, there are still oscillations regarding the destination of finances according to political changes. The tendency is that each new government management increases such fragility (NEGRI & SQUEFF, 2016).

A common feature in technologically developed countries is "... the granting of tax incentives, subsidies and the opening of lines of credit for companies that invest in research; regulation of the market through laws that protect intellectual property and encourage innovation; a government procurement policy that favors national industry; among others" (QUEIROZ, 2006, p. 31).

In the national territory, there is a well-structured legislation, however, there are still flaws with regard to tax incentives and intellectual property. Few entrepreneurs know what IP is and what it is for, even in the academy there are still people who do not know it. It is noted that the image of IP in the country needs to be improved. Disclosure policies are needed on the importance of protecting everything that results from human capital. In the next topic, it will be described about patents and research institutions in Brazil.

2.4 Patents and research institutions

Public policies to encourage S&T, in general, are characterized by:

"... strong articulation between commercial and technological policies, progressive decentralization / regionalization, significant government participation in R&D spending, adoption of policies to encourage technological cooperation between companies, combination of horizontal and vertical / sectorial measures, and concern with technological diffusion" (QUEIROZ, 2006, p.30).

These characteristics are observed in countries with development and technological advances in the most diverse areas. Countries that are not concerned with protecting their creations through intellectual property cannot sustain the stimulus to innovation and technology, and it can be said that countries that did not act in this protection, unfortunately, were not successful in competing in the market, as well as improving technological performance indicators of the country (QUERIOZ, 2006; FABRIS, 2016).

As described throughout the article, it appears that part of Brazilian businessmen and society is unaware of what will become Intellectual Property. According to the World Intellectual Property Organization - WIPO, PI can be defined as:

"To literary, artistic and scientific works; the interpretations of the performers and the performances of the performing artists, the phonograms and broadcasting broadcasts; inventions in all fields of human activity; scientific discoveries; industrial designs and models; industrial, commercial and service brands, as well as commercial firms and trade names; protection against unfair competition and

“all other rights inherent in intellectual activity in the industrial, scientific, literary and artistic fields.” (Convention Establishing the World Intellectual Property Organization, signed in Stockholm on 14 July 1967; Article 2, § viii)

IP is restricted to the temporal dimension - it ensures the right to financial gains for a certain period of time, then falls into the public domain; the scope of law - each PI object has a protection boundary; legal certainty - if someone financially exploits his creation without due right; and territoriality - with regard to industrial property, protection occurs in a given territory of a country, with the exception that protection may be via PCT - Patent Cooperation Treaty (INPI, 2019; OMPI, 2016).

In some cases, breeders choose to deposit via PCT instead of going directly to the National Institute of Industrial Property - INPI. This is justified by the period of analysis here in the country being longer than abroad, presenting yet another barrier to national S&T.

When the deposit occurs via PCT, the objective is to facilitate the protection of the invention in several countries and the economy with costs (NOGUEIRA, 2013). Even with the condition that each country has specific legislation regarding IP, it is noted that there is mutual respect between the countries that are part of the PCT and CUP Agreements in order to avoid diplomatic conflicts (INPI, 2019).

Returning to the definition of Intellectual Property, there are three classifications, among its relative rights: Copyright and Related Rights, Sui generis Law and Industrial Property that covers patents, industrial design, trademarks, geographical indication and repression of unfair competition (OMPI, 2016).

With respect to Brazilian legislation regarding Industrial Property, Law No. 9,279 / 1996 describes and regulates rights and obligations related to IP:

"Art. 2º The protection of industrial property rights, considering its social interest and the technological and economic development of the country, is effected through:

I - granting of invention and utility model patents;

II - concession of registration of industrial design;

III - grant of trademark registration;

IV - repression of false geographical indications; and

V - repression of unfair competition" (BRASIL, 1996).

Since any invention that has novelty, inventive step and has an industrial application can be patentable (BRASIL, 1996). A creator or entrepreneur must patent in order to guarantee exclusive commercial exploitation rights, establish a strong position in the market, increase the return on invested capital, the creation reward providing an environment for new creations, positive image of the company for demonstrating technical level and technological capacity as well as providing knowledge to society, avoiding duplication in R&D and, finally, facilitating technological monitoring and research activities of its competitors (OMPI, 2016).

When the inventor and/or entrepreneur are going to make a patent filing with the INPI and / or another international patent office, they need to carry out the so-called search for precedence. In this search, it is verified whether what is being claimed is actually due. That is, if there is no misuse of intellectual property (CLARKE, 2018).

The INPI makes available on its website all the information regarding the procedures for the deposit, after the completion of all stages, an 18-month confidentiality period is granted. After this period, the analysis of the application process begins counting. In Brazil, the average for the granting of an invention patent is around 10 years, the opposite of what occurs in countries such as the USA, Japan, Taiwan, and so many others (SENADO, 2016; INPI, 2019).

In addition to having a technology park formed in recent years (NEGRI & SQUEFF, 2016), we still face few professionals specialized in IP in the country, mainly working at INPI.

Clarke (2018) points out that the volume of patents deposited at patent offices has been growing considerably:

“The existing volume of patent documents is huge. Publicly available free patent databases, for example Espacenet, PatentScope and DepatisNet [6] give access to tens of millions of patent documents. The cumulative volume of patent documents is growing rapidly too; 2.9 million patent applications are reported as having been filed in 2015 worldwide [7]” (CLARKE, 2018, p. 1).

It is observed that even with all the advances through public policies such as CT-Petro, the Brazilian scenario is not favorable to compete in the international scenario. Schiavi & Hoffmann (2015) point out that part of the companies operating in the oil production chain that filed patents in Brazil were foreign companies.

De-Carli et al (2017) state that patent production can generate economic returns through commercial technologies, systematizing knowledge through science that can be applied in practice, expanding the interaction between those involved in the national innovation system (government, company and university). It is necessary to encourage Brazilian companies to come to take the lead in the process of generating patents (SENADO, 2016).

In other countries, there is a movement towards bringing universities and research institutes closer to companies and / or business corporations. In Germany, for example, researchers, in addition to producing science, aim to work on the state of technology, the promotion of entrepreneurship and commercialization through patents (BLIND et al, 2018).

“It is an option to commercialize one’s own research results directly by referencing one’s own patents in standards and indirectly by using standardization as an opportunity to establish collaborations with companies as a starting point for raising funds for common research projects or contract research” (BLIND et al, 2018, p.1).

In this way, this work tries to present what was actually developed through partnerships and public policies through CT-Petro. Mainly, if the objective of leveraging the oil production chain was met satisfactorily. Verifying if with the implantation of the Brazilian technological park there was the diffusion of intellectual property through the filing of patent applications, as well as, if these were through public-private partnerships. Or only, research institutions and universities have developed products and processes that have been patented.

3 Methodology

The methodology applied in the work was predominantly qualitative, carried out through articles specific to the area, institutional reports and what the academy has made available on the subject in recent years. Regarding the analysis of patents created with FNDCT resources, patents developed through the CT-Petro notices were requested to FINEP, by the Access to Information Law. Initially, it is reported that there is no list of patents generated by the participating companies. Thus, the CNPJ of the winners of public notices and / or public calls was requested. With the fulfillment of this request, the spreadsheet provided by FINEP was organized, per year of the demand. Afterward the spreadsheet data were separated by the large South / Southeast and North / Northeast and Midwest regions. Regions separated in this way, within the CT-Petro itself, to meet the demand of 40% of resources obligatorily destined to the North / Northeast.

With the basic data provided by FINEP, the evolution of the participation of agents in the agreements and partnerships signed was analyzed and it was verified whether the main objective for the existence of the CT-Petro Sectorial Fund to strengthen the relations between University-Government-Company had occurred. In the data analysis, it is attested that part of the institutions participating in the FINEP notices are public and / or focused on teaching and research. Inferring a pattern of participating projects developed for pure research, to the detriment of applied research.

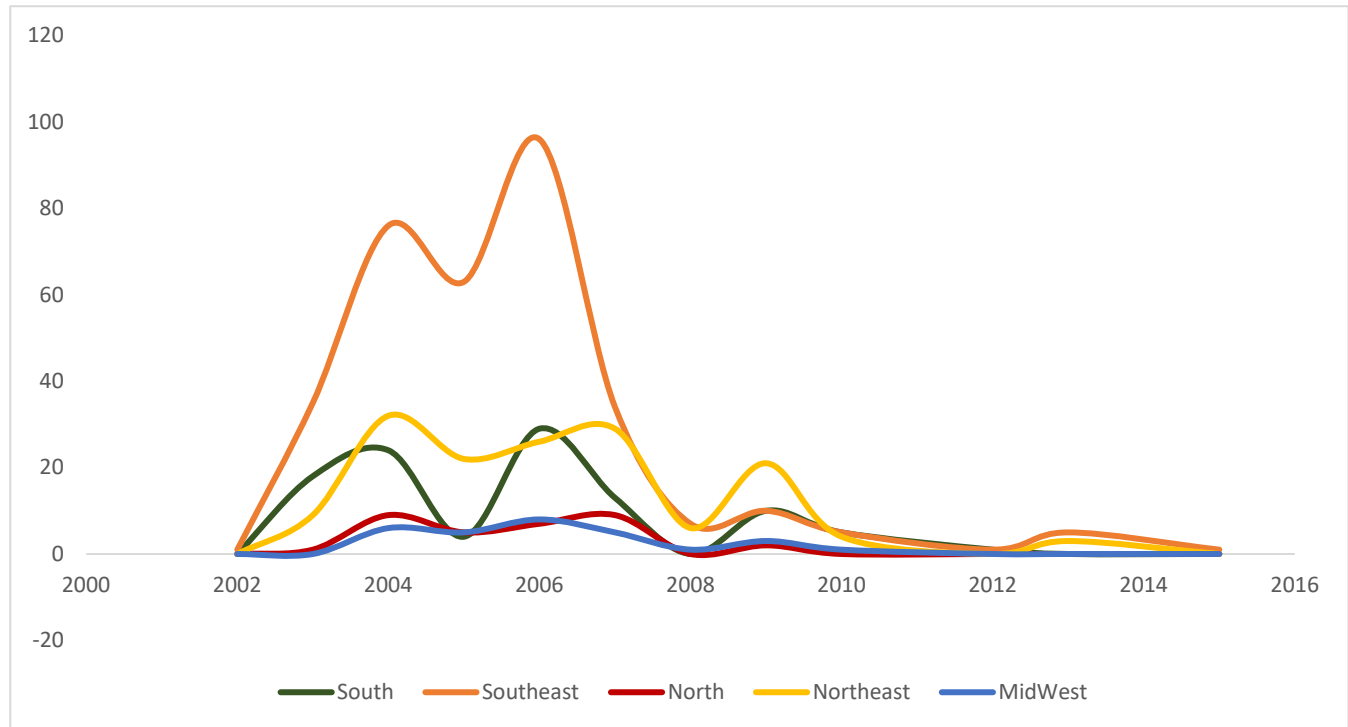
Due to the volume of participating institutions between 1999 and 2018, it was not feasible to apply questionnaires to all the participating agents in order to verify whether patents were developed and technology transfer was carried out, as well as whether the research developed was applied to the needs of the Brazilian market.

4 Results and Discussion

The main data used in this research were provided by FINEP, after requesting information through the Brazilian Access to Information Law. The spreadsheet made available presented 652 projects during the period from 2002 to 2015, and the region with the largest number of projects was the Southeast region with 334 projects, making up a percentage in the analyzed period of 51.23%. It is worth mentioning that even though CT-Petro was created to stimulate the great Northeast, Midwest and North regions, over time, there were no significant changes for the region. Thus, maintaining the concentration in the South-Southeast axis. Figure 1 shows the evolution since the approval of the first project by the FINEP notices, in 2002, until 2018. This study seeks to show the evolution of projects and resources released in the 20-year period, however, even though it was created in 1999 the participation of institutions took place only in 2002. With the University Support Foundation of the Federal University of Uberlândia (MG). During the period from 1999 to 2002, the actions were in creating a normative framework for the actions of the edicts to attract the most diverse partners. The figure below shows that the period between 2002 and 2008, had a higher volume of approved projects, under the assumption that there was a greater release of public funds, with greater emphasis on the Southeast region of the country. The second and third places were disputed between the South and Northeast regions. The Southeast region, historically, attracts a greater number of researchers and research institutions, as well as a greater industrial concentration, inferring that this history may have

impacted on a high number of institutions participating in the edicts. It is worth noting that most of the institutions participating in these calls are universities or foundations linked to Brazilian universities.

Figure 2 - Evolution in the number of projects approved by the CT-Petro Sector Fund by region in the period 2002 to 2015



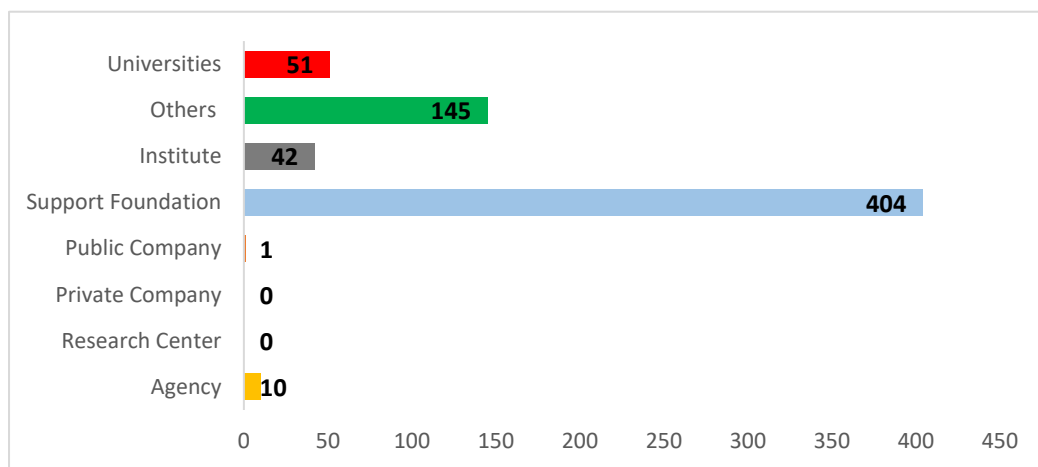
Source: Prepared by the authors, 2019.

The main characteristics of the CT-Petro public notices are the encouragement of partnerships between different profiles of institutions, thus, the personalities of those in agreement and executors are noted, it is understood that such form of structuring envisions the work between different institutions and exchange of information. experiences among professionals working on the projects. After prospecting in the INPI database, with the institutions' CNPJ, it can be noted that in some projects the convenient CNPJ was the same as the executing CNPJ, thus inferring that the partnerships did not occur at a public-private level in large proportions. It was identified that part of the institutions participating in the FINEP notices had the highest percentage of participation for the Support Foundations and Universities. Even with such incentives, the partnerships for the development of R&D, between the Government-University-Enterprise agents were still few significant.

Figures 3 and 4 show the participating structures of the institutions, with respect to those in agreement, the highest percentage is with Support Foundations, being accompanied by Others and Universities. It is evident that the participation of companies, both public and private, did not occur. Reaffirming that the participation of companies in this context in Brazil needs more stimuli and / or proposals for public policies that arouse confidence and interest to interact with institutes and / or research centers. Demonstrate that the country, like other countries in the world, can develop applied research in a larger volume. When it comes to analyzing figure 4 which deals with the executors of the winning projects,

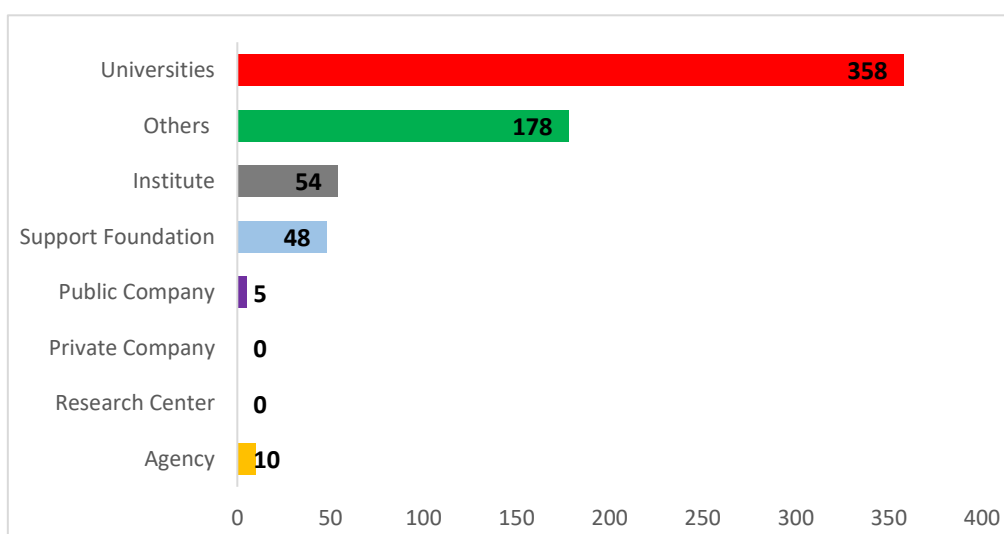
there are some changes, among them, the participation of public companies (around 1%). Even with minimal representativeness, it creates expectations that this distribution among participating agents can be balanced. It is worth mentioning that in the scenario of executors the highest percentage of performance is among Universities (54,83%), then by Others (27,26%). Given what was presented in the figures and what was presented in the literature review above, it appears that part of the Support Foundations and Universities have very close institutions. Negri et al (2016) highlight in the mapping carried out, that a good part of the Support Foundations existing in the country were created so that Public Universities could act in partnerships with private agents without creating problems for them.

Figure 3 – Distribution in the CT-Petro Announcements, of the Participating Institutions as Convenient in the Period 2002 to 2015



Source: Prepared by the authors, 2019.

Figure 4 – Distribution in the CT-Petro Announcements, of the Participating Institutions as Executor in the Period 2002 to 2015



Source: Prepared by the authors, 2019.

After the analysis of the distribution of the number of projects among conveners and executors, the present work was directed to prospect in the INPI database, seeking the quantity of patent applications filed in the years in which the institutions had projects approved by CT-Petro's edicts. Table 2 shows the distribution of patent application filings between covenant and executor.

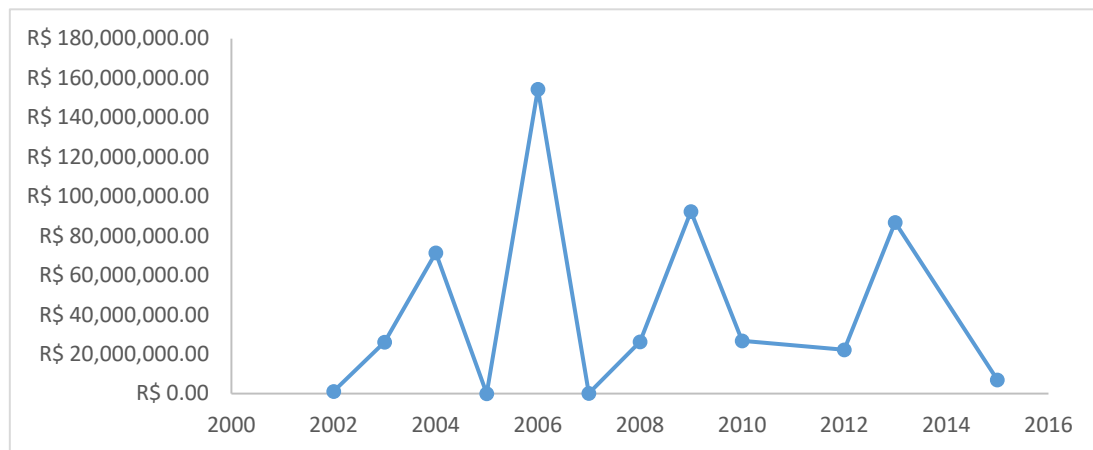
Table 1 – Distribution of patent application filings in the INPI Database

Year	Patent	
	Contracting Party	Executor
2002	47	172
2003	65	193
2004	60	205
2005	62	220
2006	71	234
2007	89	338
2008	101	302
2009	101	335
2010	121	436
2012	164	632
2013	231	709
2015	241	778
Total	1353	4554

Source: Prepared by the authors, 2019.

With the data in the table 2, it is noted that the executors made a greater volume of patent application filings, especially in recent years. In order to minimize the bias of the research and provide greater security to the results obtained, the analysis of the participating CNPJs was worked on, in which the repetition of the participating institutions between the contractor and the executor was verified. Between 2002 and 2015, 217 participated in the sample of CNPJ of the participating institutions, and of this sample only one institution appears with the name company in its corporate name, the Agricultural Research and Rural Extension Company of Santa Catarina SA - Headquarters, the other participants predominantly foundations, associations, universities and research institutes. Another information to be highlighted is that the period under analysis is from 2002 to 2015, but in 2011 and in 2014 there were no results for patent filings of the surveyed CNPJs. The prospecting was carried out between the months of September and December 2019, since that time there were no deposits for the period 2016 to 2018. The prospecting option only by the CNPJ number sought to avoid biased results due to the similarity of the participants' names. Regarding the volume of public resources released by FINEP for the referred Sectorial Fund, Figure 4 shows the evolution, with the highlight being in the year 2006. From 2008, there are small fluctuations with a considerable drop from 2014.

Figure 5 - Value of Financial Resources Released by FINEP



Source: Prepared by the authors, 2019.

It can be inferred from Figure 5 that there is a growth in the volume of financial resources released after the publication of the first public notice. It is noted that this growth does not continue over the years, with 2006 as the peak. Thus, it can be inferred that the enactment of Law N° 10,973/2004 stimulated the participation of institutions. Another factor that can be induced in this behavior of the release of resources is that they are linked to the profiles of the governors of the executive (SENADO, 2016).

5 Final Considerations

From what was exposed throughout the text it is noted that even with the change in the structuring of the research development within the oil and gas production chain, in national territory, it is still necessary to work public policies to stimulate the private initiative of approach research institutions and academia. Even with the release of a considerable amount of public resources to assemble the entire structure that currently exists, only one company participated, which by the way is public.

In the current world economic situation, the trend is the adoption of public policies with profiles the action of the State Minimum, the tendency is for an increasingly minimal state, exercising the role of mere legislator within the relations between public and private. It is known that private enterprise has many demands and it is not interesting to assemble a team just to develop research. The academy has a qualified workforce and is able to meet these demands, what is lacking is greater interaction and trust between the agents.

In the global P&G chain, the strongest remains and there are a large number of large companies at work and many political interests that in some cases have already caused wars between several countries.

With the new discoveries of oil reserves within the Brazilian territory, the maintenance of programs such as CT-Petro is extremely important. Aiming at a better performance of the application of public resources. Until the monopoly was broken, research laboratories in the area were restricted to Petrobras, with the sectorial fund, laboratories in all regions could be structured. However, the structuring of laboratories should not be just for infrastructure. Such laboratories and researchers need to act in punctual ways, keeping research pure but also doing applied research so that citizens can feel served, that is, see the result of public taxes paid to public coffers.

It is expected to create an environment for a society with more jobs an environment for a society with a greater number of jobs, greater and better training of its professionals and with economic competitiveness with any other country in the world. Not forgetting the importance of stimulating protection through Intellectual Property for everything that is created and developed in order to increase the number of Brazilian patents. It may impact the importance of national technology in the international scenario.

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YIELD, YIELD COMPONENTS AND NUTRIENTS UPTAKE IN ZURI GUINEA GRASS INOCULATED WITH PLANT GROWTH-PROMOTING BACTERIA

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Abstract

The objective of this study was to evaluate the effects of strains of Azospirillum brasilense, Pseudomonas fluorescens and Rhizobium tropici on biomass yield and nutrients uptake of shoots and roots of Megathyrsus (syn. Panicum) maximus cultivar BRS Zuri (Zuri Guinea grass) inoculated with plant growth-promoting bacteria (PGPB). Treatments consisted of inoculation and re-inoculation with A. brasilense strains Ab-V5 and Ab-V6, P. fluorescens strain CCTB 03 and of co-inoculation with R. tropici strain CIAT 899 + A. brasilense Ab-V6, with or without N-fertilizer (100 mg dm⁻³). Evaluations were performed on three cuts for the determination of root and shoot dry weight yield, morphological compositions, tiller mass, number of tillers, and nutrient uptake. Inoculation with bacteria in association with N-fertilizer increased N, NH₄⁺, Ca, Fe, Mn and Zn accumulation in shoots and P and K uptake in roots. P. fluorescens and co-inoculation with R. tropici CIAT 899 + A. brasilense Ab-V6 increased the relative chlorophyll index in relation to the non-inoculated control. As expected, PGPB were not able to fully replace N-fertilization. However, when combined with N-fertilizer, the PGPB increased yield, the relative chlorophyll index, and the uptake of N, NH₄⁺, Ca, Zn, Mn and Fe of Zuri Guinea grass. The results indicate that PGPB can represent a sustainable alternative for reducing the use of N-fertilizers. There were no effects of re-inoculation with PGPB on the nutrition or yield of Zuri Guinea grass, demonstrating that the determination of the method of application and periodicity of inoculation still require investigation.

Keywords: diazotrophic bacteria, inoculant, nitrogen, biological nitrogen fixation, tropical forage grass,

1.INTRODUCTION

The areas devoted to pasture cultivation in Brazil have increased over the last few decades, given that they constitute the basis for ruminant production in the country [1]. Brazil has 160 million hectares of pasture, under different edaphoclimatic conditions. The area supports 226 million head of cattle, representing 33% of the global number of heads, occupying the second position after India [2]. In the genus

Megathyrsus (syn. *Panicum*), the *M. maximus* species has been broadly cultivated in both tropical and subtropical regions, mainly due to its tolerance and adaptability to diverse edaphoclimatic conditions [3]. The Zuri Guinea grass (*M. maximus* cv. BRS Zuri) is one of the most important cultivars because of its agronomic and nutritional qualities. In addition to a rapid growth and high biomass yield, this forage grass uses its extensive root system to regrow over successive cycles.

Nitrogen (N) is often a limiting factor in plant growth and yield, especially in tropical forage grasses [4]. Fertilization represents an alternative to potentially reduce seasonal variations in warm-season grass quantities and may increase their quality; however, commercial fertilizers are the costliest input for warm-season grass forage yields. Fertilizer costs, with an emphasis on N-fertilizers, have increased over the last few decades, mainly in response to the increased costs of fossil fuels. Nitrogen is routinely the first nutrient applied to warm-season grass pastures because of its effect on forage production and its nutritional value. However, repeated fertilizations or high amounts of N alone may cause nutrient unbalances in soil and can ultimately have negative effects on forage production and on the nutritional value [5]. In addition, growing concerns about the development of more sustainable and less polluting agriculture have led to the search for alternatives to reduce the environmental impact of mineral fertilizers [6] without causing losses in productivity [7]; [8].

In this sense, the beneficial use of bacterial inoculants stands out as a viable alternative, especially under conditions of low soil fertility [9]; [10]; [11]; [12]. Some bacteria, known as plant growth-promoting bacteria (PGPB), can highly contribute to plant growth, by means of several processes, that can act in a single, cumulative or cascading manner [13], including biological nitrogen fixation [14], increased nutrient and water uptake [15]; the production and secretion of phytohormones and other signaling molecules, such as auxins [16], cytokinins [17], gibberellins [18] and salicylic acid [19]; [20]; phosphate solubilization [21], among others.

Priority should be given to the use of alternative strategies that promote improvements in animal production, especially management strategies that associate sustainability with profitability. Thus, the use of PGPB in forage grasses may represent an important management alternative for improved pasture production and quality, consequently, animal production. The objective of this study was to evaluate the effects of different species and inoculation procedures with *Azospirillum brasilense*, *Pseudomona fluorescens* and *Rhizobium tropici* previously identified as elite PGPB in other crops [22]; [23]; [10]; [12]; [24]; [25], on the nutrient uptake of shoots and roots and the shoot and root dry weight yields of Zuri Guinea grasses.

2. MATERIALS AND METHODS

Growth conditions and experimental design

The experiments were conducted with forage species *Megathyrsus* (syn. *Panicum*) *maximus* cv. BRS Zuri during spring and summer (November to March of 2017/2018) under greenhouse conditions (average temperature of 22°C and photoperiod of 14/10 h, day/night) in 8-L plastic pots, at São Paulo State University (UNESP) in Araçatuba County, São Paulo State, Brazil (21°8' LS, 50°25' LW, 415 m.

The pots were filled with ultisol [26] collected at a depth of 0-0.2 m with the following chemical

attributes: 23 mg dm⁻³ P (resin); 26 g dm⁻³ O.M.; 5.2 pH (CaCl₂); K = 2.9 mmol_c dm⁻³; Ca = 25 mmol_c dm⁻³; Mg = 17 mmol_c dm⁻³; H + Al = 28 mmol_c dm⁻³; base sum (SB) = 44.9 mmol_c dm⁻³; cation exchange capacity (CEC) = 72.9 mmol_c dm⁻³; base saturation (V) = 62% according to [27]. Using an NFb (N-free broth) culture medium in a semi-solid form we estimated the total population of diazotrophic microorganisms in the soil to be 9.5x10⁴ bacteria g⁻¹ of soil by the technique of the largest probable number, according to [28]; [29].

The experimental design was a randomized complete block design with five replicates with repeated measures over time (three growth cycles). The main plots consisted of different treatments. The treatments were determined based on the inoculation of plant growth promoting bacterial (PGPB) strains, including (1) *Azospirillum brasilense* strains Ab-V5 (=CNPSO 2083) and Ab-V6 (=CNPSO 2084), (2) *Pseudomonas fluorescens* CCTB 03 (=CNPSO 2719) and (3) co-inoculation with *Rhizobium tropici* CIAT 899 (=CNPSO 103, =SEMIA 4077), and *Azospirillum brasilense* Ab-V6, each with or without the application of N. All strains result from selection programs performed in Brazil and are used in commercial inoculants. *A. brasilense* Ab-V5 and Ab-V6 are used as inoculant for maize (*Zea mays* L.) [10], wheat (*Triticum aestivum* L.) [10], *Brachiaria* (*Urochloa* spp.) [24] and co-inoculation of soybean (*Glycine max*) [12] and common bean (*Phaseolus vulgaris* L.) [12]; *P. fluorescens* is used in maize [25], *R. tropici* in common bean [12]. In addition to the three treatments, we evaluated the effect of re-inoculation after each round of cutting, as well as two control treatments, one without inoculation and with the application of N (positive control) and one without N fertilization and without inoculation (negative control), totaling eleven treatments. All strains used are deposited in the "Diazotrophic and Plant Growth Promoting Bacteria Culture Collection of Embrapa Soja" (WFCC Collection # 1213, WDCM Collection # 1054). The inoculants were produced at the Laboratory of Soil Biotechnology of Embrapa Soja (Londrina, Paraná State, Brazil). at sowing. *A. brasilense* was prepared in DYGS medium [30], *P. fluorescens* in TSB medium [29], while *R. tropici* inoculum was produced in YM medium [29]. At sowing, the concentration of each bacterial inoculant was adjusted to 2 x 10⁸ cells per mL. The soil from each pot following nutrient addition consisted of the following: Ca(H₂PO₄)₂, 200 mg dm⁻³ P; K₂SO₄, 150 mg dm⁻³ K and 61.53 mg dm⁻³ S; H₃BO₃, 0.5 mg dm⁻³ B; CuSO₄ 1.0 mg dm⁻³ Cu; H₂MoO₄, 0.1 mg dm⁻³ Mo; MnSO₄, 5 mg dm⁻³ Mn; ZnSO₄, 2.0 mg dm⁻³ Zn. After four days, the Zuri Guinea grass was sowed.

Fifteen mL of each inoculant (2 x 10⁹ UFC mL) were used for each kg of seed before, resulting in the supply of 3 x 10⁹ CFU kg⁻¹ of seed, as recommended for brachiarias [24]. Considering that 1 g of seeds corresponds to approximately 660 seeds, the concentration of bacteria was of about 4.5 x 10³ cells seed⁻¹. Seeds were soaked with the inoculants for 1 h, then dried for approximately 30 min in a cool and sun-sheltered location, after which they were seeded at 15 seeds per pot (experimental units). This is the usual inoculation procedure adopted by the farmers for all crops and pastures. According to the Brazilian legislation, experiments aiming at identifying elite microbial strains must include two non-inoculated controls, with and without chemical fertilizers. Therefore, these two controls were included, in our case with and without N-fertilizers [10]; [12]; [24].

The plants were thinned when they presented three fully expanded leaves, with five uniform plants maintained per pot. Only one inoculant treatments strains were reinoculated by spraying a known volume (300 mL) after the first and second cuts, at which time the leaves began to develop again. The same

concentration of 3×10^9 CFU plant⁻¹ was diluted to complete 300 mL with distilled water for spraying, that was performed directly onto the plant leaves. Re-inoculation was applied by foliar application because when the pasture grows, it covers completely the soil, and the only way of reintroducing the strains is by foliar spray. N-fertilization occurred only one via a solution from a graduated pipette four days before the forage was sown, for a total of 100 mg dm⁻³ of N (NH₄NO₃).

Plant harvest and measurements of productive and nutritional parameters

Two weeks after the emergence of Zuri Guinea grass, thinning was performed to keep five uniform plants per pot. Deionized water was used for irrigation. Evaluations were performed when the plants reached an average height of 0.6 m (four-week intervals), when shoots were harvested down to 0.1 m above the surface of the ground. Three growth cycles with four-week intervals were evaluated. After each harvest, the shoots were identified, weighed and oven dried at approximately 65°C until they reached a constant mass. Shoots were subsequently weighed on a precision balance to quantify the shoot dry weight yield (SDWY). After drying, the samples were ground to pass a 1 mm screen in a Wiley type mill and the foliar nutrient concentrations (N, P, K, Ca, Mg, S, B, Fe, Mn and Zn) were determined according to [31].

One day before each cutting took place, plant height readings were taken with a millimeter ruler. Relative chlorophyll indexes (RCI) were taken using a digital chlorophyllometer (Clorofilog). Plant height and RCI readings were carried out on two blades of newly expanded leaves from the five plants in each pot. The number of tillers per pot was also counted. The collected plant material was first separated into tillers and main plants, and later the tiller mass per pot was determined. The material was then collected, and a second separation was performed on the grass leaves and stems to determine the mass of each component.

The roots were collected at the end of the experiment and washed in running water using 2 mm mesh sieves until all soil was removed. To determine the root dry weight yield (RDWY) the samples were properly identified, bagged, and the material was dried as described above. After drying in forced ventilation at approximately 65°C to a constant mass, all root material collected was weighed on a precision balance to quantify the RDWY. The samples were ground to pass a 1 mm screen in a Wiley-type mill to determine the nutrient concentrations (N, P and K) in the roots according to [31].

Statistical analysis

For each response variable, the following linear mixed model was fitted to the data:

$$\mathbf{y} = \mathbf{X}\mathbf{b} + \mathbf{Z}\mathbf{u} + \mathbf{e}$$

where \mathbf{y} is the $r \times 1$ vector of records for the response variable, \mathbf{b} is the $p \times 1$ vector of unobserved fixed effects, \mathbf{X} is a $r \times p$ design matrix relating observations in \mathbf{y} to fixed effects in \mathbf{b} , \mathbf{u} is the $n \times 1$ vector of unobserved random effects, \mathbf{Z} is a $r \times n$ incidence matrix relating observations in \mathbf{y} to random effects in \mathbf{u} , and \mathbf{e} is the $r \times 1$ vector of random residual effects. Fixed effects included the overall mean (i.e., intercept), cutting order, treatment and block. Random effects accounted for repeated measurements taken from the same plot, and were assumed $\mathbf{u} \sim \text{MVN}(\mathbf{0}, \mathbf{I}s_u^2)$ where s_u^2 is the variance component attributed to the plots.

Residual effects were assumed $\mathbf{e} \sim \text{MVN}(\mathbf{0}, \mathbf{I}s_e^2)$ where s_e^2 is the residual variance. The model was fitted with the *hglm* v2.2-0 package [32] in *R* v.3.5.3 [33]. All treatments were contrasted with the negative control, and significant differences were evaluated with a Wald t-test considering $\alpha = 0.05$. The results were summarized using marginal means (i.e., average within a level of a factor corrected for all remaining effects in the model, analogous to least squares means in fixed effects regression), which were computed from the linear combination \mathbf{Lb} , where \mathbf{L} is a matrix containing contrasts between levels of a tested factor (e.g., treatment) and average values for levels of other factors (e.g., cutting and block). Standard errors for marginal means were computed as the square root of the diagonal elements of $\mathbf{L}(\mathbf{X}^T\mathbf{V}^{-1}\mathbf{X})^{-1}\mathbf{L}^T$ for $\mathbf{V} = \mathbf{I}s_u^2 + \mathbf{I}s_e^2$.

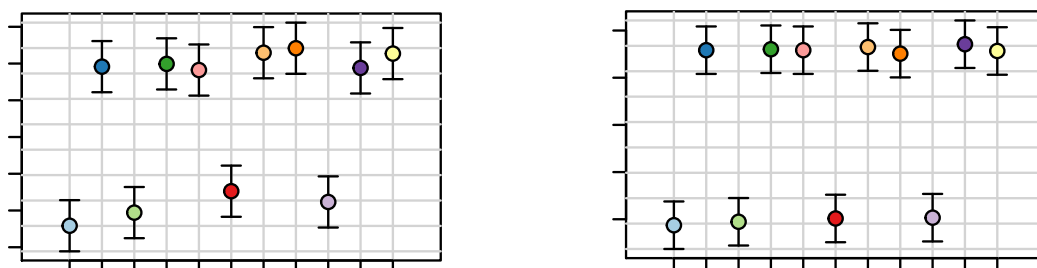
The data of shoot accumulation, roots dry weight, N root uptake, P root uptake and K root uptake were assessed using analysis of variance (ANOVA) with the F test ($p \leq 0.05$) and compared using the Scott-Knott test with a 5% probability.

3. RESULTS

It is worth mentioning that all inoculated treatments receiving the same amount of N-fertilizer than the positive control, as rhizospheric diazotrophic bacteria cannot supply all plant's N demands, while the negative control is represented by non-inoculated non-fertilized plants.

Shoot and roots dry weight yields

In the analysis of variance for shoot dry weight yields (SDWY), and the SDWY accumulation, root dry weight yields (RDWY), relative chlorophyll index (RCI), tillers units and tillers dry mass was highly significant, indicating higher yields in the treatments receiving N-fertilizer ($p \leq 0.05$) (Figure 1 and Table 1). The values of SDWY ranged from 23.2 to 46.3 g pot⁻¹, RDWY from 6.6 to 9.6 g pot⁻¹, for the RCI of the Zuri Guinea grass, values ranged from 17.6 to 22.9, tillers units from 8.0 to 14.1 and tillers dry mass from 3.0 to 10.4 g pot⁻¹. None of the inoculated treatments differed statistically from the positive control receiving N-fertilizer, and three of them had decreased SDWY (Table 1).



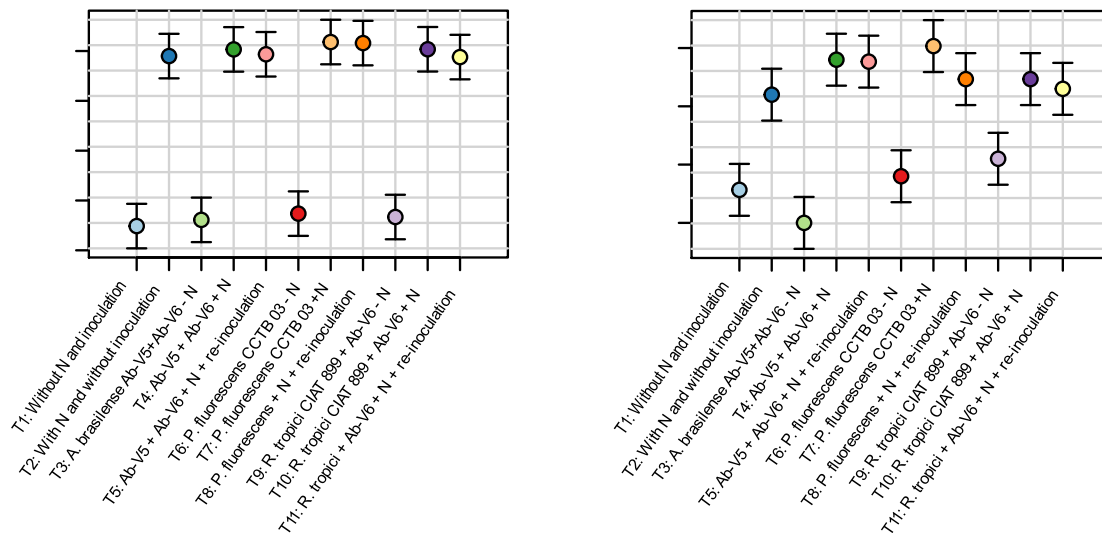


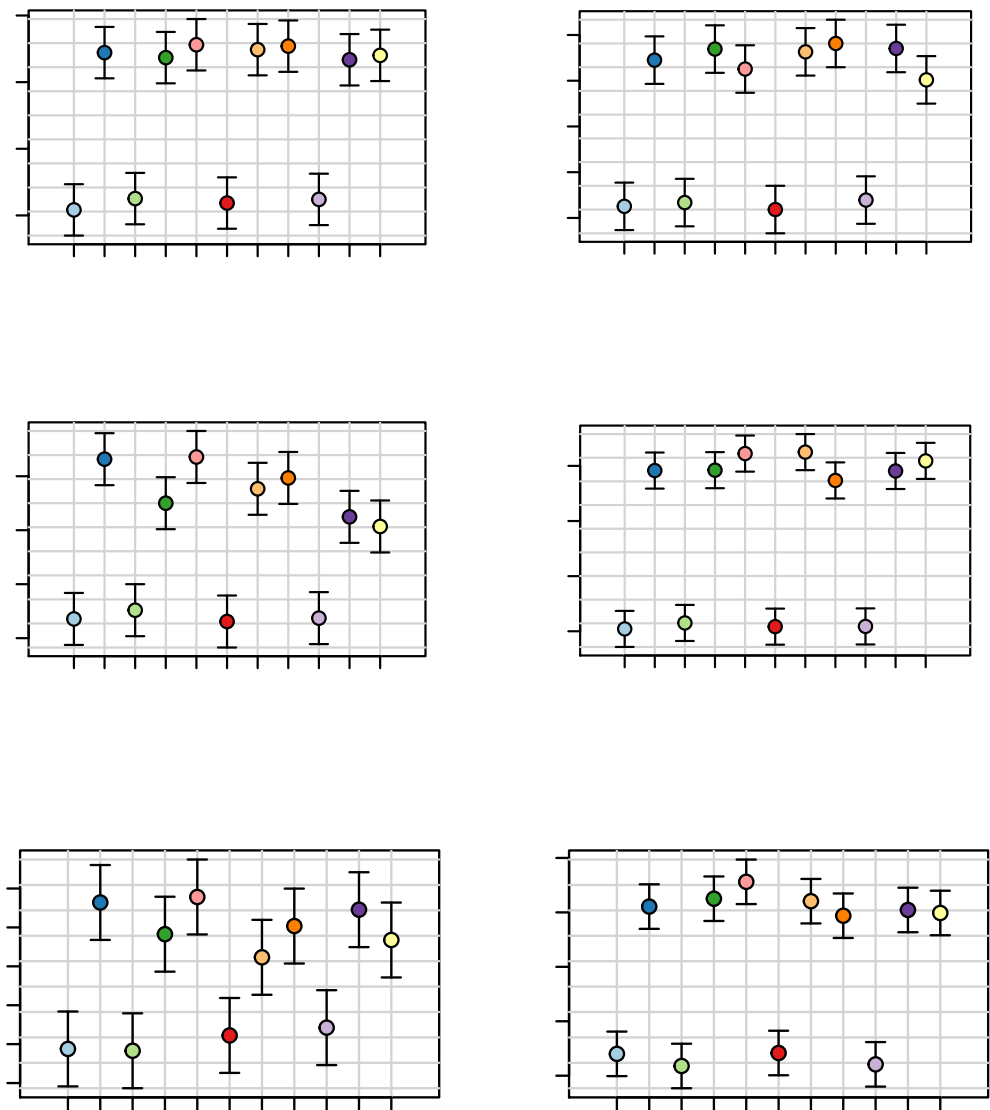
Figure 1. Relative chlorophyll index (a), shoot dry weight yield (g pot^{-1}) (b), tiller dry mass (g pot^{-1}) (c), number of tillers (units) (d) in Zuri Guinea grass inoculated with strains *Azospirillum brasilense*, *Pseudomonas fluorescens* and *Rhizobium tropici*. T1= Negative control (without N and inoculation), T2= Positive control (with N and without inoculation), T3= *A. brasilense* Ab-V5+Ab-V6 – N, T4= *A. brasilense* Ab-V5+Ab-V6 + N, T5= *A. brasilense* Ab-V5+Ab-V6 + N + re-inoculation, T6= *P. fluorescens* CCTB 03 – N, T7= *P. fluorescens* CCTB 03 + N, T8= *P. fluorescens* CCTB 03 + N + re-inoculation, T9= *R. tropici* CIAT899 + *A. brasilense* Ab-V6 – N, T10= *R. tropici* CIAT899 + *A. brasilense* Ab-V6 + N and T11= *R. tropici* CIAT899 + *A. brasilense* Ab-V6 + N + re-inoculation. Per-treatment marginal means estimated from mixed models for all response variables investigated in the present study. Error bars represent the standard errors of the means. All marginal means followed by asterisks (*) differed significantly ($p < 0.05$) from the negative control (treatment 1).

Table 1 Shoot dry weight yield (SDWY) accumulation (g pot^{-1}) and root dry weight yield (RDWY) (g pot^{-1}) in Zuri Guinea grass inoculated with strains *Azospirillum brasilense*, *Pseudomonas fluorescens* and *Rhizobium tropici*.

Treatments	SDWY accumulation (g pot^{-1})	RDWY (g pot^{-1})
Negative control (without N and inoculation)	23.24 b	7.03c
Positive control (with N and without inoculation)	45.50 a	9.55 a
<i>A. brasilense</i> Ab-V5+Ab-V6 – N	23.68 b	6.77 c
<i>A. brasilense</i> Ab-V5+Ab-V6 + N	45.62 a	9.18 a
<i>A. brasilense</i> Ab-V5+Ab-V6 + N + re-inoculation	45.50 a	8.37 a
<i>P. fluorescens</i> CCTB 03 – N	24.10 b	7.23 c
<i>P. fluorescens</i> CCTB 03 + N	45.90 a	7.90 b
<i>P. fluorescens</i> CCTB 03 + N + re-inoculation	45.06 a	9.11 a
<i>R. tropici</i> CIAT899 + <i>A. brasilense</i> Ab-V6 – N	24.20 b	6.64 c
<i>R. tropici</i> CIAT899 + <i>A. brasilense</i> Ab-V6 + N	46.26 a	7.99 b
<i>R. tropici</i> CIAT899 + <i>A. brasilense</i> Ab-V6 + N + re-inoculation	45.40 a	9.47 a
P value	<0.01	<0.01

Means followed by lowercase letters differ for treatments as determined by the Scott-Knott test ($P < 0.05$).

Statistically significance differences in the -ammonium, nitrate, P, K, S, Ca and Mg accumulations in the shoots of Zuri Guinea grass were observed in the experiment (Figure 2).



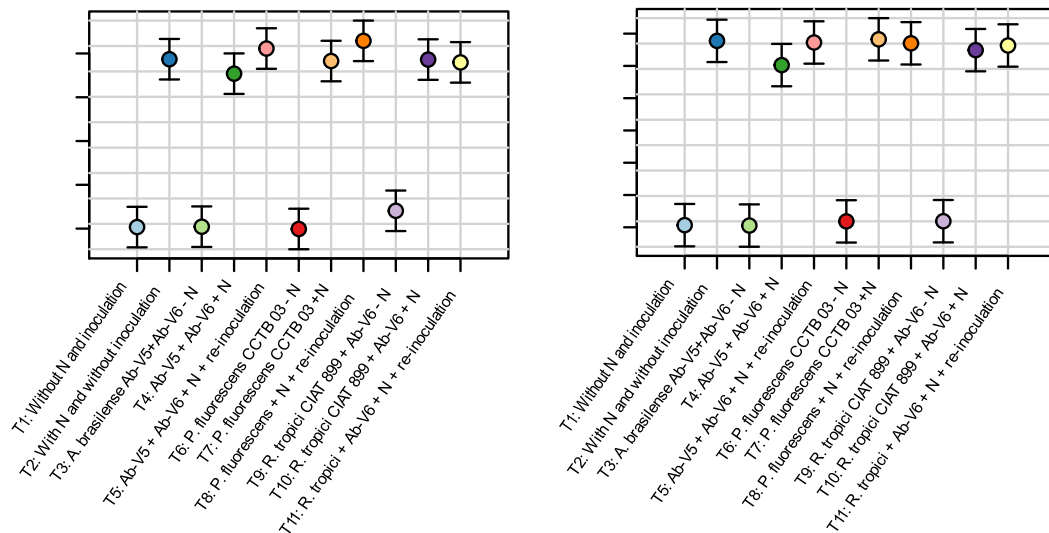


Figure 2. Uptake N (mg pot⁻¹) (a), uptake NH₄⁺ (mg pot⁻¹) (b), uptake NO₃⁻ (mg pot⁻¹) (c), uptake P (mg pot⁻¹) (d), uptake K (mg pot⁻¹) (e), uptake S (mg pot⁻¹) (f), uptake Ca (mg pot⁻¹) (g), uptake Mg (mg pot⁻¹) (h) in Zuri Guinea grass inoculated with strains *Azospirillum brasilense*, *Pseudomonas fluorescens* and *Rhizobium tropici*. T1= Negative control (without N and inoculation), T2= Positive control (with N and without inoculation), T3= *A. brasilense* Ab-V5+Ab-V6 - N, T4= *A. brasilense* Ab-V5+Ab-V6 + N, T5= *A. brasilense* Ab-V5+Ab-V6 + N + re-inoculation, T6= *P. fluorescens* CCTB 03 - N, T7= *P. fluorescens* CCTB 03 + N, T8= *P. fluorescens* CCTB 03 + N + re-inoculation, T9= *R. tropici* CIAT899 + *A. brasilense* Ab-V6 - N, T10= *R. tropici* CIAT899 + *A. brasilense* Ab-V6 + N and T11= *R. tropici* CIAT899 + *A. brasilense* Ab-V6 + N + re-inoculation. Per-treatment marginal means estimated from mixed models for all response variables investigated in the present study. Error bars represent the standard errors of the means. All marginal means followed by asterisks (*) differed significantly ($p < 0.05$) from the negative control (treatment 1).

Plants inoculated with *A. brasilense* Ab-V5 + Ab-V6 and *P. fluorescens* CCTB 03 at sowing and then reinoculated after the first and second cuttings had the best performance in terms of N accumulation, with 418 and 416 mg pot⁻¹ of N, respectively. Additionally, plants that were inoculated with *A. brasilense* Ab-V5 + Ab-V6 together with N fertilization accumulated 2.72 mg pot⁻¹ of NH₄⁺, and for both variables, N fertilization together with inoculation was statistically higher than the positive control (2.44 mg pot⁻¹). Although not significantly different from the negative control treatment, the plants inoculated with *A. brasilense* Ab-V5 + Ab-V6, *P. fluorescens* CCTB 03 or *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 had 17.2%, 9.7% and 13.9% increased N accumulation, respectively (Figure 2).

In relation to the NO₃⁻ accumulations, plants fertilized with N and inoculated with *A. brasilense* Ab-V5 + Ab-V6 at sowing and re-inoculated after the first and second cuttings presented the highest value, of 5.06 mg pot⁻¹, however, not differing statistically from the positive control. The unfertilized treatments were statistically lower than the other treatments.

The accumulations of P, K, S, Ca and Mg in the shoots of the Zuri Guinea grass in all inoculated treatments receiving N-fertilizer, as well as in the positive control were statistically higher to those not

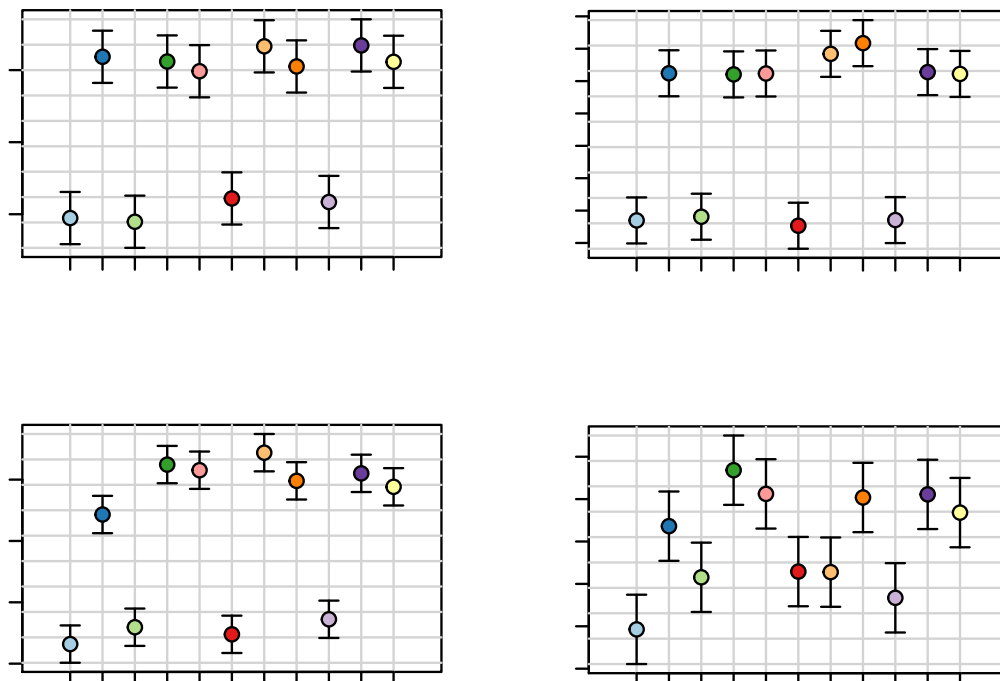
fertilized and similar to each other (Figure 2).

For the K accumulations in the shoots again the control without N-fertilizer was statistically lower. The positive control and plants inoculated with *A. brasilense* with N presented the highest accumulation of K ($p \leq 0.05$), with 480 and 490 mg pot⁻¹, respectively (Figure 2).

The accumulation of Ca was higher in the treatment re-inoculated with strains of *P. fluorescens* CCTB 03 after the first and second cuttings, of 70 mg pot⁻¹. However, plants that were inoculated with *A. brasilense* or *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 had a 12.5% increase in Ca accumulation relative to the positive control.

For the Mg accumulation it should be noted that the treatment without N fertilization were lower than the other treatments. The treatments in which the plants were inoculated with *P. fluorescens* showed the highest accumulation of Mg at 80 mg pot⁻¹, which was a 4.8% increase in accumulation relative to the positive control.

For the accumulation of B the plants fertilized with N were statistically higher to those not fertilized and similar to each other, and there were no significant differences between the unfertilized treatments (Figure 3). The treatments in which the plants were inoculated with *R. tropici* CIAT 899 and *A. brasilense* Ab-V6 N showed the highest accumulation of B, with 220 mg pot⁻¹, which was a 6.3% increase in accumulation relative to the positive control.



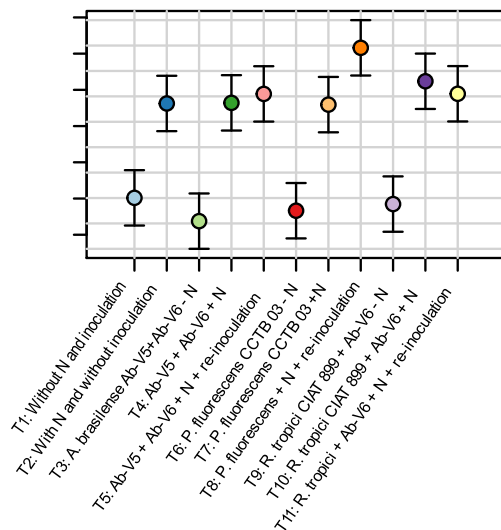


Figure 3. Uptake B (mg pot^{-1}) (a), uptake Zn (mg pot^{-1}) (b), uptake Mn (mg pot^{-1}) (c), uptake Cu (mg pot^{-1}) (d), uptake Fe (mg pot^{-1}) (e) in Zuri Guinea grass inoculated with strains *Azospirillum brasilense*, *Pseudomonas fluorescens* and *Rhizobium tropici*. T1= Negative control (without N and inoculation), T2= Positive control (with N and without inoculation), T3= *A. brasilense* Ab-V5+Ab-V6 – N, T4= *A. brasilense* Ab-V5+Ab-V6 + N, T5= *A. brasilense* Ab-V5+Ab-V6 + N + re-inoculation, T6= *P. fluorescens* CCTB 03 – N, T7= *P. fluorescens* CCTB 03 + N, T8= *P. fluorescens* CCTB 03 + N + re-inoculation, T9= *R. tropici* CIAT899 + *A. brasilense* Ab-V6 – N, T10= *R. tropici* CIAT899 + *A. brasilense* Ab-V6 + N and T11= *R. tropici* CIAT899 + *A. brasilense* Ab-V6 + N + re-inoculation. Per-treatment marginal means estimated from mixed models for all response variables investigated in the present study. Error bars represent the standard errors of the means. All marginal means followed by asterisks (*) differed significantly ($p < 0.05$) from the negative control (treatment 1).

For the accumulation of Zn the plants inoculated with *P. fluorescens* presented the highest accumulation of Zn, 0.35 mg pot^{-1} , representing a statistically significant increase of 13.7% relative to the positive control. The Cu accumulation of the plants inoculated with *A. brasilense* Ab-V5 + Ab-V6 stood out at 0.12 mg pot^{-1} , representing an increase of 40.0%, although not statistically different, compared to the N-fertilized control treatment (Figure 3d).

The Mn accumulation in the plants inoculated with PGPB were statistically higher than the others, including the positive control. The Mn accumulation in the plants inoculated with *A. brasilense* Ab-V5 + Ab-V6, *P. fluorescens* CCTB 03 or *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 was of 2.7, 2.8 and 2.6 mg pot^{-1} , respectively, representing increases of 17.5%, 23.5% and 19.5%, respectively, relative to the positive control (Figure 3c).

For the Fe uptake the plants inoculated with *P. fluorescens* presented the highest accumulation of Fe, 1.6 mg pot^{-1} , which was statistically higher and represented an increase of 14.3% relative to the positive control (Figure 3e).

Nutrient accumulation in roots

The P and K uptake (or accumulation), but N in roots were significantly affected by the treatments as (Table 2). Although not statistically different, *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 accumulated 147 mg pot⁻¹ of N, an increase of 34.9% relative to the positive control; the same was verified for the P content (22 versus 14 mg pot⁻¹). As for the K in roots, the inoculation with *A. brasilense* Ab-V5 + Ab-V6 accumulated 40.4% more K than the positive control.

Table 2. Uptake N root (mg pot⁻¹), uptake P root (mg pot⁻¹) and uptake K root (mg pot⁻¹) in Zuri Guinea grass inoculated with strains *Azospirillum brasilense*, *Pseudomonas fluorescens* and *Rhizobium tropici*.

Treatments	N root (mg pot ⁻¹)	P root (mg pot ⁻¹)	K root (mg pot ⁻¹)
Negative control (without N and inoculation)	109.00	18.00 b	70.00 a
Positive control (with N and without inoculation)	109.00	14.00 b	47.00 b
<i>A. brasilense</i> Ab-V5+Ab-V6 - N	121.00	21.00 a	66.00 a
<i>A. brasilense</i> Ab-V5+Ab-V6 + N	113.00	15.00 b	47.00 b
<i>A. brasilense</i> Ab-V5+Ab-V6 + N + re-inoculation	114.00	17.00 b	54.00 b
<i>P. fluorescens</i> CCTB 03 - N	114.00	20.00 a	61.00 a
<i>P. fluorescens</i> CCTB 03 + N	128.00	15.00 b	64.00 a
<i>P. fluorescens</i> CCTB 03 + N + re-inoculation	138.00	15.00 b	51.00 b
<i>R. tropici</i> CIAT899 + <i>A. brasilense</i> Ab-V6 - N	118.00	21.00 a	56.00 b
<i>R. tropici</i> CIAT899 + <i>A. brasilense</i> Ab-V6 + N	123.00	16.00 b	48.00 b
<i>R. tropici</i> CIAT899 + <i>A. brasilense</i> Ab-V6 + N + re-inoculation	147.00	22.00 a	49.00 b
P value	0.152	0.036	0.004

Means followed by lowercase letters differ for treatments as determined by the Scott-Knott test (P <0.05)

The Supplementary Material shows the soil means chemical properties at the beginning and end of the experiment. The data show that there was a decrease in the chemical properties of the organic matter soil, K, Mg, H + Al, S, cation exchange capacity, base saturation, B, Cu, Fe, Mn and Zn (Table 3 and Table 4).

4. DISCUSSION

For most of the evaluated parameters, the treatments in which the plants were inoculated exclusively with plant growth-promoting bacteria (PGPB) had a lower performance than those that received a combination of PGPB + N fertilizer. Therefore, and as expected for PGPB with grasses, the results showed that the bacteria alone cannot replace N fertilizers, but that they do promote greater uptake and utilization of the available N in the soil [34], resulting in a synergistic effect between PGPB inoculation and N fertilization [35].

In general, there was no significant difference between inoculation with bacteria and control positive treatments for most of the variables analyzed, what can be attributed to soil chemical conditions that were decreased at the end of the experiment (Table 3). However, PGPB promoted increases in yields when

compared to the non-inoculated control without N-fertilizer, since we observed positive effects of PGPB inoculation on SDWY, tillers dry mass and RCI of Zuri grass.

For many PGPB, one main benefit results from the synthesis of phytohormones such as auxins as indoleacetic acid (IAA) and giberellins. IAA has an important effect on root growth, resulting in increases in the absorption of water and also of nutrients, ensuring the efficient use of these resources [10]. Auxins and gibberellins act on the growth and elongation of stalks, leaves and roots, and induce changes in the expansion, division and cellular stretching of the meristematic regions, where plant growth occurs [36]; [37]. In this study, some of the strains have been reported as able to synthesize phytohormones. The inoculant strains *A. brasilense* strains Ab-V5 and Ab-V6 are well known by the synthesis of IAA [22], and the same for *R. tropici* CIAT 899 [38].

Increases in leaf and stem production of forage plants results in higher SDWYs and, consequently, higher amounts of carbon (C) are hijacked to increase the productivity and for storage in the soil via the roots. Well-managed forage plants with high biomass production can sequester a considerable amount of C [39]. Reported by [24] the sequestration of 9.27 Mt e-CO₂ in pasture areas inoculated with *A. brasilense* strains Ab-V5 and Ab-V6 and destined for forage biomass yields.

The main reported mechanisms of action of the genus *Pseudomonas* improving plant growth are the solubilization of phosphate, and the promotion of phytohormones (including IAA) [40]. In the case of *P. fluorescens* CCTB 03, we have identified that the strain possesses the capacity of synthesis of IAA and of P solubilization *in vitro* (unpublished data). By evaluating the effects of inoculation with *P. fluorescens* on *Pennisetum clandestinum* during the winter, [41] verified higher dry and green mass productions by the plant compared to plants receiving only N fertilization and emphasized that such increases were the result of the release of phytohormones.

The co-inoculation of *Azospirillum* Ab-V6 and *R. tropici* CIAT 899 has been successfully used in Brazil for the common bean crop [12], and also promoted growth of maize, and a main driven effect could be the induction of plant systemic resistance to tolerance of abiotic stresses [23]. The approach of co-inoculation consists on the combination of microorganisms that can contribute with different biological processes, resulting in a synergistic effect, tending to surpass the productive results obtained when these organisms are used in an isolated form [42]; [43]. In Gramineae, strains of *Azospirillum* (Ab-V5 and Ab-V6) contribute as plant growth promoters [12] mainly by the synthesis of (IAA) [37]; [44]; [22], while *Rhizobium* could also participate phytohormone in non-legumes [45]; [46]; [38]. For example, [47] found that the inoculation of *Azospirillum* spp. in natural pastures had a beneficial potential, especially in regions with hydric deficits and low soil fertility, due to the larger root biomasses that increases the soil exploration capacity [48].

The results obtained in this study agree with those obtained by [49], in which, when evaluating the production of Coastercross-1 grass inoculated with *Azospirillum* Ab-V5 and Ab-V6 and fertilized with 100 kg N ha⁻¹ observed increased shoot production in comparison to non-inoculated plants. [24] also observed beneficial effects of PGPB on biomass yield when evaluating 26 cuts of *Brachiaria* (*Urochloa*) spp., with mean increase of 5.4% with the application of 40 kg N ha⁻¹, and of 22.1% when combining the same dose of N with inoculation with *A. brasilense* Ab-V5 and Ab-V6. In general, rhizobia are broadly used in microbial inoculants for legumes, but not for grasses. However, there are rhizobial strains that can also be effective PGPB for grasses. [23] evaluated the effects of co-inoculation of *R. tropici* and Ab-V6 in maize,

and reported increases in in plant growth relative to the control treatments without inoculation; in addition, an important effect on the increase in salinity tolerance was observed. In addition, the combination of *A. brasilense* and *R. tropici* in this study resulted in a further 2% SDWY over the positive control. The treatments in which plants were inoculated with PGPB and fertilized with N had higher RCI values relative to the unfertilized plants. According to [50], the photosynthetic capacity is optimized with a higher availability of N, as this nutrient is the main constituent of the chlorophyll molecule. Thus, the RCI can be used to predict the nutritional status of N in plants by reading the amount of green pigments in the forage leaves, and RCI values over 20 can be considered a good nutritional status of grass. [51], using a chlorophyll apparatus for RCI readings in *Brachiaria brizantha* cv. Marandu inoculated with *A. brasilense* (Ab-V5 and Ab-V6) obtained similar results than in this study, with an average value for the *P. fluorescens* CCTB 03 inoculated treatment group of 22.5 RCI.

It is worth mentioning that the inoculated treatments fertilized with N tended to have no significant effect after the first cut, demonstrating that the effects of bacteria and N fertilization were more pronounced at the plant establishment stage. There were also effects of grass exposure during periods of low light intensity in the rainy summer. All these factors could be related to the addition of N-fertilizer only at the beginning of the experiment.

Re-inoculation of PGPB in permanent pastures is a difficult task. The effects of re-inoculation are not well defined yet, as well as the method of re-introducing the strains, as PGPB are rhizospheric bacteria, and the soil is covered by the grass, such that foliar application would represent practically the only viable strategy. In this study, re-inoculation did not result in improve SDWY and RDWY. These results agree with [49], who concluded that the re-inoculation of *A. brasilense* in Coastcross-1 grass after the first year of cultivation was not necessary. [52] also concluded that the re-inoculation of Mavuno grass with PGPB did not present significant results for shoot and roots yields. In general, nutrient accumulation in the shoots and roots of Zuri Guinea grass was positively affected by inoculation with PGPB. The nutrients with the greatest accumulation were N and K, important nutrients for forages [53]; [54]. The increases in nitrogen accumulation, as well as N, nitrate and ammonium compounds, benefited mainly by the inoculation with the *Azospirillum* and *Pseudomonas*, might be attributed mainly to the synthesis of phytohormones, improving root biomass and, in the case of *Azospirillum*, and also by a contribution of biological nitrogen fixation [20]; [55]. In addition, *Azospirillum* may influence the activity of glutamine synthetase in grass roots, impacting plant N nutrition and growth [56]; [57]. The present study demonstrated (in absolute values) a greater nitrate accumulation relative to ammonium. These are important values because the use of absorbed N can vary according to the proportion of $\text{NO}_3^-/\text{NH}_4^+$. To be used, nitrate needs to be reduced in an energy-dependent process that is mediated by nitrate reductase and nitrite reductase enzymes, whereas ammonium does not require this step to be assimilated [37]. Despite this high energy demand for nitrate utilization, plant growth is better when supplied with nitrate compared to ammonium [58].

Although the differences were not significant relative to the other bacteria or to the positive control treatment, inoculation with *P. fluorescens* had the highest P accumulation in the first cuttings, which was higher than the other treatments. These data might be attributed to the reports that *P. fluorescens* may increase the available P through the mineralization of organic phosphates from phosphatases or the solubilization of inorganic phosphates and organic acids [59]. [60] reported that each strain of *P. fluorescens*

secretes different amounts of organic acid, which directly influences phosphate solubilization and promotes plant growth. As we mentioned before, *P. fluorescens* CCTB 03 has the capacity of phosphate solubilization *in vitro* (unpublished data).

In general, the accumulation of micronutrients was positively affected when the plants were inoculated with PGPB. The bacteria significantly increased the accumulation of Mn, Fe and Zn relative to the control treatment with N. The higher accumulation of these nutrients might be attributed to increases in root biomass, allowing higher uptake to these nutrients. Other reported microbial mechanisms could also be involved, such as the synthesis of siderophores, but they have not been investigated yet in the strains used in this study. For example, *Pseudomonas* can produce siderophores, that bind to Fe with a high affinity [61]; [62], allowing the utilization of this nutrient for its growth, and also conferring competitiveness advantage in relation to other microorganisms [63]. Some plants can take advantage of the bacterial Fe-siderophore complex, making it available to plant growth [64]. Zn is one of the most limiting micronutrients to forage grass yields, participating in important processes as photosynthesis, synthesis of tryptophan, and processes to maintain the integrity of bio membranes [65]. Increases in Zn content of inoculated plants *P. fluorescens* CCTB 03 could also result from higher root biomass.

As expected PGPB were not able to replace N fertilization. However, when combined N-fertilizer, the PGPB increased yield, the relative chlorophyll index, and the uptake of N, NH_4^+ , Ca, Zn, Mn and Fe of Zuri Guinea grass. This result indicates that PGPB can be a sustainable alternative for reducing the use of N-fertilizers. There were no effects of re-inoculation with PGPB on the nutrition or yield of Zuri Guinea grass, demonstrating that the determination of the method of application and periodicity of inoculation still require investigation.

5. ACKNOWLEDGMENT

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APPENDIX

	P resin	– M.	O. pH	K	Ca	Mg	H+Al	Base Sum
Treatments	mg/d m ³	g/d m ³	CaC 12	mmolc /dm ³	mmolc /dm ³	mmolc /dm ³	mmolc /dm ³	mmolc /dm ³
	23.0	26.	5.20	2.90	25.0	17.0	28.0	44.9
First Soil Analysis		0						
Negative control (without N and inoculation)	29.2	19.4	5.48 a	0.86 a	23.8	18.2	20.0 b	42.8
Positive control (with N and without inoculation)	41.8	20.4	5.44 a	0.64 b	28.0	20.2	20.8 b	48.8
<i>A. brasilense</i> Ab-V5+Ab-V6 - N	30.8	20.0	5.48 a	0.92 a	24.8	18.8	20.4 b	44.5
<i>A. brasilense</i> Ab-V5+Ab-V6 + N	35.6	20.2	5.36 b	0.72 b	24.2	16.6	23.6 a	41.5
<i>A. brasilense</i> Ab-V5+Ab-V6 + N + reinoculation	35.8	21.0	5.42 a	0.70 b	24.6	17.4	21.2 b	42.7
<i>P. fluorescens</i> CCTB 03 - N	38.2	22.0	5.44 a	1.00 a	24.8	18.2	21.2 b	44.0
<i>P. fluorescens</i> CCTB 03 + N	34.4	21.4	5.32 b	0.62 b	24.0	16.2	21.6 b	40.8
<i>P. fluorescens</i> CCTB 03 + N + reinoculation	42.2	20.2	5.28 b	0.68 b	26.0	16.2	23.4 a	42.8
<i>R. tropici</i> CIAT899 + <i>A. brasilense</i> Ab-V6 - N	33.8	19.8	5.42 a	0.94 a	24.6	18.0	20.4 b	43.5
<i>R. tropici</i> CIAT899 + <i>A. brasilense</i> Ab-V6 + N	43.6	20.4	5.4a	0.68 b	25.6	17.2	21.6 b	43.4
<i>R. tropici</i> CIAT899 + <i>A. brasilense</i> Ab-V6 + N + reinoculation	37.6	20.2	5.42 a	0.60 b	25.4	16.4	20.8 b	42.4
		0.6	0.00					
P value	0.727	84	7	0.001	0.333	0.157	0.042	0.409

Table 3 - Soil chemical attributes at the start and last of the experiment.

Means followed by lowercase letters differ for treatments as determined by the Scott-Knott test ($P < 0.05$).

Table 4 - Soil chemical attributes at the start and last of the experiment.

Treatments	Base							
	S	CTC	Saturation	B	Cu	Fe	Mn	Zn
	mg/d	mmolc/		mg/d	mg/d	mg/d	mg/d	mg/d
	m ³	dm ³	%	m ³	m ³	m ³	m ³	m ³
First Soil Analysis	19.0	72.9	62.0	0.55	1.2	111.0	9.9	3.5
Negative control (without N and inoculation)	9.8	62.8	68.0 a	0.24 b	1.0	60.0	3.6 c	1.7 b
Positive control (with N and without inoculation)	9.6	69.6	70.2 a	0.30 a	1.0	64.2	4.1 c	2.3 a
<i>A. brasilense</i> Ab-V5+Ab-V6 - N	7.0	64.9	68.4 a	0.25 b	1.0	60.0	3.8 c	1.8 b
<i>A. brasilense</i> Ab-V5+Ab-V6 + N	5.2	65.1	64.0 b	0.28 a	1.1	63.2	4.0 c	2.3 a
<i>A. brasilense</i> Ab-V5+Ab-V6 + N + reinoculation	5.4	63.9	66.8 a	0.26 b	1.1	69.4	4.9 b	2.4 a
<i>P. fluorescens</i> CCTB 03 - N	9.8	65.2	67.6 a	0.27 a	1.1	63.6	4.0 c	2.0 b
<i>P. fluorescens</i> CCTB 03 + N	5.2	62.4	65.0 b	0.25 b	1.1	61.4	4.1 c	2.2 a
<i>P. fluorescens</i> CCTB 03 + N + reinoculation	5.4	66.2	64.0 b	0.29 a	1.1	71.0	4.2 c	2.5 a
<i>R. tropici</i> CIAT899 + <i>A. brasilense</i> Ab-V6 - N	6.0	63.9	68.2 a	0.27 a	1.1	63.2	4.0 c	1.9 b
<i>R. tropici</i> CIAT899 + <i>A. brasilense</i> Ab-V6 + N	3.8	65.0	66.6 a	0.29 a	1.1	67.8	5.2 a	2.4 a
<i>R. tropici</i> CIAT899 + <i>A. brasilense</i> Ab-V6 + N + reinoculation	6.6	63.2	66.8 a	0.28 a	1.0	75.4	6.3 a	2.3 a
<i>P value</i>	0.57			0.02	0.71	0.27	0.00	0.04
	4	0.629	0.019	0	8	0	1	3

Means followed by lowercase letters differ for treatments as determined by the Scott-Knott test ($P < 0.05$).

Prospecting the Impact of New Business based on Project Keywords

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Abstract

In this paper we present and use the ITW-Index – this name was given in reference to the term Technology Watch, which is a technique of observation, analysis and identification of possible opportunities and threats, linked to the method of technological forecasting called Monitoring and Intelligence Systems. The purpose of TW-Index is to provide the user the capacity of monitoring and identifying whether certain terms which are used for defining a technology or research are currently been searched and used in the Internet. For this, we used as a basis the Google Trends. So, in this paper we present three contributions: (i) the concept of the TW-index, (ii) options for evaluating and getting a value for the TW-index applied in two different examples, and (iii) we measure and explain the means of TW-index when it is applied in two ideas for creating new business into the IdeaLAB program at University of Minho, Portugal.

Keywords- *Technological forecasting, Technology Watch, Intelligence Systems, Google Trends, Business and Research.*

1. INTRODUCTION

In today's world, where companies and institutions compete daily to stay ahead of their competitors for business success, efforts are being made to gain competitive advantage [7] [8]. In order to deal with uncertainties and seek a more prosperous future, technology prospection techniques have proven to be an effective alternative to achieve satisfactory results. According to Coelho (2003, p. 1) "Although the future is uncertain, there is evidence that systematic attempts to gain perspective on the present and possible future situations have been helpful."

So, technological prospecting studies seek to add value to present information, helping in decision making. The purpose of prospecting studies is not to unravel the future, but to delineate and test possible and desirable visions, allowing choices that will contribute positively to building the future. Such visions can help to generate long-term policies, strategies and plans that provide likely and desired future circumstances in close alignment (MAYERHOFF, 2008, p. 7).

For Coelho (2003, p. 84) "technological prospection cannot and should not be made focused solely on technology, but also to try to anticipate and understand the social, environmental, economic and political factors that interact with it". With this in mind, the potential of technological prospection, which emerges as a strategic planning tool, is capable of monitoring and making decisions that impact positively in the face

of the globalized world and the increasingly competitive market.

With the increased competitiveness, organizations have sought to anticipate innovations and changes in the market. To succeed, they have invested in technology prospection methods that underlie the choices and decision-making for structuring a desirable future.

In this sense, knowledge and use of indices that measure the impact of an idea or technology or research is relevant, thus helping organizations that want to conduct a prospective study focused on trend analysis, identifying terms that are prominent in order to subsidize their actions. looking for a possible successful investment [1][3].

Thus, this paper presents three contributions: (i) presents the creation of a new index, call for us as, ITW Index, which allows quantifying how much a subject of a technology or scientific research or idea for a new business is being sought by people on the Internet, or in the world or in a particular region or country, and (ii) mechanisms to obtain the value of this index either manually or by using a web application that assists in the exploration of technologies using the TW-Index index for identification and monitoring of research and technology subject trends; and (iii) analysis of two ideas to create two new businesses within the IdeaLAB program of the University of Minho, in Braga and Guimaraes, Portugal, using the TW-Index.

To achieve the objectives of this work it was necessary to carry out a theoretical study on technological prospection, knowing existing works and tools that could support the development of the application. In addition, for the software development stage, it was necessary to use several technologies and the implementation of new features, aiming to make the application more interactive and complete. This enabled us to test and validate the WEB application and the index concept, applying it to two new business ideas, one dedicated to environmental management consulting, and the other to adding virtual reality technology in museums.

The remainder of this article is organized into five sections, part 2 devoted to presenting the concept of the TW-Index index, section 3 presents options for obtaining the value of the TW-Index index, section 4 presents the use of the TW-Index. in two new business ideas, and finally section 5 presents the conclusions and ideas for future work.

2. CONCEPTS OF ITW-INDEX

In this article we present the TWI or TW-Index (Technology Wathing Index) index. This index gives a score from 0 to 100, and allows you to measure how a particular technology, described by your keywords, is being sought by people on the world wide web (Internet). The main idea is for anyone to evaluate a subject using keywords. To get a quantifiable number, we designed a robot that searches these subjects on the Internet, and for each keyword you enter, you see how that word is being used and searched by people in a particular region, country, or continent. Similar to Google Trends, we look at how this subject appears over a period of time, and we continue it over time. Google Trends [4] is a free tool that allows you to track the evolution of a keyword's number of searches over time through a graph.

The creation of ITW-Index was mainly inspired by this tool, as it allows the discovery of current trends, showing if a particular term is highlighted and its evolution over time.

Figure 1 shows the search for a particular term using the Google Trends tool. In this example we observe the trend of the term “Business Intelligence and Technology” in the last year period (counted before the

date of the search for this term, made on 12/12/2019). This way, besides observing the search behavior, it creates a value from 0 to 100, for each research day, and its evolution over time. The maximum value (100) is obtained when a maximum number of people in this specified period searches the term on the Internet. The other values are relative to this maximum. Thus, the index will be 50% which represents half of the (maximum) value found. Thus, the index offers that demand on that day was 50%. This is done for each day within a certain period of time.

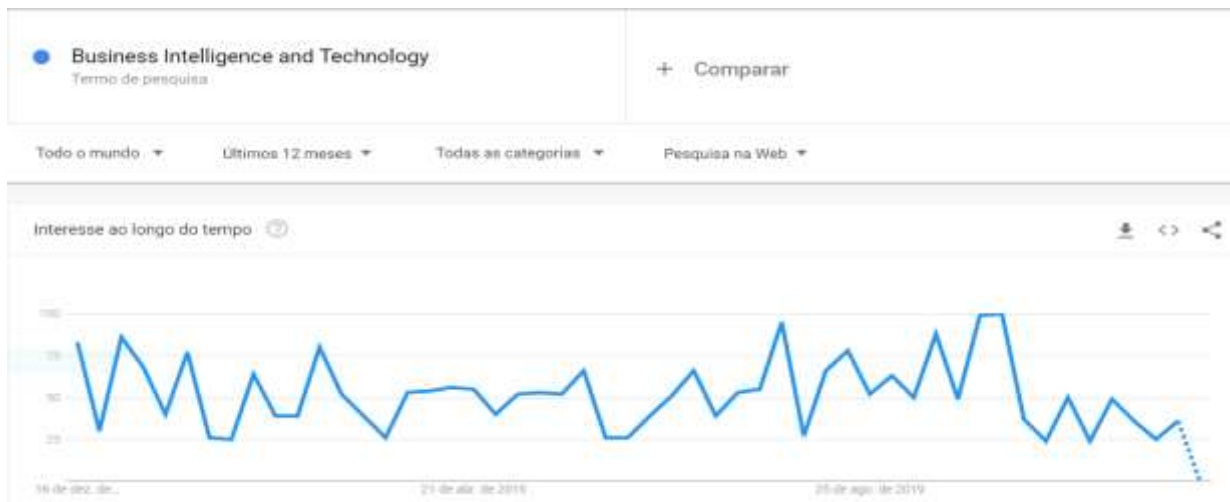


Figure 1 – Behavior of term “Business Intelligence and Technology” using Google Trends

Our ITW-Index index gives a value from 0 to 100, being the arithmetic average of the demand of each searched day. In this article, we think it might be of interest to look at this demand in the last week, last month, or last year. That way we can set an index by week, by month, or by year. We call them, respectively, ITW-I week, ITW-I month, and ITW-I year.

The main contribution of this article is to create a number that quantifies the demand for a given subject using this ITW-index. We calculate the subject's TW-Index as the geometric average of all TW-Index indices for all keywords describing a particular technology or research or new business idea.

In our view, this index can be used to measure the impact of a given survey. The ITW-Index can be used to assess the impact of works derived from scientific research (PhD Theses, Master's Dissertations, Course Completion Papers, Scientific Reports, Technical Reports, etc.), or in the business and business world (for evaluate patents, software registrations, products, services, etc.), or Technological Prospecting on the valuation of ideas and their impact on the market (measured as the amount of people looking for information in the terms that define the new product or service).

In this paper we present the ITW-Indexes for two proposals, two new ideas presented in the IdeaLAB project of the University of Minho (Portugal) [9], here called Green Startup, and the other as Blue Startup. Green wants to offer specific Environmental Management Consulting, and Blue wants to add virtual reality technology to museum's products and services.

3. CALCULATING THE ITW INDEX

The index proposed here can be obtained in two ways. The first one is by hand, where each interested person should follow these steps:

- (1) Login to google trends website (<https://trends.google.com.br/trends>);
- (2) Configure with the desired information, for example, enter which country or region you want to analyze, what period you want (1 year, 1 month, 1 week), what kind of information to look for on the Internet (all options, images, etc.);
- (3) Enter the keyword, and wait for the results. Here you can visualize a graph similar to the one in figure 1;
- (4) Analyze the data from this graph. It can be done manually. To calculate the ITW index proposed in this article, an interested user must export the results to a file;
- (5) Analyze the file data. This must be done for each keyword. Then generate the index and make the graphs.

This process is time consuming and must be done manually. For better data search and analysis, we propose a WEB-based software that makes the entire previous process more automated.

The tool can be viewed in four (4) parts: presentation pages (contains basic tool information); authentication pages (to assist users in registering and recovering their password); administration pages (to assist administrators, the application has pages where you can view data entered by users, as well as add, modify or remove other types of data that are stored in the application), and finally system pages (which request the information and provide the results of the analysis based on the keywords).

To use this software on a local machine, can make a download and install it into local machine, using the code available in Moreno (2019). After correct installation seems one page similar to Figure 2.



Figure 2 – First page after correct setup of WEB-based software

4. CASE STUDY – BLUE AND GREEN STARTUPS

In this article we present the example of applying the ITW index on two business creation options. BLUE wants to open a field by consulting in environmental management, and GREEN wants to add virtual reality technology to museum presentations.

For BLUE, she outlined her new product / service with 11 keywords, in Portuguese, (1) arqueologia virtual, (2) reconstituição arquitetônica, (3) realidade aumentada, (4) realidade virtual, (5) visualização 360, (6) Digital Tourism, (7) Virtual heritage, (8) Gamefication, (9) Turismo cultural, (10) Imersivo, and (11) Interativo.

They intend to open the market only in Portugal, for this reason analysis was made only for that country and in the world, and using Keywords in Portuguese, see behavior in Figure 3.

Our assessment detects that the keywords “gamefication”, “architectural reconstitution”, “virtual archeology”, “360 visualization”, and “virtual heritage” returned ITW = 0 (see Figure 3 and 4).

Again, this indicates that in this country, people are not looking for information with these words, and therefore there is possibly no interest in these products / services. This is a good indication for the entrepreneur, as he should think better about the market strategy for his product in this country, or invest less in the technical qualities of his product that have or use these words. It also indicates that you should consider inserting better marketing strategies of your products in this country.

In the case of BLUE, the ITW index for worldwide searches was 38, and for Portugal it was 22. In the case of the words “architectural reconstitution” and “360 visualization”, an ITW = 0 value was also obtained for searching the world. This causes the overall ITW index to be lower than the ITW. Thus, when the ITW-0 index is lower than the general ITW index, an alert is generated for the entrepreneur, as it indicates that there are no interests in the world or region searching for these terms, and this may indicate that there is no market for your products / service with these descriptions.

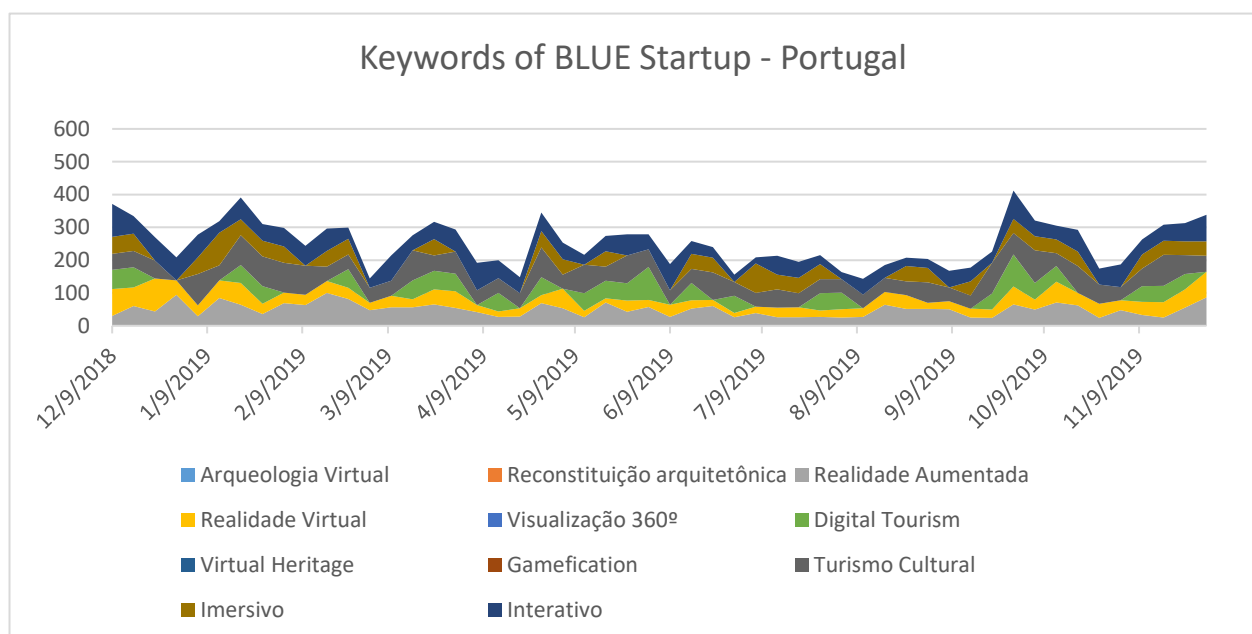


Figure 3 – Behavior of ITW index for 11 keywords of BLUE Startup

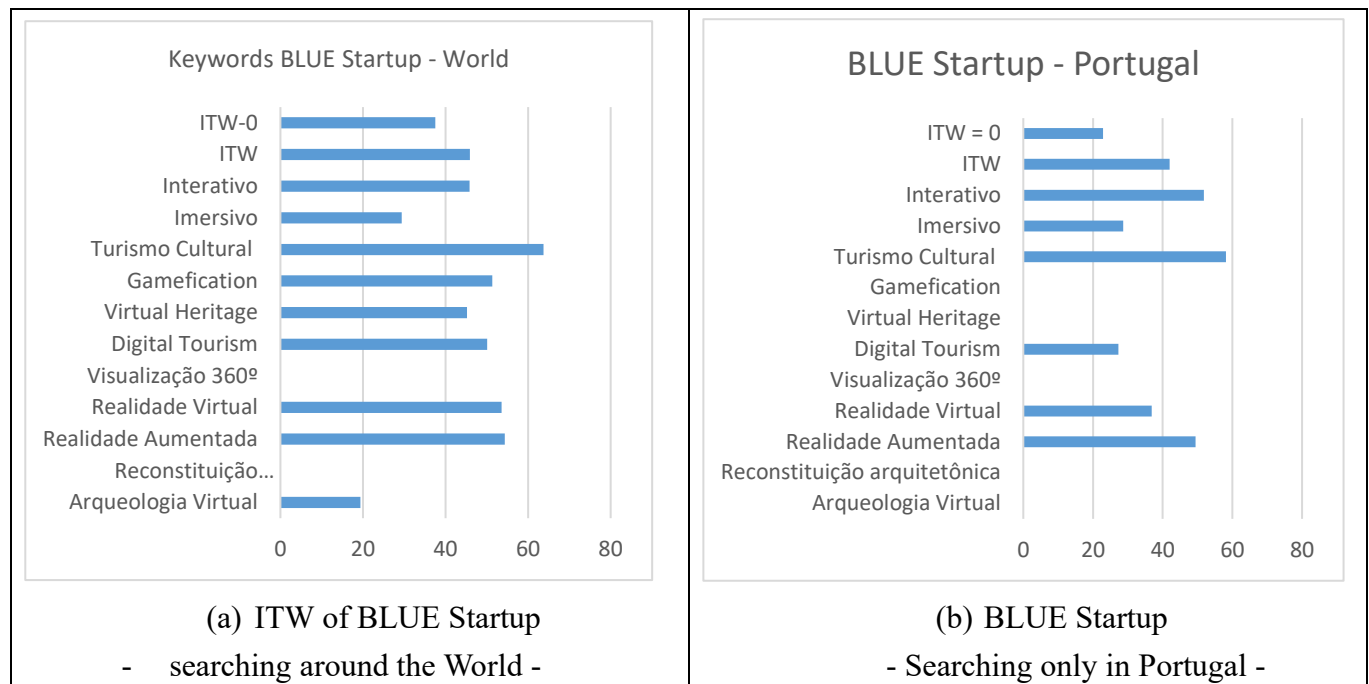


Figure 4 – ITW Index for BLUE Startup using keywords in Portuguese

On the other side, GREEN has characterized its new product / service with 9 keywords. The keywords used are: (1) gestão participativa, (2) responsabilidade socioambiental, (3) Analise de dados, (4) Tomada de Decisões, (5) Gestão Pública, (6) Mediação de Conflitos, (7) Participação Cidadã, (8) Estudos Sociológicos, and (9) Consultoria.

They intend to open markets in the countries of Portugal and Brazil, Spain and Colombia, for this reason the index analysis was made using the keywords in Portuguese (see Figure 5) and Spanish (see Figure 6). The assessment was made for these four countries, as well as searching the world (with Portuguese words), as shown in figures 5 and 6. In these figures you can see that some words gave a return of 0 (zero), this indicates that there are no people interested in these issues, which could indicate that there is no market, or that entrepreneurs should be careful with their product in these countries, or that you should think of some different marketing strategy so that there will be interest in your products.

In the case of GREEN, our index suggests that there would be a better market in Brazil than in Portugal.

In the case of GREEN, our assessment using the ITW index suggests that their market would be equivalent in Spain and Colombia (ITW indices of 34.04, 34, 93). In the world this index gave a value of 58.82, and in Portuguese it was 51.85 (see data in the following table I). Table I shows the values of the ITW indexes evaluated for the Startup GREEN, for different periods (1 year, 1 month, 1 week). These indices change, as they track Internet searches for a given subject in a given period.

We think it is best to consider a period of 1 year to get an idea of how the interests of a given subject happen. We also consider it important to follow up over a period of one year, to observe periods when there are high and low values, and to observe and analyze why these behaviors.

Comparing the indices for BLUE and GREEN companies evaluated here, our index suggests that GREEN (environmental management consultant) may have a better market than BLUE's desired product.

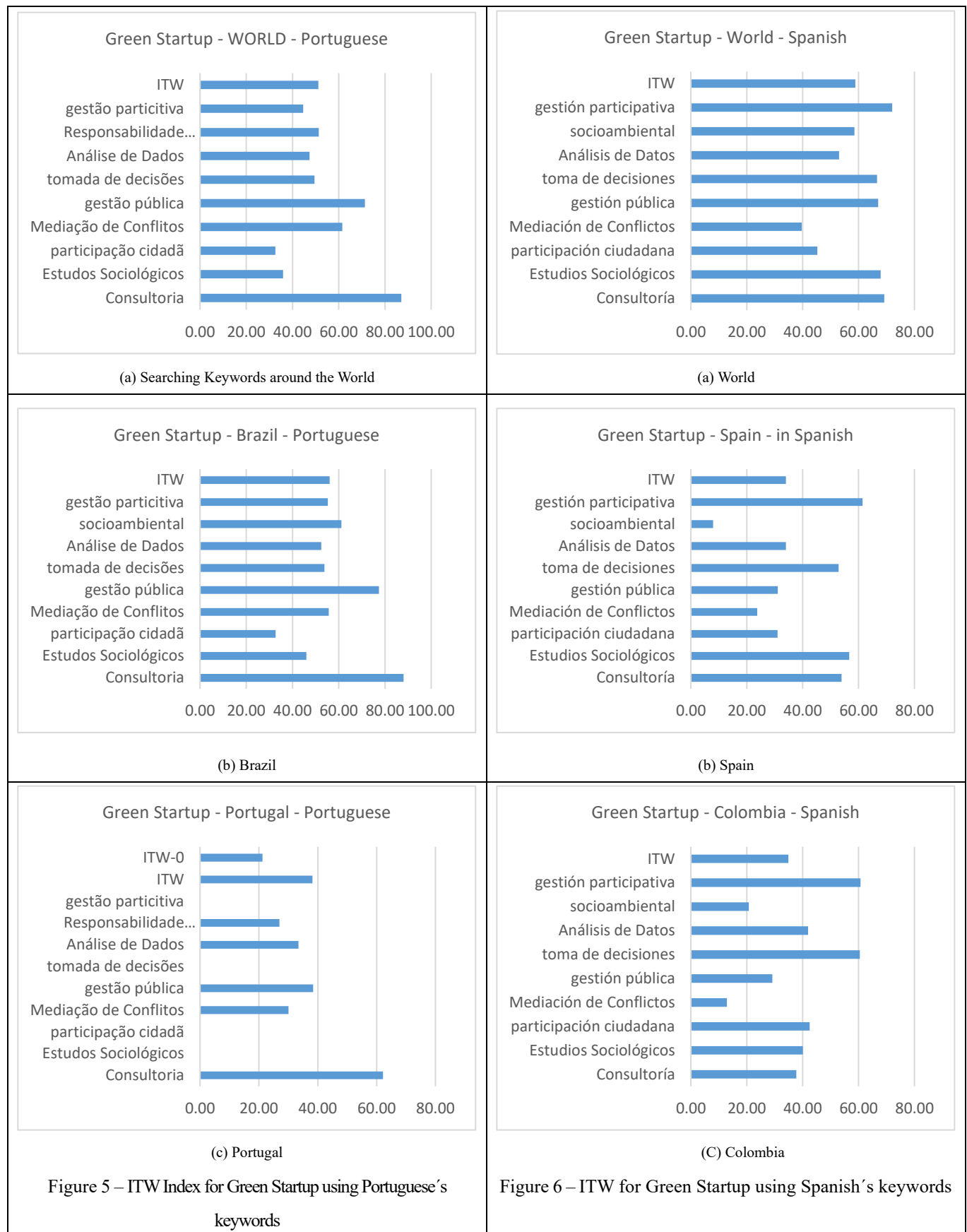


Table I - Summary of ITW Values for GREEN Startup

Portuguese	Year	Mont	Week	Spanish	Year	Mont	Week
World	51,85	61,59	82,98	World	58,82	69,75	66,92
Brazil	56,02	65,38	66,01	Spain	34,04	43,79	33,73
Portugal	21,23	18,36	37,33	Colombia	34,93	39,99	34,72

5. CONCLUSIONS

This paper introduces the concept of a new index, called the ITW index, an index that measures the impact of a particular technology or research subject by measuring the amount of Internet searches for the key terms that characterize a particular product / service.

This index is based on information generated by Google Trends. The article also presents a way to calculate this index for any keyword, which can be calculated manually by accessing Google Trends, or automatically using a web tool that facilitates evaluation. Finally, the article presents an example with two new business ideas, and using the data from the new index, it can be concluded that the GREEN business has more market potential than the BLUE business, and the GREEN business has more opportunities in Brazil, Spain and Colombia than in Portugal.

So, the ITW-Index emerges as a technology-driven aid application, and can be used to quantify market possibilities in a particular country for a particular product or service, and also helps to take special care of some terms that will define or will define. the product / service.

As future work, we would like to suggest the following points: improve the Web tool by allowing new functionality and analysis, as well as validating the impact of the proposed index (the TW-index) so that it has greater mastery of what it actually represents in prospecting technologies and researches, and measure the impact of new products and services as new business.

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IMPROVEMENT PERFORMANCE OF HATCHERY DUE TO THERMAL EGGS HANDLING

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Abstract

The objective of the experiment was to evaluate the influence of thermal manipulation on the improvement of hatching eggs of different weights of laying breeder hens in the last embryonic stage. The experiment was carried out in a commercial hatchery of laying breeder hens, located in Birigui - SP, Brazil. 1950 light-colored eggs of the Dekalb White commercial strain were used. The eggs were classified among different sizes and n in hatching trays. In the period from 19 to 21 days, two hatching machines were used, where the first machine maintained the temperature and humidity values of the hatchery's standard air (37.0 ° C and 60% RH) and in the second machine the temperature was adjusted to 37.7 ° C with 60% RH. The treatments differed according to the residence time in the second machine, and egg weight (G and M) controls T1 (0h-G) and T6(0h-M), 1 hour T2(1h-G) and T7(1h-M), 3 hours T3(3h-G) and T8(3h-M), 6 hours T4(6h-G) and T9(6h-M) 9 hours T5(9h-G) and T10 (9h-M). The design was completely randomized, in a 2X5 factorial scheme. Regarding thermal stimulation, the best results were observed in the 1h-G treatment. However, in the productive life of these birds, the thermal stimulation showed no influence. Concluded that for large eggs (G), the residence time of 1 hour (T2), obtained a better index of commercially viable females and lower rates of late-stage embryo mortality and shelter.

Keywords: epigenetics, thermal stress, animal welfare, posture.

1. INTRODUCTION

In the last decades in poultry farming, there has been a great increase in productivity, compiled to the pillars of nutrition, sanity, and genetic improvement. However, it is reported in the literature a high mortality and fall in poultry productivity due to heat stress [1];[2]. Concomitant to this fact, it is noticed that the climate undergoes changes and the animals will have to undergo adaptations to global warming.

These results suggest that there is an increase in the prevalence of climatic phenomena known as heat waves ([1];[2], which relate a combination of factors such as high temperature and relative humidity and absence of ventilation, and these are related to the mortality of commercial laying hens) [1].

Facing this challenge, studies to acclimatize birds at high environmental temperatures, through embryonic thermal manipulation or also called epigenetic temperature adaptation [3];[4] are being developed. This procedure alters the points of thermoregulation of birds, and it is necessary that changes in the temperature of the prenatal body occur during the critical periods of embryonic development, making the thermoregulatory function more flexible, and improving the performance in responses to the variation of temperature of the birds [5]; [6].

Thus, the objective of the study was to evaluate the influence of thermal manipulation on the productivity of hatching eggs of different laying breeder hens weights in the last embryonic stage.

2. LITERATURE REVIEW

In order to perform embryonic thermal manipulation, three important factors must be considered: (A) the sensitive embryonic period, where this factor can vary between the beginning of the hatching until the moment of hatching; (B) Temperature intensity, which can be positive or negative in relation to the standard temperature; and (C) Embryo exposure time to temperature change [3];[7].

To evaluate the effects of the different treatments on the embryo development stage, several protocols have been studied [8];[9];[10];[11];[12];[13];[14];[15];[16]. In these studies, the sensitive period was maintained in the intermediate phase of embryonic development, however, with changes in temperature intensity and time of exposure.

Following a different protocol, [5] reported that the period of exposure during the late embryonic stage developed greater resistance to heat stress during adult life.

Reported in a thermal manipulation study that in the commercial poultry industry [17], the hatching process of fertile eggs is performed and commercially distributed, where the optimization of chick production does not only imply in the hatching of fertile eggs but in high productivity in a sustainable manner, including the hatching yield of healthy chicks with high survival rates and maximum expression of their genetic potential under any conditions.

In this line of research, [18] evaluated the embryonic development of the Ross lineage, thermally manipulating the embryonic development in a period of 14 to 18 days, verifying that the thermal manipulation did not increase the embryonic mortality and observed improvements in chick quality.

With thermal manipulation protocol during the last phase in the incubator and in the hatchery [5], reported effects on hatching productivity as improvements of 1.5% hatch rate. Thus, forms of changes in the hatching process must be researched to develop improvements and make the process more efficient in

the embryonic development as in the productive life of the bird [19]; [18]; [20].

3. MATERIAL AND METHODS

The study was conducted in a commercial hatchery, certified by the Committee of Ethics in the Use of Animals (CEUA), of the Animal Science Course, São Paulo State University (UNESP), Faculty of Agricultural and Technological Sciences, Dracena/SP under the No. 11/2016 in accordance with the ethical principle of animal experimentation.

The study was carried out in a commercial hatchery of laying breeder hens, located in Birigui-SP, in the "latitude of 21°16'53" south and longitude 50°19'35"west, an altitude of 406 meters, with climatic classification according to Koppen Wa.

For the experiment, 1950 light-colored eggs of the commercial Dekalb White® lineage were used at 39 weeks of age, produced on the same day, and incubated after 3 days of storage. These eggs were classified in the Yamasa® CHS 54 machine with egg weight ranging from 53g to 58g (M), and 59g and 64g (G), totaling 975 eggs of each weight, automatically allocated in hatching trays acclimated for 2 hours before the standard hatching process of the hatchery until the 18th day of embryonic development.

The eggs were incubated in the CASP CM® machine, with multiple hatching phase, where the thermostat was set to keep the temperature constant at 36.5 °C and 60% relative humidity. The temperature control was regulated through sensors built to operate in the range of 21.1 °C to 43.3 °C (70 to 100 °F), calibrated by the system through a high precision thermostat.

In the period from 18 to 21 days, two CASP® machines were used, positioned frontally to the central corridor. In the first machine, standard temperature and relative humidity of the hatchery were maintained (37.0 °C with 60%) and in the second machine, the temperature was adjusted to 37.7 °C with 60% RH. Adapting this to the protocol used by [5] for the thermal manipulation of the embryos in the last phase of embryonic development.

For the experiment, a completely and randomized design with 2x5 factorial design (2 egg weights and 5 exposure periods) was used (Table1).

Table 1 - Exposure Period at 37,7°C

Treatment	Thermal maintenance hours/37,7C°	Standard temp. hours/37,0C°
T1/G	0	24
T2/G	1	23
T3/G	3	21
T4/G	6	18
T5/G	9	15
T6/M	0	24
T7/M	1	23
T8/M	3	21
T9/M	6	18
T10/M	9	15

Source: Elaborated by the authors.

In the first selected machine the temperature and relative humidity of the hatchery were maintained (37.0 °C with 60%) and in the second selected machine, the temperature was adjusted to 37.7 °C with 60% RH. The treatments were differentiated according to the length of stay in the second machine and egg weight (G and M), for the control groups T1 (G) and T6 (M) 0 hours, T2 (G) and T7 (M) 1 hour, T3 (G) and T8 (M) 3 hours, T4 (G) and T9 (M) 6 hours and T5 (G) and T10 (M) 9 hours. The formation of the design occurred on the 18th day of hatching, where the eggs were transferred from the incubators to the delivery room and were distributed in 130 trays of births, with 15 eggs each, identified according to the treatment, thus making each tray an Experimental Unit.

The removal of the chicks from the hatchery machines occurred at 504 hours (21 days of hatching), following the standard hatchery process, starting with the transfer of the trays to the chick's room, where the number of live chicks and unhatched eggs from each tray were counted (experimental unit). The live chicks were referred to as the process of quality selection, sexing and vaccination. The quality selection process was carried out through a careful analysis of the birds, in which chicks with poor formation, low vitality, dehydration, leg problems, open navels, omphalitis, and neurological problems were discarded.

The sexing of the chicks was performed by a trained collaborator of the hatchery, using the primary feather method on the wings, chickens out of the hatchery quality standard and the male chicks were numbed by the CO₂ method, sacrificed according to the humanitarian method.

Vaccination of the chicks was performed by pneumatic machines, by subcutaneous administration to the posterior neck, where all the females that underwent the selection process were vaccinated against Marek's Disease and Gumboru's Disease and then sent to the transport sector for individual weighing of each chick.

For the weighing process, a digital scale of the brand Tanita® model 1475, with a scale of 1g, was used, where all the birds had their weight checked individually and recorded according to their treatment and replication.

The unhatched eggs were identified and sent to the embryo diagnostic room, where they were opened to diagnose the embryonic mortality stage and calculate the fertility rate.

For the differential diagnosis of the mortality phase, the methodology was used to establish the moment when the incubation process was interrupted or if it was an infertile egg and these data were recorded in a specific worksheet.

The following phases were considered hatching failures in the embryo diagnosis: fertility rate (%), embryo mortality rate (TME) in the early and intermediate stages (0 to 18 days), late-stage mortality (18 to 21 days).

The fertility rate was calculated to determine the exact number of fertile eggs incubated, differing from the influence of variables of the egg production sector, with the hatching process. In this way, the fertility rate was used to determine the number of fertile eggs submitted to thermal stimulation (Equation 1).

Fertility rate (TF).

$$TF = (NOTI - NOI) / NOTI * 100 (\%) \quad \text{Eq.1}$$

Where: TF = Fertility rate, NOTI = number of total incubated eggs, NOI = number of infertile eggs.

To determine possible problems in the incubators or in the hatching process, the embryonic mortality rate was calculated for the period of 0-17 days of hatching (Equation 2).

Embryonic mortality rate (TME).

$$\text{TME} = \text{NEM} / \text{NOTI} * 100 (\%) \quad \text{Eq.2}$$

Where: TME = Embryo mortality rate, NOTI = number of total incubated eggs, NEM = number of dead embryos

The fertility rate and mortality rate from 0-17 days of hatching were used to determine the exact number of fertile and viable eggs that underwent thermal stimulation from the 18th day of hatching.

In addition to these variables, hatching rate, number of viable eggs for treatment (NOVT) in (%), productivity of commercially viable females on total incubated eggs (PFCT) in (%), commercially viable females on viable eggs (PFCV) in (%), rejected chicks plus embryonic mortality in hatching of 18 to 21 days (PRME) in (%) for total eggs and for viable eggs, were also evaluated.

The hatching rate determines the number of birds of both sexes, which hatched in relation to the number of incubated eggs, (Equation 3).

Hatch Rate (TE).

$$\text{TE} = \text{NOE} / \text{NOTI} * 100 (\%) \quad \text{Eq.3}$$

Where: TE = Hatching rate, NOE = number of hatching eggs, NOTI = number of total incubated eggs

The form of calculation of the number of viable eggs for the treatment (NOVT) is shown in Equation 4.

The number of viable eggs for treatment (NOVT).

$$\text{NOVT} = \text{NOTI} - (\text{NOI} + \text{NEM from 0 to 17 days}) \quad \text{Eq.4}$$

Where: NOVT = Number of viable eggs for treatment, NOTI = Total number of incubated eggs, NOI = number of infertile eggs, NEM = number of dead embryos

The number of viable eggs submitted to treatment (NOVT) was used to avoid that variables such as; fertility rate and embryonic mortality from 0-17 days of hatching, influenced the production results of commercially viable females.

The rate of productivity of commercially viable females (PFCT), considered a variable of great importance for hatchery incubators, was also calculated in Equation 5.

Production of commercially viable females on total incubated eggs (PFCVT).

$$\text{PFCVT} = (\text{NFCV}) / \text{NOTI} * 100 (\%) \quad \text{Eq.5}$$

Where: PFCT = Production of commercially viable females on eggs, NFCV = number of commercially viable females, NOTI = number of total incubated eggs

To determine the influence of the treatments on the productivity of commercially viable females

without the influence of egg fertility and embryonic mortality of 0-17 days, the percentage of the productivity of commercially viable females was calculated on the number of viable eggs with 18 days of hatching (PFCV), (Equation 6).

Productions of commercially viable females on the number of viable eggs with 18 days of hatching (PFCV).

$$\text{PFCV} = (\text{NFCV} / \text{NOVT}) * 100 (\%) \quad \text{Eq.6}$$

Where: PFCV = Production of commercially viable females on the number of viable eggs, NFCV = number of commercially viable females, NOVT = number of viable eggs.

Equations 7 and 8 show the calculation of the rate of rejected chicks and late mortality in the hatching of 18 to 21 days (TPRMT) for total eggs and for viable eggs (TPRMV) respectively.

Rates of the number of rejected chicks and embryo mortality from 18 to 21 days, on the number of eggs incubated (TPRMT).

$$\text{TPRMT} = (\text{NPR} + \text{NEM from 18 to 21 days}) / \text{NOTI} * 100 (\%) \quad \text{Eq.7}$$

Where: TPRMT = Rate of sum of rejected chicks and number of dead embryos from 18 to 21 days over total number of incubated eggs.

NPR + NEM = number of rejected chickens + number of dead embryos from 18 to 21 days, NOTI = number of incubated eggs.

Rate of the rejected chicks sum and embryo mortality from 18 to 21 days, on the number of viable eggs (TPRMV).

$$\text{TPRMV} = (\text{NPR} + \text{NEM de 18 a 21 dias}) / \text{NOVT} * 100 (\%) \quad \text{Eq.8}$$

Where: TPRMT = 'Rejected chicks' sum and embryo mortality rate from 18-21 days on the number of viable eggs, NPR + NEM = number of chicks rejected + number of dead embryos from 18 to 21 days, NOVT = number of viable eggs.

Data analysis

For the variables studied, comparisons were made between the control treatment and the treatments with better results, through an accurate Binomial test (95%), totalizing 13 replicates per treatment, 130 trays. Comparisons were made respecting the sizes of the eggs (MinitabStatistical Software – version 18).

4. RESULTS AND DISCUSSION

It was not identified, from 0-17 days of hatching, the influence of treatments for infertile eggs, fertility rate, embryonic mortality rate, the sum of infertile eggs + embryonic mortality. The same behavior was observed for the number of viable eggs with 18 days of hatching (Table 2).

Table 2 - Variables not influenced by the treatments: infertile eggs, fertility rate, embryonic mortality 0-17 days hatching, Embryonic mortality rate 0-17 days, the sum of infertile eggs + embryo mortality 0-17 days and number

of viable eggs with 18 days.

	<i>0h-G</i>	<i>0h-M</i>	<i>1h-G</i>	<i>1h-M</i>	<i>3h-G</i>	<i>3h-M</i>	<i>6h-G</i>	<i>6h-M</i>	<i>9h-G</i>	<i>9h-M</i>
NOI (eggs)	12	7	11	10	11	7	7	10	9	12
TF(%)	93,85	96,41	94,36	94,87	94,36	96,41	96,41	94,87	95,38	93,85
NEM 0-17 days (Eggs)	7	10	6	9	10	18	10	8	9	9
TME 0-17 (%)	3,59	5,13	3,08	4,62	5,13	9,23	5,13	4,10	4,62	4,62
NOI+NEM 0-17 days (Eggs)	19	17	17	19	21	25	17	18	18	21
NOV – 18 days (Eggs)	176	178	178	176	174	170	178	177	177	174

M= eggs (53g to 58g) G= eggs (59g to 64g). h: hours, NOI= Number of infertile eggs.

TF= Fertility Rate (%). NEM = Number of dead embryos TME= Embryonic mortality rate (%).

NOV= Number of viable eggs.

Source: Elaborated by the authors

These results corroborate with studies [24] who evaluated the effect of three sizes of small, medium and large (60g, 65g, and 70g) broiler breeders eggs on hatching and reported maximum fertility on small eggs (96.67%), followed by medium eggs (93.33%) and large (90.33%) eggs.

Reported [5] that in 6 hatching trials, with a total of 9,88 eggs of heavy matrices found mean fertility of these protocols of 94.7%.

In viable eggs submitted to thermal manipulation, (Table 3) It is perceived that smaller eggs (M) thermally manipulated for 6 hours, were the only ones who obtained favorable results in relation to the control group. However, recent studies have identified that pre-or post-hatching thermal manipulation may improve the thermotolerance of broiler chickens in the long term [3].

This fact demonstrates the importance of adapting the suggested protocols and the various physical characteristics of the eggs.

Table 3 - Embryo hatch rate

	<i>0h G</i>	<i>0h M</i>	<i>1h G</i>	<i>1h M</i>	<i>3h G</i>	<i>3h M</i>	<i>6h G</i>	<i>6h M</i>	<i>9h G</i>	<i>9h M</i>
NOE (Eggs)	173	175	172	169	168	169	170	178	170	171
NOTI (Eggs)	195	195	195	195	195	195	195	195	195	195
TE(%)	88,72	89,74	88,21	86,67	86,15	86,67	87,18	91,28	87,18	87,69
P-value			SEF	SEF	SEF	SEF	SEF	0,2846	SEF	SEF

The P-values are the result of the exact test based on Binomial Distribution, comparing the respective treatment against

the control, for eggs of the same size.

P-value ≤ 0.05 shows the effect on treatment. The values should be read in the column.

M=eggs (53g to 58g) G= eggs (59g to 64g), NOE= Number of hatched eggs, NOTI= total number of incubated eggs

TE(%)= Hatch Rate (%). SEF= no favorable effects, h: hours

Source: Elaborated by the authors

However, they did not present P value ≤ 0.05 , therefore without statistical evidence. In this variable, no relation was observed between thermal manipulation, egg size, and control group.

Close results were found by [21] who evaluated the influence of egg classification in the hatchery of heavy matrices with 25 to 60 weeks of age. They observed a hatching rate of 89.6% for eggs weighing 58g to 65g, but for eggs weighing between 52g and 57g the hatching rate was 87.1%, and this small difference may be related to the lineage of the matrices (laying and broiler breeder hens), age of matrices and differences in the hatching process.

In contrast, [5] found a high hatching rate in the embryos of the Ross 308 embryo. The authors thermally handled 30 to 50-week broiler breeder hens eggs in the final hatching phase (18 to 21 days of hatching) with two thermal manipulation protocols that obtained hatch rates above 94%.

The eggs of size (M), except for eggs stimulated for 1 hour, had lower embryonic mortality of 18 to 21 days (Table 4), indicating a favorable effect of the stimulated eggs with 3 hours, however, with a P-value of 0.196. For size eggs (G), the thermal stimulation did not show favorable effects in relation to the control group.

Table 4 - Embryonic mortality 18-21 or late mortality

	<i>0h G</i>	<i>0h M</i>	<i>1h G</i>	<i>1h M</i>	<i>3h G</i>	<i>3h M</i>	<i>6h G</i>	<i>6h M</i>	<i>9h G</i>	<i>9h M</i>
NEM 18-21 days (Eggs)	3	3	4	7	6	1	8	3	7	2
NOTI (Eggs)	195	195	195	195	195	195	195	195	195	195
ME 18-21 days (%)	1,54	1,54	2,05	3,59	3,08	0,51	4,10	1,54	3,59	1,03
P-value			SEF	SEF	SEF	0,1968	SEF	0,6472	SEF	0,4215

The P-values are the result of the exact test based on Binomial Distribution, comparing the respective treatment against the control, for eggs of the same size. P-value ≤ 0.05 shows the effect on treatment. The values should be read in the column.

M=eggs (53g to 58g) G= eggs (59g to 64g), NEM= Number of dead embryos,

NOTI= total number of incubated eggs, ME (18-21) % = Embryonic mortality 18-21 or late mortality (%),

SEF= no favorable effects, h: hours

Source: Elaborated by the authors

As one of the biggest challenges currently in poultry production is the thermal stress and its

consequences for the main zootechnical indexes, including mortality. There is indicative that the size of the eggs may have an influence on the protocol adopted. Verified by [22] that the thermal manipulations, with temperatures below the recommended for quails, delayed hatching and reduced birth weight.

Subtle changes (< 1.0 °C) in the hatching environment lead to important physiological changes in the physical fitness of the chick. Suggests by [23] that pre-hatch thermal manipulation has a greater influence on thermotolerance than post-hatch.

Thus, these changes found in thermotolerance due to the hatching environment, bring limitations in the performance and economic return of the whole system [16].

By [24] when evaluating eggs from three different sizes of heavy matrices, observed maximum embryonic mortality in the last phase ($P \leq 0.05$) during hatching in the group of large eggs (70g) followed by the group of eggs of medium (65g) and small (60g) size.

Thermally manipulating eggs of heavy matrices [12], during the period from 7 to 16 days of hatching, with a temperature of 39.5°C ($+ 2^{\circ}\text{C}$) and duration of 12 and 24 hours of elevation of temperature, reported that in the 60% of the embryos failed to perform complete hatching, compared to 33% and 23% in the 12-hour and control treatments respectively, reporting a negative effect on embryo development, due to the factors; temperature and time of exposure.

The treatment, referring to 1 hour of thermal stimulation in G eggs (Table 5), was more effective (P-value 0.033) in relation to the quality of hatched chicks. It was observed (Table 5) that the thermal stimulation of 1 hour in eggs (G), showed P-value 0.033, evidencing its favorable effect of the thermal stimulation, in relation to the quality of hatchlings. These results agree with [5], who evaluated the effects in 6 trials of thermal manipulation of 2 hours in the last 4 days of hatching in broilers, reporting clear signs of improvement in chick quality in relation to the control group.

Table 5 - Rate of the number of chicks slaughtered and the number of dead embryos in 18-21 days of hatching, in relation to the number of eggs incubated and viable with 18 days.

	<i>0h G</i>	<i>0h M</i>	<i>1h G</i>	<i>1h M</i>	<i>3h G</i>	<i>3h M</i>	<i>6h G</i>	<i>6h M</i>	<i>9h G</i>	<i>9h M</i>
NPR+										
NEM 18 to 21days (Chicks)	16	16	9	31	22	12	42	11	43	30
NOTI (Eggs)	195	195	195	195	195	195	195	195	195	195
TPRMET (%)	8,21%	8,21%	4,62%	15,90%	11,28%	6,15%	21,54%	5,64%	22,05%	15,38%
P-value			0,0372	SEF	SEF	0,1819	SEF	0,1166	SEF	SEF
NPR+										
NEM 18 to 21 days	16	16	9	31	22	12	42	11	43	30

(Chicks)										
NOVT	176	178	178	176	174	170	178	177	177	174
(eggs)										
TPRMV	9,09	8,99	5,06	17,61	12,64	7,06	23,60	6,21	24,29	17,24
(%)										
P-value		0,0332	SEF	SEF	0,2329	SEF	0,1199	SEF	SEF	SEF

The P-values are the result of the exact test based on Binomial Distribution, comparing the respective treatment against the control, for eggs of the same size. P-value ≤ 0.05 shows the effect on treatment. The values should be read in the column.

M=eggs (53g to 58g) G= eggs (59g to 64g), NPR+NEM 18 to 21days = Number of rejected chicks and embryonic mortality from 18 to 21 days hatching, NOTI = total number of incubated eggs, NOVT = number of viable eggs, TPRMET (%) = Rate of rejected chicks sum and embryo mortality from 18 to 21 days of hatching, on the total number of incubated eggs, TPRMV (%) = Rate of rejected chick sum and embryo mortality from 18 to 21 days of hatching on the number of viable eggs, SEF= no favorable effects, h: hours

Source: Elaborated by the author

Studied the thermal manipulation [18] for hot and cold, in eggs of heavy matrices and also reported the increase in hatching and quality of the chicks, however, the negative results of the present study also corroborate with other authors, such as [25] who also manipulating thermally for hot and cold but with temperature intensity of 40.6°C, reports an increase in mortality of chicks after hatching.

Thermally manipulating eggs of heavy matrices [12]; [13], during the period from 7 to 16 days of hatching, with temperature variables and duration of 12 and 24 hours of temperature rise, reported that the percentage of hatched chicks, with presence of the external yolk sac of the abdominal cavity, and chicks with open navels, reached 34% for embryos exposed to 24 hours, 14% and 5% for 12 hours and control treatment respectively, demonstrating negative effects on mortality and quality of chicks when embryonated eggs are exposed to long-term thermal manipulation.

The best results regarding productivity (Table 6) were found by thermal stimulation of 1h-G, (P-value 0.021), showing its favorable effect. However, this increase in the productivity of commercially viable females was not related to a higher number of hatched eggs (Table 2), but to a reduction in the variable chicks and mortality from 18 to 21 days of hatching (Table 4). However, large (G) eggs handled with exposure time over 6 hours (6h-G and 9h-G) presented the worst results, dramatically decreasing the quality of hatched chicks, and increased embryo mortality (18-21 days).

Table 6 - Production of commercially viable females in relation to the total number of incubated eggs and viable eggs with 18 days.

	<i>0h G</i>	<i>0h M</i>	<i>1h G</i>	<i>1h M</i>	<i>3h G</i>	<i>3h M</i>	<i>6h G</i>	<i>6h M</i>	<i>9h G</i>	<i>9h M</i>
NFCV (Chicks)	84	86	99	74	82	90	63	92	61	71
NOTI (eggs)	195	195	195	195	195	195	195	195	195	195
PFCVT (%)	43,08%	44,10%	50,77%	37,95%	42,05%	46,15%	32,31%	47,18%	31,28%	36,41%
P-value			0,0184	SEF	SEF	0,3062	SEF	0,2135	SEF	SEF
NFCV (Chicks)	84	86	99	74	82	90	63	92	61	71
NOVT (eggs)	176	178	178	176	174	170	178	177	177	174
PFCVV (%)	47,73	48,31	55,62	42,05	47,13	52,94	35,39	51,98	34,46	40,80
P-value			0,0211	SEF	SEF	0,1292	SEF	0,1841	SEF	SEF

The P-values are the result of the exact test based on Binomial Distribution, comparing the respective treatment against the control, for eggs of the same size. P-value ≤ 0.05 shows the effect on treatment. The values should be read in the column.

M=eggs (53g to 58g) G= eggs (59g to 64g), NFCV= Number of commercially viable females, NOTI = number of incubated eggs, NOVT = number of viable eggs (18 days), PFCVT= Productivity of commercially viable females on the total number of incubated eggs (%), PFCVV= Productivity of commercially viable females on the number of viable eggs (%)

SEF= no favorable effects, h: hours

Source: Elaborated by the authors

The negative results for production of heat-engineered chicks with a 9-hour exposure period in this study corroborate the results of [13], who thermally manipulated eggs from heavy matrices during the period of 7 to 16 days of hatching, with a temperature of 39.5 °C (+ 2 °C) and a duration of 12 and 24 hours of exposure to high temperature, and found a reduction in chick productivity due to lower quality of the hatched chicks manipulated thermally in relation to the control group.

Evaluated the hatchability of eggs from thermally manipulated [25] heavy matrices during the hatching period until the 18th day, with a controlled temperature of 37.6 °C, high (40.6 °C) and low temperature (34.6 °C), with a 24-hour exposure period. Significant negative differences were observed in chick productivity of the group exposed to high temperature in relation to the control treatment, demonstrating that the time of exposure to high temperatures may lead to a decrease in chick production in the hatchery. The same authors also present positive results that agree with the evaluation of [5], thermally manipulating

eggs of heavy matrices, noted that the short-term thermal manipulation, in the final 4 days, with intensity + 1 °C for 2 hours per day, improved hatching results by 1.5%.

In the results observed in Table 6, the group of large eggs submitted to the exposure time of 1 hour (1h-G), achieved positive results, with differences of 7.8% in relation to the control treatment. Although the results of the findings are consistent with [5]; [11], thermally manipulating eggs from heavy matrices, in the period from 16 to 18 days of hatching, with 4 exposure time of 3, 6, 12 and 24 hours, reported increase in chick productivity in eggs with exposure time of 12 and 24 hours, in contrast to the results found in Table 5, which showed a drastic drop in chick production as the egg exposure time increased.

When it comes to hatching performance, it is important to highlight welfare indicators in the productive life of these animals. These indicators can be leg and walking problems.

Found that thermal manipulations [22], with temperatures below the recommended for quails, affected the frequency of falls during bird walking. In a study of broiler chickens, it was found that increased embryonic activity provides a mechanism that explains increased leg and bone muscle growth in embryos incubated for 3 days at higher temperatures.

5. CONCLUSION

In conclusion, it is noticed that there is an interaction between the size of hatched eggs and the time of thermal manipulation, and with 1 hour of stimulation had better results.

It is expected that, with the next analyzes carried out, the influence of thermal handling and its interactions with thermal stress and productivity.

6. ACKNOWLEDGMENT

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Field's Education in the National Plans of Education: Tensions, Contradictions and Challenges in the Face of the Assurance and the Denial of the Right to Education

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Abstract

The present work is the result of studies performed at the college's subject Education, Public Policy and Management in Education. The function of this work is to investigate the tensions, contradictions and new challenges that are engendered in the confrontations towards the assurance and the denial of the right to education for the peasant population. The research was developed through a documentation analysis of qualitative nature, guided in the dialectical historical materialism approach as a method. This work is based on the theoretical assumptions defended by Arroyo and Fernandes (1999), Caldart (2003; 2011), Marx and Engels (2011, among others. The findings indicate advances in the Education National Plan (2014), but it did not show significant achievements towards the Field's Education. There is a long way to go in the educational rights for the peasant population, which are permeated by tensions, contradictions and challenges. significant achievements with regard to the Rural Education.

Keywords: Rural Education; National Education Plan; Public policy

1. Introduction

The Brazilian historic difficulty to elaborate and deploy, in the sphere of political action, projects that implement effective laws which, in fact, produce impacts on peasant's reality and it is noticeable. In a social

situation marked by contrasts, it is perceptive a more and more incisive presence of tensions between the guarantee and the realization of basic rights such as life, health, education, among others. Thus, under a prism there is a guarantee of these rights in legal terms, by a more vehement way, there is a “normalization” if their denial.

Undoubtedly, the discussions that emerge on Field's Education, and it is important to define here that it is a concept raised to bring a political discussion for the education in rural areas and this education is supposed to respect the particularity of the subjects, their life and other characteristics. In the discussion, then, when rural is treated like “field” it is made politically and not just a geographic difference from the urban areas and it have advanced categorically having as backdrop some important considerations, among them the idea that this type of education is not a market training, in which the subject is understood like a specific product which satisfies the interests of capital. Another particularity mentions the Rural Education as a process that permeates the social, political and economic of individuals, in view of the respect for socio-cultural and economic diversity of the communities.

In this sense, we planned in this text to provide an overview analysis of the National Education Plans (NAP) and its legal conditions since its first version in 1993, secondly, in 2001 and therefore the last in effect since June 25, 2014 that specifically establishes guidelines, goals and strategies for the following ten years in the Brazilian education system. It should be added that since the Constitution of 1988, the country has an obligation to plan for the future of its teaching, aiming to promote education with more quality for the entire Brazilian population.

Regarding the PNE (BRAZIL, 2014b), which directed the national policy of the country's education for a decade, twenty goals were firmed as the commitment of Brazilian State in favor of education for the population in general. In this document, the priorities are explicitly guided regard to national education, especially when it refers to the commitment to quality, structure, financial investments, accessibility, retention and success of students. It features a set of goals and strategies that cover all levels, modalities and educational stages, from kindergarten through graduation, and establishes guidelines for the teaching profession, the implementation of democratic management and financing of education. In addition to the above aspects, policies are also directed to the reduction of inequalities for groups like the disabled, indigenous, slave reminiscent communities, rural students and paroled assisted students.

The detailed analysis of this set of targets signs to the rural neglect. Thus, this analytical framework emerges it entire scope and theoretical framework of this paper through a documentary analysis backed by legal documents.

2. Field's Education: Tensions, Contradictions and New Challenges

Despite its fundamentally agrarian origin, the peasant population was neatly excluded from the educational public policies of the country. It is salutary even say that the exclusionary process that demarcated the educational issue of the rural population was, thus, a historical fact (CALDART, 1997). In this aspect, despite the advances, it was not consolidated, instantly, a mechanism that could meet the Education in rural areas, considering its history and culture. As can be seen from the above-mentioned aspects, being a predominantly agrarian country, this space was consigned to oblivion by the government.

The peasant context, during the years, as a major supplier of products for the cities employed strong investments in education. It should be added that to work in the agricultural sector demands were not made on the worker guided by instructional criteria or, either, their literacy was charged.

Thus, the period concerning the decades of 1930/1940, was marked by the effective presence of the "pedagogical rurality". This proposal had as main function the defense of a focused education in stabilizing the man / woman at the rural areas. In this scenario of force correlations and antagonistic processes emerged, by the State, an action that aimed to stem the rural exodus through school, that is, it would be this institution's role convincing the subject to remain in rural areas. It is worth mentioning that the "pedagogical rurality" was based,

[...] in the defense of an adapted school and always referred to the interests and hegemonic needs. These are diluted between what one could see as economic interests of character classes and groups of rural capitalists or as interest groups, especially politicians interested in urban issues. (PRADO, 1995, p. 6)

Based on the above assumptions, we see that the hegemonic interests and needs, have always been prevalent in the definition of parameters concerning the peasant educational context. In the meantime, it can be said that the context in which Rural Education is originated, is unfortunately marked by social inequality, the result of policies that never aimed at ensuring the basics to the peasant people. In accordance with the above aspects elucidated, Moura (1988, p.52) states that: "The gate can be closed by those who have the power, but on the other hand, the fences can be and are being taken down every day, by the subalterns and the expropriated".

Given the above, it is seen that especially the social impacts of these changes come to the rural areas decisively influencing the production process and guidelines for education offer. Thus, the LDB no. 9.394/96, states in Article 28 that:

On the offer of basic education for rural people, education systems promote necessary changes for its adaptation to the peculiarities of rural life and of each region, especially. I - curriculum and methodologies appropriated to the real needs and interests of students from rural areas; II - own school organization, including the adequacy of the school schedule to the stage of the agricultural cycle and climate conditions; III - adequation to the nature of work in the countryside. (SAVIANI, 2001, p. 172)

Looking at it that way, despite the advances, there has been a consolidation, instantly of mechanisms that are able to meet the field's education, considering its history and culture. In short, the Field's Education, brings in the midst of discussions the creation of a pedagogical approach and fosters the structuring of a legal order, the need for unification of the peasant struggle and their organization for public policies to ensure the right to education for the peasant population and the need for recognition, strengthening and legitimacy of the political-pedagogical experiences that, over time, have been accumulated by these social subjects in their relationship with the environment.

3. Historical Biases of the Education National Plan and its Basic Principles

Tracing a historic resumed overview about the National Education Plan - PNE within a reality of

fighting and resistance in favor of the guarantee of rights, especially in the case of peasant reality, is important since it represents an initial tool for discussion and / or conceptions aimed at the educational level. However, in spite of PNE presenting little practical implementation in regard to the advancement of the Brazilian education quality as well as to consolidate itself as a guiding document in the context of public disclosure, this government policy instrument is a mean for the population to require improvements from the State and educational guarantees, even experiencing a period of recession, like the one we are currently facing.

When we look back in history, we realize that the first time that the referred document appears in a law text has been through the Federal Constitution enacted in 1934, which stipulated in Article 150, the need to "to stablish the national education plan , comprehensive of teaching all grades and branches, common and specialized; and coordinate and supervise their implementation throughout the country's territory. "

Subsequently, on December 20, 1961, specifically, it is established the first Law of Directives and Bases of National Education, Law No. 4024, which revolved, among other things, the need to regulate the education system in Brazil, concerning issues such as the regulation of state boards of education, minimal training required for teachers and the establishment of a National Education Plan.

Consecutively, it was set up in December 20, 1996 a new perspective of prominently action related to the education in its broadest sense, that is, the enactment of the current Law of Guidelines and Bases of National Education, Law No. 9394 which "sets out the guidelines and Bases of National Education. " In its scope, its laws stipulated in Articles 9 and 87 that is the responsibility of the Union the development of the National Education Plan, in collaboration with federal agencies, and instituted, among other things, the Decade of Education. Also indicated that the Federal Government should forward the document to the National Congress a year after the publication, basing on guidelines and targets for the next ten years, in accordance with the World Declaration on Education for All.

In 1993, the Ten-Year Education Plan in force between 1993 to 2003, brought in its scope one "[...] set of policy guidelines in continuous process of updating and negotiation" (BRAZIL, 1993, p. 40). Consecutively, already in January 9, 2001, it emerged the need to devise a more settled plan able to gather elements to dialogue with the main guiding aspects of education in the Brazilian context. then elaborated the First National Plan for Education (Law No. 10,172) post-democratization, effective ten years from 2001.

The Rural Education appears in the strategy "f" at the second objective of the plan, in which it asserts the commitment to make universal, equitable, educational opportunities and to establish qualitative and appropriate levels of learning for poor rural children. Thus, the primary function of the plan lay in the necessity of ensuring universalization through differentiation methods, educational strategies and appropriate methods to the needs of these groups, guaranteeing both access to education and school quality (BRAZIL, 1993).

Subsequently, the sixth goal of the text brings up the important fixing and need to "[...] increase funds for maintenance and investments in the quality of basic education" (BRAZIL, 1993, p. 40). Thus, presents the Rural Education pointed in strategy "b", which envisions the undisputed creation of funds and unconventional mechanisms regarding the financing of innovative projects in areas that have large demographic concentrations of poverty, included in this bulge the "areas rural criticism."

Finally, it is important to bring out another perspective contained in the plan, which refers to the field's education in the Ten Year Plan, specifically in the "global goals". Nevertheless, in regard to the relation of twelve goals, the penultimate presents the following text: "[...] equip all elementary schools, urban and rural, state and local, basic operating conditions" (BRAZIL, 1993, p. 43).

In this context of struggles and clashes for the sake of educational rights guarantee, essentially the graded in the field's education needs, PNE (2001-2011) (BRAZIL, 2001) was adopted in very different conditions of the previous ten-year plan. In this new scenario, the respective document becomes the Law No. 10.172, of January 2001, after a great deal of debate and political tensions in the national congress. Thus, occurred in 1996 and 1997, two National Congresses of Education (CONED), the need for, among other things, elaborating a more solidified proposal based on the real needs of the diverse groups that integrate the Brazilian education, namely, the indigenous population, riverine people, slave-reminiscent communities, sharecroppers, squatters, etc.

It should be mentioned that the reflection of this movement occurred on February 10, 1998, which itself resulted in the submission to the Deputy Chamber of the so called PNE of civil society. The next day, in turn, the government filed another PNE project. It is worth saying that the processing of two PNE proposals emphasized at that historic moment, as pointed out by Valente (2001, p. 11) to "[...] existence of two school projects, two opposing educational policy proposals; they actually translated two antagonistic projects of the country."

According to Aguiar (. 2010, p 710), the PNE approved in that context considered the following elements: "a) education as an individual right; b) education as a factor of economic and social development; c) education as a means of combating poverty. " Although they were raised in the central emergency points of the document content, they were not configured as crucial points of public policy for the peasant people.

Thus the Rural Education, as a teaching modality discussed herein, had marked its birth with the completion of the 1st ENERA (1997), the 1st Conference for a Field's Basic Education (1998) and the creation of Pronera (1998). However, the Ministry of Education - MEC remained dissociated from this building. Earlier references were still alien to a conception of education disconnected from the rural aspect. The first National Education in Agrarian Reform Program - Pronera, created by the Agrarian Policy Extraordinary Ministry and incorporated into the National Institute of Colonization and Agrarian Reform (INCRA) in 2001, brings with it some important change proposals. However, the PNE (2001-2011) (BRAZIL, 2001) remained with the same conception of Rural Education in the text, ignoring the concept of Rural Education as a politic aspect.

It is salutary to highlight that the PNE policy priority was drafted and based essentially on an idea of urban education. Again, the set of objectives and goals kept as a central focus, brands, direction and characteristics of an education that would foster the aspirations, demands and needs of the urban population.

The rural school requires special treatment, for the elementary school supply needs to reach every corner of the country and expanding the supply of four regular series in exchange for single-teacher isolated classes is goal to be pursued, considering the regional peculiarities and seasonality. (Valente, 2001, p. 72)

Thus, as shown, the goals were not related to the specific Field's Education regarding the peasant culture, the production of knowledge or the curriculum, however, be emphasized, in the PNE (2001-2011) (BRAZIL, 2001) the presence of specific targets for the education of the peasant population.

Before the aspects raised, it should be added that in June 2014, even though understood as the object of debates and propositions in disparate segments of society since 2010, has been approved and sanctioned the new PNE for the decade from 2014 to 2024 (BRAZIL, 2014b) even without a performance assessment of the previous plan or a diagnosis that point the issue of Brazilian education quality in addition to the numerical data.

4. Tensions Between the Warranty and Denial of the Rights to the Effectivation of Policies Aimed at the Field's Education

In the current educational framework in our country, historical moment in which trigger struggles, tensions and clashes for the sake of ensuring a quality education and enforcing policies for Rural Education, space where many elements are configured, actors and situations involved from the development of a national proposal, through the educational thinkers and ending in making professional in the classroom in which materializes the whole theory, It becomes increasingly an incessant need to think education for rural population that exceeds the purely capitalist vision, set as a central axis in policy discussions set at this juncture.

In the first decades of the twentieth century, the main idea combined with the interests of the elites, which were limited to control workers in order to defend the order and harmony in cities prioritizing just trying not to drop agricultural productivity. This initiative spurred the creation, in the 50s, of programs like Rural Social Service (SSR) and the National Rural Education Campaign (CNER). Their programs did not have an effective concern regarding the ability of offering autonomy to the peasant subjects.

In this sense, they worked with a focus turned to the qualification and hand inserting peasant work in a particular production system that in that historical context, emerged with aspects focused on modernization. It is worth adding that actions concerning public policies were restricted that directed the field and its development, that is, it were emerged attempts to characterize the field as aspects related to the strictly economic framework

About the points raised, Molina (2003) adds that:

Historically, the rural education concept was associated with a poor education, delayed, with poor quality and few resources. It had as backdrop a rural space seen as inferior, archaic. The timid programs that took place in Brazil for the Rural Education were designed and developed without their subjects, without their participation, but for them. (Molina, 2003, p. 76)

Meanwhile, Ribeiro (2010, p. 182) also points out that "the rural school only has this identification due to the place where it is located, as its contents, concepts and methods are identical to the urban school," on the assumption that cities mean progress and civilization. action. Starting from the assumptions listed above, the identity issues, pedagogical aspects and the curriculum itself back to the campesino space did not hold a specific emphasis on educational proposals targeting and designs that went beyond the simple maintenance of subjects on the peasantry. The function that was inherent in the rural school at that time

was intended, in addition to instruct, assist in the adjustment of the individual to the environment. Thus, the Rural Education had as fundamental principles: "[...] valuing the rural man, to educate is to settle the ground where you live, it is adapted to their environment, form the mentality of the rural man" (Prado, 1995, p. 14-15).

In the meantime, it is relevant to emphasize that rural education is based on purely economic and ideological interests, not having primacy of the need to ensure a quality education for workers in rural areas, but in return, qualifying them for an ongoing obedience to the precepts of capitalism, even in adverse conditions and experiencing the everyday weather, because there was no public investment in order to promote improvements and priority conditions to that territory.

The 50's, specifically, has been characterized as the "developmental" period, as was this context that engendered the industrialization of conditions in Brazil. In this sense, the progressive idea brought up an overvaluation culture of urban cultural aspects at the expense of rural areas. This predominant idea of urban culture intensified the social conception of the subjects of the countryside through negative stereotypes such as "tucky", "backward", "hick", among others. Over this vulgarized perception of the peasant, the peasantry, in addition to set obstacle to development for their alleged character "naive" and "ignorant", is engendered as vulnerable to subversion. In this sense, it is necessary to emerge the state control over this social framework to combat possible subversive actions, ensuring, like this, the considered development of Brazilian society.

Over the years, specifically in the decades of 1960/1970, the rural education is undergoing a transformation whose primary function focuses on a substantiated demarcation of programs with strong US influence. It is worth to mention that in this period, were emerged actions that aimed at strengthening the community design and integration, guided by integration projects that contemplated, among other things, education focused on developing community.

Concurrently, the 1980s in Brazil started incisive inferences and new directions in the policy framework, for example, the political reopening of the country with the end of military dictatorship. In this historical context, the country has to face the consequences of the international crisis, which was triggered strongly affecting mainly all productive sectors.

In the last decade of the twentieth century, Brazil will incorporate a policy geared towards the neoliberal precepts in policy discussions, as well as national policy more broadly. In the countryside, agrarian policy had, taking as reference previous decades, the United States as its main postulator. Thus, the guiding biases followed the model of agriculture concerning that country. It is noteworthy that in 1998 were recorded "[...] over a thousand conflicts spread across the country" (OLIVEIRA, 2001, p. 197).

In terms of the educational component, it is postulated also a process of educational reform, which provide for the approval of the Law of Directives and Bases for National Education - LDB No. 9.394 / 1996 and the National Curriculum Parameters - NCP as well as the creation of Fund for Maintenance and Development of Fundamental Education and Teacher Appreciation - FUNDEF. In rural areas, the deterioration of schools has a big damaging character.

Under this spectrum of changes actions are emerged, becoming more forceful actions to confront the workers with the state, seeking to claim basic rights such as health, work (land tenure), health, housing, credit, and especially access to inserted education in broader perspective of meeting the needs of farmers.

In this sense, it is shaped the formulation of a proposal for cultural education and socially committed with the territory (identity) of peasant workers. At a historic resumption of its emergence, two events occur propitiated by the MST that will be shaped as a watershed for the process of realization of a real proposal, equal and sedimented within the premises defended by the group. In partnership with the University of Brasilia (UNB), the National Conference of Bishops of Brazil (CNBB), the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the UN Children's Fund (UNICEF) these initial questions are engendered as follows: the 1st National Meeting of Educators of Agrarian Reform (ENERA), conducted in 1997,

Gradually, other important actions give further strengthening for the peasant question. The first National Meeting of Educators of Agrarian Reform - ENERA is closed with the document entitled "Manifest of Educators and Teachers of Agrarian Reform to the Brazilian People" (AGRARIA REFORM DATA, 1997). In that manifesto, the teachers emphasize the importance of education as a fundamental instrument for the transformation of society, which is understood as exclusionary, unequal and unfair. In addition to the aforementioned aspects, reaffirm the need for a school "[...] to awaken the dreams of our youth, to cultivate solidarity, hope, desire to learn and always teach transforming the world" (CALDART, 2003, p. 80)

Over the years, there were many changes in the educational peasant frame. As data on the portal QEDu (which was developed by Meritt and Lemann Foundation whose aim is to allow the Brazilian society to know and track how is the quality of learning of students in public schools and cities), in a cutout of the results of external evaluations concerning 2017, in the case of the 5th year of elementary school in the Portuguese test at national level, it is clear that there was an average difference of 30.42 points in high performance areas of students urban (217.96) and rural (187.54). And in mathematics, the disparity is somewhat lower, 28.69 points (227.33 to 198.64 urban and rural).

In contrast, in the 9th year in Portuguese, was registered in Amazonas, in northern Brazil, the biggest difference in results between those who live in urban areas and in the countryside: 41.62 points. In the city, averaging 208.5 points and in the field, 166.88. This is also the state with the greatest disparity, with 37.86 points. In urban areas, average performance of 217.06 and in rural areas, 179.2.

In the 3rd year of high school at the national level, the performance difference between the Portuguese exam of those who are from the urban area and those who live in rural areas is 24.8 points (average score of 235.93 points in the field and 260.73 in the cities). In math test, similar disparity of 24.94 points (rural and urban with 235.82 to 260.76).

According to the National Education Research in Agrarian Reform - PNERA (2017), there are 167 648 students served by the Youth and Adult Education (EJA), 9,116 graduated in the Middle Level, 5,347 students graduated in Higher Education, 1765 specialists and 1527 students at the National Agrarian Residence. Furthermore, still according PNERA and based on data from 2016, the rural territory that is "locus" of Field's Education, is the historical protagonist of the need to implement more incisive educational policies. However, it has sought to make less unequal reality through the struggle to guarantee the right to quality education in the field, according to the National Education Research in Agrarian Reform-PNERA.

These and other issues already mentioned in this study lead us to a more detailed and careful analysis in order to consider the many actions that need to be implemented. In this sense, the new PNE emerges as an instrument of educational public policy that aims, among other things, to face imminent challenges and engender a considerable qualitative leap in Brazilian education. Thus, structured goals and strategies, the document emphasizes as important guidelines:

Eradication of illiteracy; Universalization of school assistance; Overcoming educational inequalities; Improving the quality of education; Training for work and citizenship; Promoting the principle of democratic management of education; humanistic, scientific, cultural and technological developments in the country; Establishment of goals of public resources applications on education as a proportion of gross domestic product, that ensures compliance to the expanding needs, with standard quality and equity; Valuing of education professionals and; Promoting the principles of respect for human rights and social and environmental sustainability. (BRAZIL, 1993, p. 40)

However, based on the above listed assumptions and weaving a review about the ten guidelines that guide the goals and strategies of this document, we do not crave a single strand that will look specifically education aimed at the field. In Tables 1 and 2, it becomes possible to identify the "priority" in the Brazilian educational policy, especially with regard to the Field's Education in the last three PNE.

Table 1. Field's Education / Ten Year Plan for Education (1983) and NAP (2001-2011).

Ten-Year Education Plan (1993)	
Goals	Universalize, with equity, opportunities to achieve and maintain appropriate levels of learning and development.
	Increase the financial resources for maintenance and investments in the quality of basic education, providing greater efficiency and equity in the distribution and application.
National Education Plan (2001-2011)	
Guidelines	The rural school requires special treatment, for the elementary school offer needs to reach every corner of the country and expanding the offer of four regular series in exchange for one-teachers isolated classes is a goal to be pursued, considering the regional peculiarities and seasonalities.

Source: Ten-Year Education Plan (1983) and PNE (2001-2011). (BRAZIL, 2001)

Table 2. Field's Education in PNE (2014-2024)

National Education Plan (2014-2024)	
Strategies and Goals	
1:10	To promote the care of population of the countryside and indigenous and quilombola communities in early childhood education in their communities through the resizing of territorial distribution of supply, limiting the nucleation of schools and the displacement of children in order to meet the specific needs of these communities guaranteed the prior and informed consultation.
2.6	Develop educational technologies that combine in a coordinated way, the organization of time and educational activities between the school and communitarian environment, considering the specificities of special education, field schools and indigenous and quilombo communities; 2:10 stimulate the supply of basic education, especially in the early years, for rural populations, indigenous and quilombolas, in their own communities.
3.7	Promote the expansion of free enrollment at high school integrated to the vocational education, observing the peculiarities of the populations from the field and indigenous and quilombo communities, and also people with disabilities; 3:10 To promote programs of education and culture for the urban population and the young field, at the age of fifteen (15) to seventeen (17) years, and adults with social and professional qualification for those who are out of school and with a lag in the school flow;
4.3	To implement, throughout this PNE, multi-functional resources room and foster continuing formation of teachers for specialized education in urban schools, of course, indigenous and quilombo communities.
5.5	To support the child literacy field, indigenous, quilombolas and mobile populations, with the production of specific teaching materials, and develop monitoring tools to consider the use of the mother language of the indigenous communities and the cultural identity of quilombo communities.
6.7	Meeting the field schools and of indigenous and quilombola communities in the provision of education in full-time, based on prior and informed consultation, considering the local peculiarities.
7:13	Ensure free transportation to all students of Rural Education in the age range of compulsory education, through renewal and full standardization of the vehicle fleet, according to specifications set by the National Institute of Metrology, Quality and Technology - Inmetro, and shared financing proportional with Union contribution to the needs of federal agencies in order to reduce truancy and the average shift time from each local situation; 7:14 Develop researches of alternative models of school attendance for the field population to consider specific local and national and international good practices; 7:27 Develop specific curriculum and educational proposals for education for schools in the countryside and indigenous and quilombola communities, including the corresponding cultural content to their communities and considering the strengthening

of socio-cultural practices and the mother language of each indigenous community, producing and providing specific learning materials, including for the disabled students.

GOAL: To raise the average education of the population of eighteen (18) to 29 (twenty nine) years in order to achieve at least twelve (12) years of study in the last year of the Plan, for the populations of field , the less educated region in the country and 25% (twenty five percent) poorest, make equal schooling among blacks and non-blacks declared to the Brazilian Institute of Geography and Statistics (IBGE).

Strategies

10.3 To promote the integration of adult education with professional education, planned courses, according to the public characteristics of youth and adult education and considering the specificities of itinerant populations and rural and indigenous, also quilombola communities, including in distance education modality.

11.9 To expand the service of free secondary education integrated to the vocational training for rural populations and indigenous and quilombola communities, according to their interests and needs.

12:13 To expand specific care to populations of the countryside and indigenous and quilombola communities in relation to access, retention, completion and training of professionals to work in these populations.

14.5 To implement actions to reduce ethnic and racial and regional inequalities and to encourage the involvement of people from the countryside and indigenous and quilombo communities to master's and doctoral programs.

15.5 To implement specific programs for training educational professionals in schools of rural education and indigenous and quilombola communities and for special education.

18.6 To consider the socio-cultural specificities of the rural schools and of indigenous and quilombola communities in providing effective positions for these schools.

Source: PNE Goals for Rural Education (2014-2014). (BRAZIL, 2014b)

As appears from the aspects identified in the boards above, when we make the analysis of Field's Education present in two National Education Plans, it is emphasized the little relevance given by Brazil to education of this population. As denotes the generalized language and away from objective aspects of the Ten-Year Education Plan (BRAZIL, 1993) is superseded by the objectivity of the PNE (2001-2011) (BRAZIL, 2001), which, moreover, also has inherent centrality in urban education.

Moreover, the Field's Education, as highlighted in the plan, is placed as an obstacle to be overcome, that is, emerges as objective of the plan to extinguish one-teacher classes, whereas the ideal would be to empower them. However, there is not in the PNE, goals or strategies that direct the eye to combat the low quality of these mentioned classes, considering the specific characteristics and peculiarities of the population located in rural areas, namely, postulating as inherent aspect of an educational proposal for alienation. In line with the points already raised, Mészáros (2008) points out that:

Prior to that, education means the process of "internalization" of the system's legitimacy conditions that exploits labor as a commodity, to induce them to their passive acceptance. To be something else, to produce insubordination, rebellion, must rediscover its relationship with the work and the world of work, with which it shares, among many things, the alienation. (MÉSZÁROS, 2008, p. 17)

In this sense, what is questioned is for serving the educational system, especially when it comes to something public, if not to generate the desire to combat alienation? Overcoming the precepts and the interests of capital is, first of all, to understand its limits, contradictions, movement and therefore its horizon to overcome.

In the case of Board 2, we can see an improvement with respect to the field to PNE (2014-2024) (BRAZIL, 2014b) at the expense of previous plans, taking into account that the very language and terms used in the text to incorporate expression "Field's Education". Meanwhile, we see clearly that this is the first plan that respects the representative character of that name in relation to that used in the previous document, that is, "Rural Education".

Relating to the numerical data presented, it is clear that PNE now assumes a broader commitment to the Field's Education, while features more strategies than in previous. In the PNE (1993-2001) (BRAZIL, 2001), targets or strategies not totaled five. In contrast, in the PNE (2014-2024) (BRAZIL, 2014b) of 254 strategies, 17 make direct reference to the Field's Education, quilombola and indigenous. Note, in turn, only the goal eight Youth and Adult Education (EJA) does in his allusion scope to the specific mode of Field's Education to establish the raising of the schooling of young and adult farmers and, in turn, minimize this obstacle in the current educational climate.

5. Some Considerations

Based on the showed premises and taking as reference the analysis of national education plans, become evident advances in the current PNE at the expense of Field's Education, especially in dealing with the educational trajectory of the peasant population to the current situation. When we group the seventeen strategies of the current PNE that make mention to the Field's Education, not specifically envisions effective action to improve this type of education. What is denoted, concretely, is the lack of objectivity in the text lines when dealing with strategies as well as to print generic character. In this sense, it is complex to identify what those conjecture strategies in terms of state policy action to raise significantly the quality of Brazilian education for peasants.

Other evidence detected in studies performed, is related to the lack of specific targets for Field's Education demonstrating their inferiority in relation to urban. Within these strategies there is a performance prediction and this results in a matter of concern with regard to its viability, whereas the same can be kept only in documentary character, such as "dead letter", which can undoubtedly reflect the Municipal Education Plans approved.

The strategy inherent in the PNE, which presupposes the guarantee of school transport is also some cause for concern, especially regarding the "survival" of schools of the field. Another emblematic obstacle concerns the stimulus of kids to go out from the field, adolescents and young apprentices, leading to a lack of living in the field of their own reality.

Another problem refers to multigrade schools and the fact that they have multiplied in the peasant context working in many units, such as single junction school years in the same space, disregarding the particularities, training times and real needs of students. This situation could not continue invisible in PNE. School census data of 2016 point to one-teaching in 7.2% of Brazilian schools all related to the field (INEP, 2017). This demonstrates that this phenomenon remains a challenge to be overcome.

In conclusion, it is understood that not facing this struggle scenario, correlation of forces, opposing contexts, something representative of the reality of rural education, can corroborate to maintain this state of affairs already put compromising the guarantee of educational law and the quality of education. Taking as a basic premise the analysis undertaken in this text, there is something even as eminent at this frame the gap in the consolidation of a Field's Education in the parameters claimed by the social and trade union movements in the countryside. What actually dispenses as necessary is the consolidation of an educational proposal that is congruent with significant new directions. Something that strongly, leave the condition of ostracism in terms of concrete actions of the State experienced in recent years.

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Contemporary issues and mobile application development learning: where is the connection?

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Abstract

As a result of discussions about the studies on Science, Technology, and Society (STS) we identified the need to understand how to promote discussions about those subjects on a mobile programming learning. The purpose of this paper is to demonstrate how to introduce subjects that are relevant to society's problems in a discipline with a high technical focus. Therefore, the present work contains an informative approach and becomes a possible subsidy to aid teachers who wish to establish, in their mobile programming classes, STS discussions. The suggestions here documented characterize themselves as resources for a probable improvement of the critical thinking, civil conduct of the students and also raise discussions and reflections among students and future professionals about the current reality, leading to imminent educational changes.

Keywords: Teaching resources. Teaching mobile programming. Contemporary social issues. Technological education.

INTRODUCTION

As well as the use of smartphones and their respective software applications are very attractive, the development of these applications can also fascinate many young people. We can affirm that, often, the opportunity to be enlightened with an impactful, revolutionary idea in the mobile computing universe is the reason why many young people seek vocational training in this area. The Brasscom (2019) report indicates Brazil as the fourth largest computing and telecommunications market in the world, behind only the United States, China, and Japan. This same report places Brazil as the fourth biggest Smart Connected Devices (desktop, notebooks, tablets, and smartphones) market, with an estimate of 71 million devices sold in 2014.

However, teaching and learning software development can not fail to address contemporary social issues, especially those resulting from its use, fads, uncritical fluency and even addictions or dependency. My concern in recent years, as a programming teacher, was to "give a sort of an uncompromising training on these topics". By beginning the studies on "Science, Technology and Society" (STS), one opens a glance at these points. Soon there was an urge: How to approach contemporary matters in a computer programming course, or discipline, specifically for mobile devices programming?

Information Technology (IT) permeates almost all human activities, including work, leisure, health,

education and communication, and the professionals in this area are the ones responsible for the development of a large part of solutions, tools, and processes that are consistent with ethical values and social interest and that also seek humans wellbeing and technological advance. However, to exercise these tasks with competence, fullness, and capacity, it is essential that the professional has carried out studies referring to social, philosophical and ethical issues, with a good degree of reflection and systematization. In summary, even in a reductionist manner, it seems that in one end lies the current trend to develop applications for smartphones, and in the other – diametrically opposite - the contemporary social themes. How to properly connect and work these poles in an integrated and contextualized way?

POINT “A”: MOBILE TECHNOLOGIES

It's easy to visualize the essential role that IT, or simply Computing, has assumed recently. Almost all everyday activities make use of one or more computing resources. Information automation changed the speed on which information is created, managed and recovered. Paying a bill on a bank branch or at a lottery agency, buying something at a supermarket, taking a plane trip or any public transport, are activities that need a computer system supporting business management. Therefore, not only companies benefit from the use of Informatics. Such advent also directly affects people either individually or collectively (ABES, 2019; BRASSCOM, 2019).

With the advance of computing technology, devices, and their components decreased in size while expanding processing capabilities. Until then, computers, which used to occupy massive amounts of physical area, nowadays fit on the palm of a hand. The so-called smartphones essentially have become personal assistants. Small-sized computing devices perform services such as alarm clock, notepad, contacts, and appointments agenda (with virtually infinite capacity), audio and video mini-stations, photo studio, personal 5 meters precision Geo-location device with embedded world atlas, instantaneous audio and video personal communication device among other countless personal use resources. In the 4th quarter of 2019, according to Statista (2020) statistics, Android's applications virtual store had 2,570,000 applications available, while its main competitor – iOS system – contained 1,840,000 mobile applications at disposal. Mobile application development has attracted many enthusiasts to technical and graduation information technology courses. Such interest arises due to the increasing market expansion and the possibility of making money through those applications. It is remarkable the dizzying growth of mobile application development. In the 3rd quarter of 2019, the App Store brought in gross revenue of \$14.2 billion, up from \$11.6 billion a year ago. In comparison, Google Play revenue grew 24% to \$7.7 billion. In other words, Apple represented roughly 65% of all spending on mobile platforms, with Google representing the other 35%, despite the fact that it powers over 75% of all mobile devices globally, according to Techspot (2020). A few years ago Gartner (2014) surveys show a forecast of this market reaching \$77 billion in 2017. In 2019 users consumed an average of about 2 hours and 38 minutes per on using smartphones and tablets, being 86% of that time (2 hours and 19 minutes) spent on apps and 14% (22 minutes) accessing mobile websites. Also according to the Gartner (2014) report, back in 2014 Internet access by mobile devices surpassed desktops access (desktops and notebooks). This high increase in the consummation of mobile applications has attracted the interest of several areas of society, including the government.

To foster the production of national applications for mobile devices and smart-TVs, the Brazilian government opened, through the Communications Ministry, at the beginning of August 2019 a public notice that aimed to stimulate the creation of public utility mobile applications and also “serious games”. A total of \$1 million in investments will serve a total of 50 apps (25 applications and 25 game applications). According to the Communications Ministry, “the development of games and applications has not followed the demand of the Brazilian market – which is the fourth consumer in this segment, moving \$200 million per year”. The competition called INOVAapps is part of the National Policy for Creative Digital Content from the Communications Ministry.

Parallel to the incentives, through notices and contests, we can witness an increase in the number of IT courses being open. The increasing offer of these courses aims to attend the increased demand for professionals in this area in Brazil as indicated by many researches. A study by the Brazilian Association of Software Companies (ABES) in 2019 showed that Brazil lacks more IT professionals. This study reveals that Brazilian IT professionals find a growing job market with low qualified competition for open positions. Researchers also alert for a worsening lack of technology professionals in the country by 2023. According to the ABES survey (2019), there are now in Brazil a shortage of approximately 40 thousand IT professionals. This number can grow to as many as 117,000 open jobs in 2023 without employers being able to hire people with the required qualifications to fulfill them. The training of these professionals to occupy open positions must be rethought to include the STS themes in the training process. Hence, the expectation is to train qualified citizens to critically and consciously participate in the decision-making process and in social debates, people concerned with the social implications inherent in the development of scientific and technological innovations (WAD, 2019).

POINT “B”: CONTEMPORARY SOCIAL TOPICS

The technical and graduate courses in the Information Technology approach in their curricula technical contents of Computing with minor grafts of humanistic and/or social disciplines. Back in 2012, the Education Ministry / Educational National Council issued a purport – CNE/CES 136/2012 on the National Curricular Guidelines for baccalaureate and graduation courses in Computing (MEC, 2012). This document suggests the embracement of disciplines with a humanistic and social nature, such as Computing and Society, Philosophy, Environment, Human relations at work, Social impacts of software technology. The insertion of debates about these topics in IT courses, not only thin the University ones, but also in the technical level courses, aims to capacitate the future professionals to exercise their attributions with competence.

In an interesting study, Côrrea & Araújo (2014) presents the perception of students and teachers of a medium level federal public technical education institution on STS subjects. The work of these authors is relevant to our discussion, given that our point is the insertion of these STS themes in vocational and technological education courses. The opinion of Côrrea & Araújo (2014), which is equally ours, states that:

[...] we need to have, as far as is necessary, knowledge in science and technology, but also about science and technology, and to compose a critical and reflexive society, watchful to the situations and dilemmas arising from the relations between S & T and social, economic and political activities, as well as to the risks generated by technical-scientific applications. [...] (CÔRREA, ARAÚJO, 2014,

p. 15).

In essence, the perspective of Côrrea & Araújo (2014), defends the promotion, in the classroom, of discussions to elaborate modern conceptions about science, technology, and society, in order to contribute to minimizing inadequate visions to the challenges presented to science education nowadays.

According to Bazzo et al. (2014), entering a classroom to deal with STS relations seems more challenging every day.

Tackling with the education foundations, primarily the technological one, is extremely complex. But in the author's day-by-day pursuit of problems of the world he felt the urge for some serious modifications. It's necessary to move away from the comfortable position of a purely technical formation, technical training that is uncompromised with social issues. It is necessary to address issues related to social content. (BAZZO ET AL., 2014, p. 39).

The teacher and all that he teaches are part of the same world that the students live. It is evident the need for an awakening to other dimensions in technological education, dimensions that address the current social issues.

According to Bazzo (2012), STS studies aim to promote an education that seeks indispensable human values towards achieving a more just and egalitarian society. There needs to be a harmony between the human and the scientific-technological areas. But as reported by Bazzo (2012), we will only achieve such harmony whenever we combine those areas and, at the same time, we have clarity as to the importance of “being” in relation to “having”. Until that happens, perhaps it’s no more than a daydream to attempt to impress upon a deeper reflection on the harmonious relationship between science, technology, and society. Eduardo Galeano, Uruguayan author, in his book “Upside down – a primer for the looking glass world” speaks about several contemporary social questions. The author brings a set of facts, historical and journalistic events that prove the world inversion in which we live. In this inside out world school, students follow basic courses on injustice, racism, and chauvinism, attend professorships on fear, seminars on ethics, classes on impunity, all elaborated through the pedagogy of solitude. Although it’s dated 1998, it remains a dossier of the hard, strange and unjust reality in which we all live.

Galeano (2001) addresses environmental issues by showing how large companies, based in countries that possess high hegemonic power, destroy nature in favor of exorbitant profits, exploiting countries through the use of cheap labor and little challenging power. The author also admits historical data and facts about urban violence, traffic violence, and other areas. Galeano also talks about the society of the consumption and how “having” has stood out over “being”. Topics such as those outlined in the book that should be discussed in IT courses, especially in the mobile application programming disciplines that are the heart of this paper.

CONNECTION BETWEEN THE POINT “A” AND POINT “B”

The insertion of STS subjects and courses in vocational and technological training institutions is of essential importance. Oliveira et al. (2012) seek in their work to identify whether there is a concern in these institutions about social implications arising from the relationship between science and technology. Based on this, the authors discuss how to conceive knowledge development linked to technical and technological

education, considering its social implications. The researchers further complement that such institutions are "consisted of public production spaces and knowledge diffusion, and must be a channel to provoke this kind of discussion in the formation of the subject" (OLIVEIRA et al., 2012, p. 10).

Eichler & Del Pino (2014) have developed a work where the relationship between STS themes and digital technologies is well articulated. An important perspective of this work refers to the relevant contributions that the STS approach has in scientific education. The authors support this by stating:

i) the abstraction level can be reduced; ii) knowledge can be repackaged by teachers; iii) knowledge can be reconstructed by students, and iv) knowledge can be contextualized. (EICHLER, DEL PINO, 2014, p. 121).

According to the authors, it is possible to declare that it takes a generation of politically and scientifically formed citizens, who do not settle for the role of shallow passive critics, in the solution of contemporary social and environmental issues.

Considering previous experience at teaching the specificity with the challenges and complexity of related STS issues, we will present some suggestions that for us it seems to be timely and relevant information on how to connect teaching mobile application development and modern social topics.

Racial discrimination is a recurring subject in our society but unfortunately barely debated in schools, and it has zero approaches in application development courses/disciplines. Currently, in Brazil, the racism cases most mentioned refer to those practiced in football matches. It is possible to orchestrate a sequence of classes that integrate application development and racism. To address this issue, the teacher can propose to the students the development of an application in which the user reports anonymously discriminatory behaviors. The application could be used within football stadiums, anonymously informing the proper authorities of the racist act location. To assist students in the educational process, the teacher should indicate readings, videos and other materials that discuss the subject with an up to date analysis. The work of Galeano (2001) is an excellent material that can be used in this kind of project. In this book, the "Basic course on racism and chauvinism" chapter introduces historical and current facts that can enrich and provide valuable input so that students can dig deeper into racial inequalities and discrimination. The thematic violence has many aspects, and one of them is perpetrated against children and women. Unfortunately, in our society, this is a recurring fact. In order to discuss this topic, the teacher may suggest conducting a project in which the students would develop an application to assist the repression of this behavior. The application would possess the main characteristics of each type of violence, based on which it would return the phone and the address of the closest places to the user's location, from which he can get help. These kinds of information can be found in booklets specialized in this subject. However, the teacher should instruct students to seek information about these services in their local communities, in their cities, information such as an address, telephone, and service hours. Thus, if the teacher has already taught the implementation of the Global Positioning System (GPS), the application may even indicate the distance between the user and these help centers. Also, such an application could support the option of automatically calling the appropriate help center. Another aspect of this topic refers to urban violence: assaults, kidnappings, robberies, regrettably more frequent every day. The educator has the option to indicate the development of a project to create an application that allows us to inform and monitor dangerous situations. Therefore, there is the possibility of creating a recommendation system informing the violence levels in

different city regions. It would be possible to map risk regions in cities based on a GPS system. Through the application, the user could silently receive and send help requests. At the same time the project is being developed, the teacher would use targeted readings and complementary materials that address violence in all its nuances. Each state's Military Police has the practice of preparing booklets with tips and information about citizens' safety. This type of informative material is very useful and can be found at each state police headquarters, some are present even on social media networks like Twitter and Facebook.

The environmental issue also holds many fields, such as air and water quality, deforestation, liquid, and solid waste management. One proposition that the teacher can make to his students would be the creation of an application that indicates location and access route to a certain solid waste recycling stations, such as cooking oil, cell phone batteries, and also recyclable waste in general. Besides, the application will inform the user where and how to dispose of different types of waste. In order to obtain this kind of information, the teacher can present the students with the Environmental Education Primer – Solid Waste Disposal (FIOL, 2015) which specifies each type of waste and how to dispose of them. Also, it is important for the teacher to seek - along with the students - information about waste disposal in their community. Thus, students can learn more about the location, the city, where they live and the environmental services available in their region.

Another serious problem today in Brazil is the scarcity of water. The Cantareira system is one of the main water capture and treatment systems in the greater São Paulo. The dams levels were sharply reduced in 2014 mainly due to the drought registered in São Paulo state and the headwaters of the dam. The water supply to the greater São Paulo is compromised. Saving water and electricity is an essential practice. Considering this context, the educator can propose to the students elaborating on a project to produce an environmental educational game portraying good practices for water and electric energy conservation. In the game, the user/player earn points by performing actions that promote the conscious use of this natural resource. The engagement that a game elicits in the youth of the 21st century is greater than reading or even a film can induce. Creating a game that has the proper game-design elements can make an application attractive and present in other people's smartphones, in addition to the students, one's themselves (BATISTA ET AL., 2016). The game-design elements of a successful game can be found in detail in the work of Jesse Schell (SCHELL, 2008). To subsidize the water theme, we suggest the technical report "Taking care of the waters", produced jointly by the United Nations Environment Program (UNEP), National Water Agency (NWA/ANA) and Brazilian Business Council for Sustainable Development (BBCSD/CEBDS) organizations. The UNEP report (2019) delivers relevant knowledge about water resources and also suggests solutions to improve water quality and actions to avoid water scarcity. Conscious consumption is a subject that needs to be addressed in our schools. Knowing the product that we are buying is very important. Knowing if it contains toxic, harmful elements, if it affects the environment in any way, can make a difference when making a conscious purchase. In an increasingly consumer-driven, media-driven society, the educator can propose creating an application to be used in a supermarket. Initially, a database is built with information and prices of various products in different commercial establishments. Thereafter, a function is implemented in which the device's camera visualizes the bar code of the product being bought, then the application returns - from the database - the information if the price for that product is better or not, in other commercial establishments. To serve as a parallel guide

to conduct this project, the teacher can use the Conscious Consumer booklets and guides, which can be found at the Consumer Protection Entity of each city, either in person or on the Internet.

At this moment we place some proposals on how to connect modern social issues to disciplines - or courses - on mobile application development. They are not redeeming proposals, with the pretense of rescuing the planet from these problems. But they can emerge as an orientation, a window, to discuss with the learners about the humanitarian and social problems that we face today.

FINAL CONSIDERATIONS

The emerging mobile technology has gained a remarkable place in our society. IT courses have been trying to keep pace with this demand. The directions of technological education, especially IT, are essentially technicians with little - or almost no - approach to the relevant issues to the modern social context in which we are inserted. A change in direction is imperative. The approach to socially contextualized issues through the coordination of mobile application design projects is shown as an alternative for educators. The content presented is meant to be a spark, so the teacher can ignite ideas and promote discussions around these and other socially relevant topics.

The direction change will enable the formation of more enlightened, aware and educated professionals regarding the civilizing process in which we are inserted. We should not be technophobic. Informatics and its advances are evident and extremely relevant, but technological advances can not suppress or even be unrelated to the issues regarding the civilizing process. The connection between these two points can and must exist, and in need to be strengthened and well-articulated.

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Intelligent Automation System in Asset Safety Using Household

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Abstract

This article describes the main stages of a project used in Home Automation (Home Automation), highlighting many general aspects about advantages and disadvantages of investing in this automation, costs and availability. The forms, propositions and compositions are also exposed for a Home Automation System to work in a pleasant way that can meet the needs and demand of a demanding emerging market. The illustrations in the course of the article proved to be not so simple to program. There is a need to find qualified professionals in the area of home automation for the complete fluidity of the project. A complete model is proposed where the main difficulties are highlighted and resolved.

Keywords: Buildings Automation; Intelligent domotics; Learning; Artificial Intelligence.

1. Introduction

Automation or automation, a concept that is not new, but in recent years it is very present. Innovating and facilitating in several aspects ranging from a simple operation to turn on a lamp, to more complex systems, such as telecommunications. Through market research we noticed a growing curve of automated homes, that is, a business that has an excellent expectation of market valuation. The project was designed to provide an automated system capable of providing a solution to optimize property security. And it is the result of research based on academic works, readings of articles and articles published on the internet about Domotics, Arduino and others.

2. Bibliographic Review

This chapter will address the content that served as a bibliographic review for the development of the project. Each of the elements, ranging from the analysis and systemic design to the physical components that integrate automation.

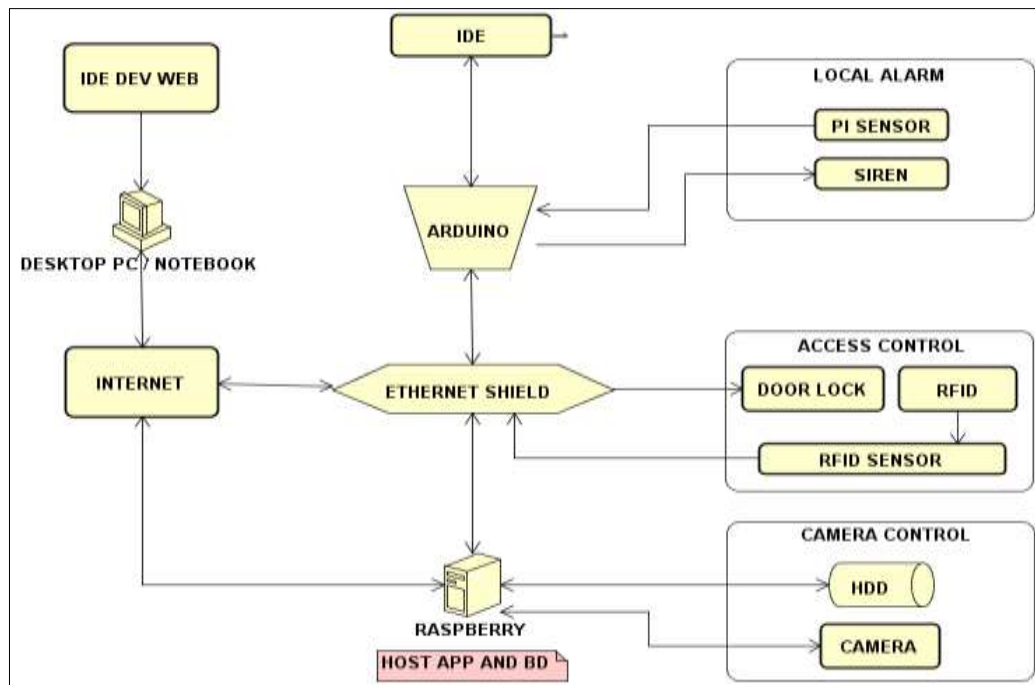


Figure 1. Project Overview.

Source: Authors, (2020).

2.1 Automation Histories

The emergence of automation is so old, that if there is a date that characterizes such an event. The act that automate will occur when we transform any common task into an auxiliary process for human beings, be they domestic, commercial or industrial. (TEZA, 2002).

In the 18th century, the industrial revolution began with the English creation, the steam engine, which boosted production. Thereafter, in the nineteenth century, the industry took the path of growth and on a large scale, with the emergence of new energy sources and steel replacing iron, one of the reasons that boosted the development of industries on the European continent and in the United States. And over the years, new devices were emerging, making the industrialization process even better. One of them was the relay, which in a short time took over the factories. In addition to all these events and others that followed, a new revolution is called. The II Industrial Revolution. (SILVEIRA and LIMA, 2003).

Second (TEZA, 2002) in the automation process electronic, intelligent and automatic devices are used. Therefore, we can automate:

- **Industries.** Applying the concepts of industrial automation, you can have control of productive machines;
- **Trade.** Applying the concepts of business automation, you can control and manage inventory and finance. With the use of resources, such as: barcode, QR CODE, RFID, these

tools promote agility in commercial operations.

- **Building.** Applying the concepts of building automation, you can control the daily operations of places such as condominiums, residential or commercial buildings. The controlled objects would be: lighting, elevators, internal TV circuit, electric fences and locks, etc.
- **Domestic.** Home automation allows us to manage and control domestic tasks, providing greater security and convenience at home.

In the timeline, when it comes to systems development, home automation comes right after its analogues in the industrial and commercial areas, for purely economic and productive reasons, both service providers and manufacturers focused on investments with greater speed of financial return. In terms of the Brazilian market, the situation was similar, in the 1970s, the first automated systems were created for specific purposes in the industrial sector.

After the consolidation of industrial automation, commerce was the next to adhere to the benefits of automation, which up to the present time remains in constant evolution due to the speed of advances in information technology, examples of which are smart tags and complex management and supervision. Several branches of commerce, supermarkets, hospitals, hotels, department stores, have their operations fully integrated, including sales, finance, logistics and so on. Even small businesses and service providers are not exempt from the benefits of automation. Intelligent Buildings are the culmination in the use of this concept, their systems automate practically everything inside the place and apply the newest technologies in the field of telecommunications, building security, access control, elevators, lighting and air conditioning.

For greater understanding, the automation process in homes, apartments and offices is called home automation, but it has other synonymous names, which would be: Home Automation, Home Automation or Home Automation.

The field of home automation or smart environments has a lot of potential. According to the extra website (GLOBO, 2017), our home can become a consumer dream, in terms of convenience. Examples, in the bedroom the bed may have a foot warmer. Water temperature in the shower is memorized according to your preference. Keys to open the door would no longer be necessary, a biometric reader attached to the lock. According to AURESIDE, the initial cost of a basic home automation project is from R \$ 6,000.00.

According to Schneider Electric, a global company specializing in energy management and automation says there are endless variations and possibilities. With more than 20 billion devices connected worldwide and that will be 50 billion in a few more years. These systems allow to control through these devices from the lighting to the sound of the house. If it is possible, remotely, to program the air conditioning to turn on and off at certain times, the same applies to curtains to open at scheduled times.

In terms of numbers, according to AURESIDE, only 0.5% of homes in Brazil have some type of automation. This figure is very distant from the average in Europe and the USA, which is around 18%.

For Schneider Eletric, Brazil accounts for 60% of the company's business. Figures are not revealed, but revenues are estimated to be around 1 billion euros in 2016.

2.2 Automation and Home Automation

A concept that for some is still new, due to the lack of information or because it is, at times, a process

that is too expensive and outside the standards or even a subject that is not part of the current reality, but of the distant future. The futuristic look that automation gives us is that in a simple voice command or clapping hands the simple daily operations of a residential or corporate environment become even simpler and without any effort. As it is not so distant, as were some technological developments in years ago that today are essential and vital. The day will come when any resident or owner of a property will be able to enjoy its benefits. (TEZA, 2002)

Domotics, nomenclature associated with automation, being more focused on home automation. Second (ABREU and VALIM, 2011) it is a relatively recent field in the scope of science, lacking hardware standards and protocols, incorporating technologies from the industrial and building environments. But with the strong demand, competent entities have been organizing and intensifying efforts to standardize and foster technology. Due to this fact, developers when starting a project look for the technologies that allowed them greater flexibility in the integration between hardware and devices. And according to (BOLZANI, 2007) dividing the Domotics implementation process into three major sectors is good practice. Figure 2 illustrates this division.

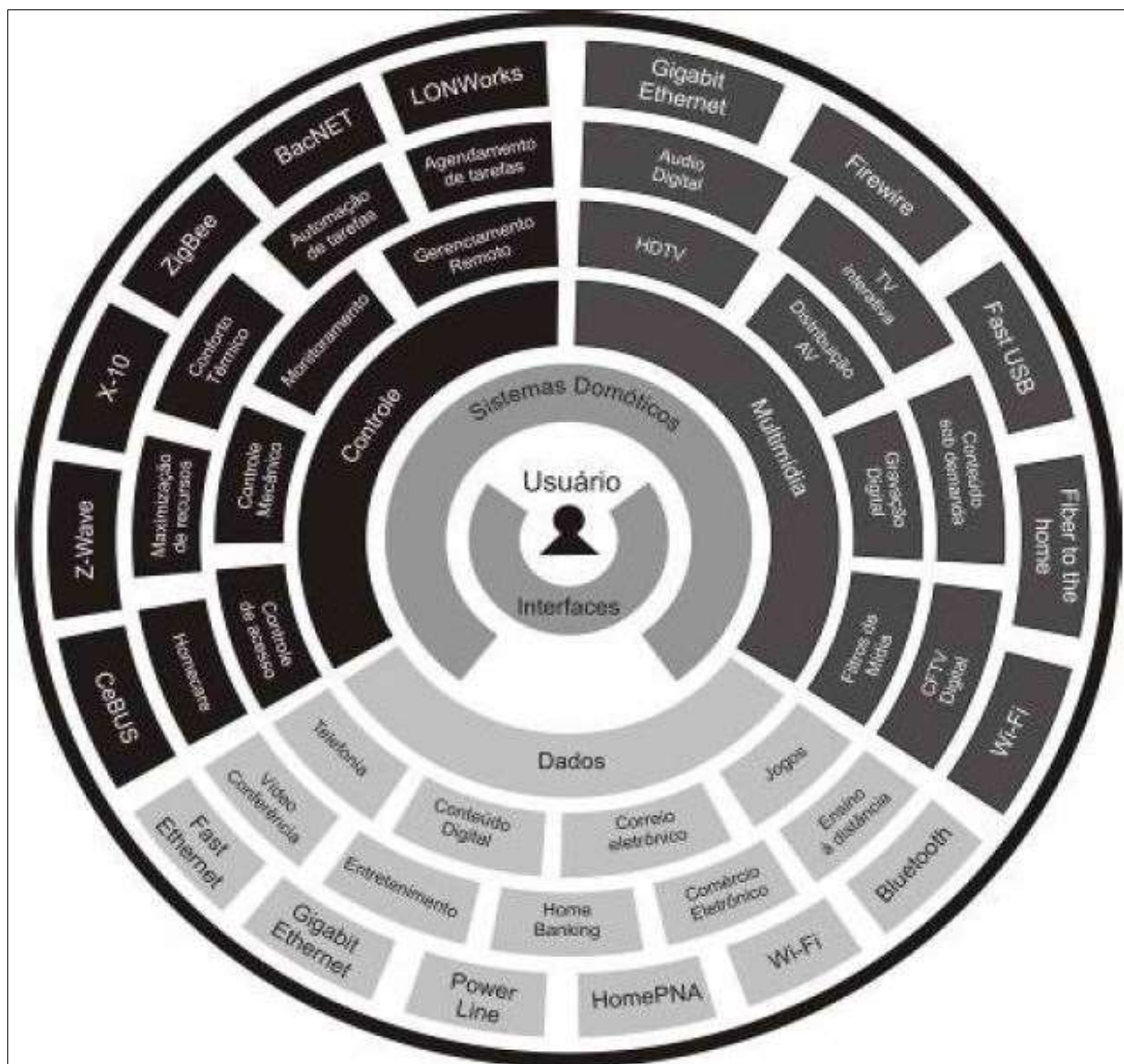


Figure 2. Planned Division of Responsibilities in Home Automation.

Source: Adapted from Bolzani, (2007).

3. Materials and Methods

According to (MOREIRA, 2012), the RUP has a development cycle that is divided into 4 parts, which are: Start, Elaboration, Construction and Transition. Each of the phases covers a specific circumstance included in the life cycle of a software engineering project, in this way, the focus between the disciplines is variable, therefore, it varies according to the needs of the project during its execution. Below the four phases:

- **Initiation:** in this phase the focus is on defining the purpose and analyzing the economic feasibility of the project. The requirements and business risks are assessed before proceeding with the project.
- **Elaboration:** in this phase the focus is related to technical and architectural risks. The purpose of the project should be reviewed and specified in detail. Functional and non-functional requirements are, for the most part, defined at this point. Non-functional requirements at this stage, characterize development risk, as they are considered a critical agent for the success of the project.
- **Construction:** in this phase, the focus is on addressing the logical risks involved in the preparation of the product. Compared to the manufacturing process, which highlights the management of resources, personnel and operations to improve costs, quality and coding.
- **Transition:** it is the final phase, in which the product will be delivered to the user, which can and must request training, as well as during the use of the new system, it will find errors to be corrected and pointed out improvements. In this phase, there will still be several iterations before the formal acceptance of the system is signed.

3.1 Software development processes through diagrams

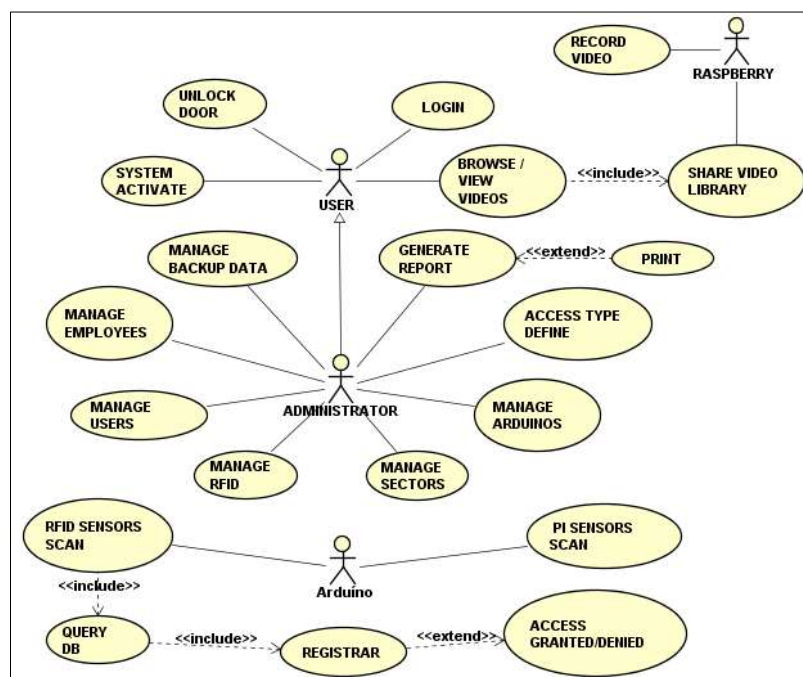


Figure 3. Use Case Diagram.

Source: Authors, (2020).

The Use-Case diagram is responsible for helping to survey the functional requirements of the system, specifying a set of system functionalities and their relationship with external and internal elements.

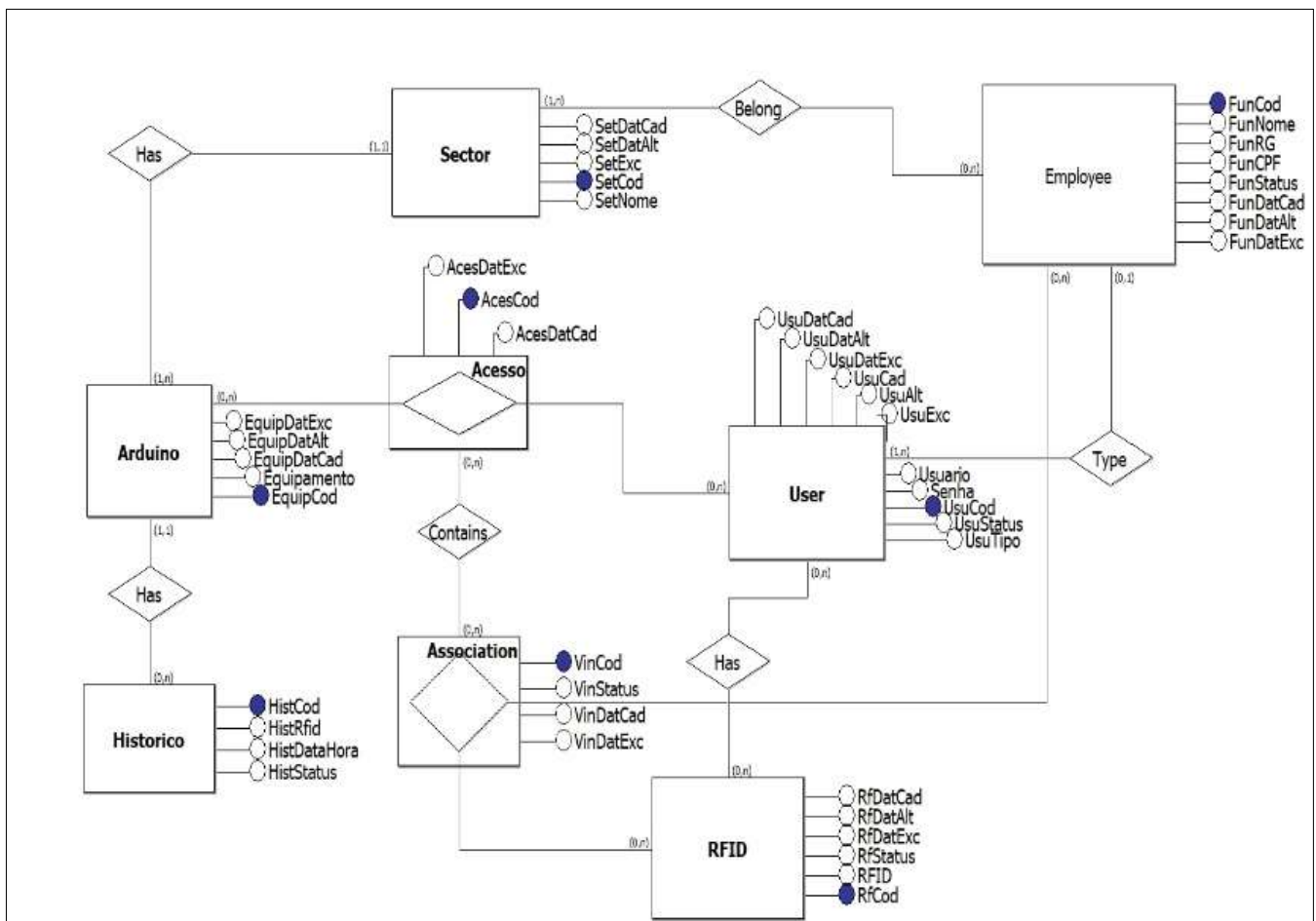


Figure 4. Relationship Entity Model.

Source: Authors, (2020).

An entity relationship model is a systematic way of commenting and defining a business process.

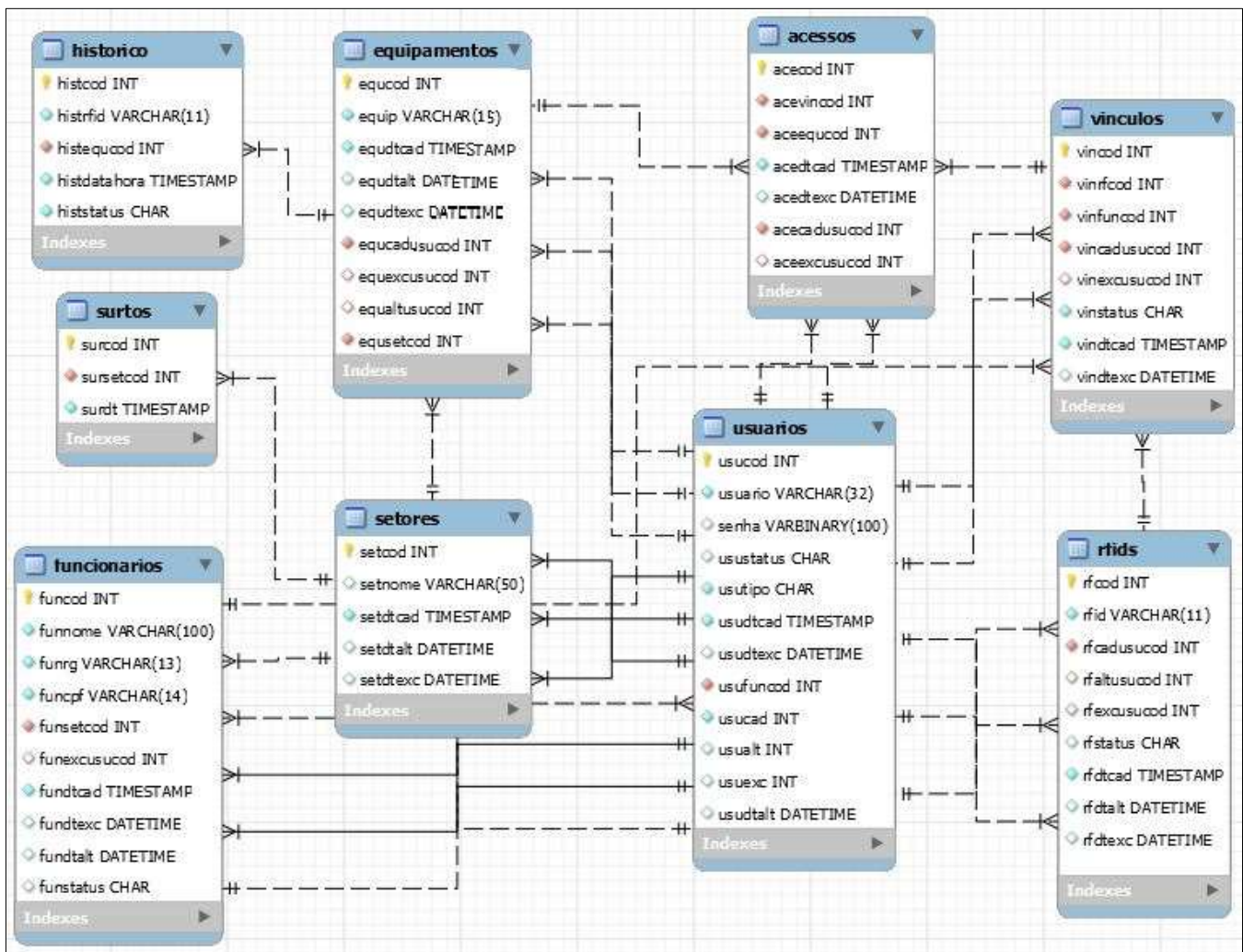


Figure 5. Relational object model.

Source: Authors, (2020).

It is a development technique and used to reduce the impedance of language or object-oriented programming using relational databases.

4. Results and Discussions

The world today is a true technological race, with more and more advances in new segments and it can make people's lives easier. One of the main techniques that has conquered space is home automation (Domotics). In addition to achieving more comfort and safety, it can generate added value to the price of the residence. However, this investment is high and is it worth it to invest in home automation in this delicate moment of our economy, where the real estate area suffers from the retraction caused by the crisis?



Figure 6. Home automation.
Source: Network Project, (2020).

The technological evolution of a home provided by automation systems to its users is unbelievable:

- Physical and patrimonial security (of people and goods);
- Systems integration and coordination.
- Flexibility (adaptation to changes);
- Remote monitoring;
- Environmental comfort (better productivity);
- Reliability;

If we were to live in a more stable economy period, automation would certainly help to enhance the property. Today, however, with declining sales, it is more complicated to be able to sell the automated home at a higher price. At least two years ago it would be worth making the investment, but today it is not feasible and maybe in two to three years it will be worth it again.

Specialist in the area says that it is more worth investing in what is essential to sell a property. “Today, hardly an investment in automation will increase the price of the home. When the used property is well maintained it has an intrinsic value. If you spend between R \$ 35 thousand and R \$ 45 thousand on automation, this value is unlikely to increase the price of the property. That is, today it is worth more to keep the property well maintained and in a pleasant state, with a good painting. This is not the time to invest in Domotics”, reinforces the real estate agent Evangelista.

5. Conclusion

This project in article format aimed to present the model of intelligent automation system in property security, based on techniques known as home automation, which adapts and reshapes its rules according to the behavior of the inhabitant (user) of the system or through the interaction of the owner himself. The study shown since the beginning of the idealization through a methodology (RUP), a software engineering process that provides a disciplined approach to assume tasks and responsibilities within a development organization, widely used in the technological area. We tried to show stages of development in a simplified way, because the details would be something very grand to transcribe in this article, and difficult for readers of this article to understand if they were not experts in the field.

6. Acknowledgments

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Inventory Automation Using RFID Technology in Romaster Engenharia

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Abstract

The inventory of assets is something common and very common in companies annually or even every semester, it is an essential factor for a large and medium-sized company. The large number and degree of complexity of the assets that a company has directly affects the difficulty of managing these assets and, of course, the definition of an accurate inventory. We are talking about a large amount of assets, not just to be on paper and registering one at a time takes a long time, so the idea of our article was to automate all the company's assets (Romaster) by tags, and install antennas at points strategic to make an accurate reading of the company's assets, thus optimizing the inventory time. This technology has existed since the last century, used for the most diverse purposes, but now inserted in the inventory management of the Romaster company.

Keywords: Inventory; RFID. Romaster; Automation.

1. Introduction

Romaster is a company that has been operating for 29 years with projects, assembly works and Industrial and Metal Structure maintenance. It aims to exceed customer expectations through responsibility, efficiency, a positive result and always striving for the safety, environment and competitive price relationship. However, there is a very big problem when it is necessary to inventory the company annually. However, in the meantime, what is an inventory? Inventory in simple terms, is nothing more than a list containing and describing all the materials or goods held by a person or a company. Now in the latter case, it usually refers to an inventory of inventory or equipment of high business value, as the list includes what the company stores internally or somewhere else, in the case of Romaster construction sites in the state and outside of it. It is quite laborious and tiring to make inventory of stock in Excel spreadsheets or even in programs, because even in programs it is still necessary the analogue work of people and even manual in certain cases going up and down stairs looking for deposits and construction plans. The inventory inventory

is always more detailed than the others. The more information about a given item that is described, the easier it is to control and the less complicated any necessary movement in the physical inventory becomes. In large companies, it is more work to control the flow of what comes and goes. The idea is to implantation of RFID technology, or “radio frequency identification”, which is to put a tag on a specific company asset, and to be able to quickly establish the information and catalogs, the exact number of items in stock and even identify where they are items inside or outside the company.

2. Bibliographic Review

Every RFID system is composed of three basic elements, which are: tags, antennas and readers, each with a specific assignment in the structure. The first component mentioned, the label, its function is to identify the different elements in which it is inserted. Antenna is responsible for establishing the link between the tag and the reader. Let's talk now about the reader, he has the task of managing multiple accesses, corrects errors, outside, sends the data collected by the antenna to data processing software.

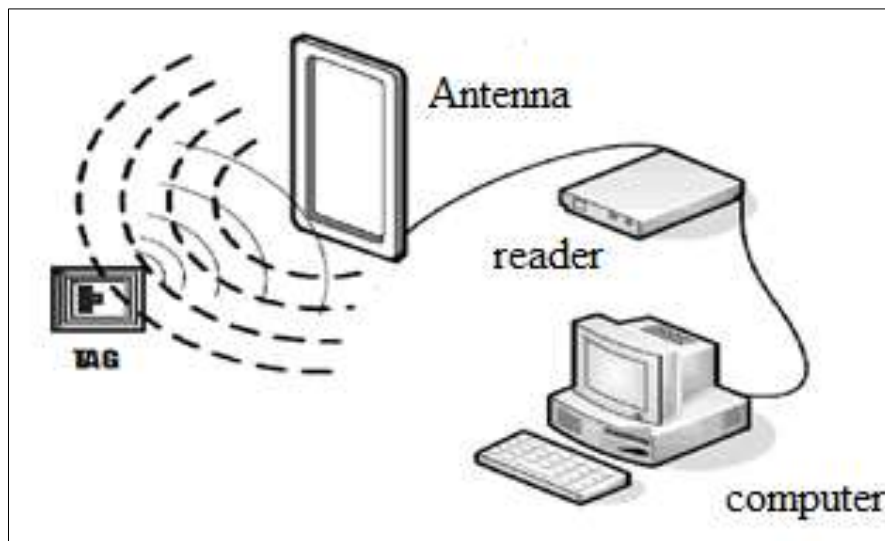


Figure 1. RFID components.

Source: ResearchGate (2020).

Since the beginning of its use, this technology has proved to be very versatile in terms of its applications. Among the various applications we highlight:

- Passage Control
- Inventory control
- Tracking
- Identification
- Access control

2.1 Standardization

With the spread of RFID technology on an increasing scale, efforts are being made to standardize it

in some countries that use it, as there is still no official resolution regarding this. Having this as one of the main objectives of some organizations such as the International Organization for Standardization (ISO), in which it is responsible for the standardization of operating frequencies and for the coding and decoding protocols, also having EPCglobal, an organization founded not only to assist in the standardization as well as to control the identification numbers of the Tags, but also to manage, control and stimulate the development of this RFID technology, in these countries.

2.2 ISO standards

Today, ISO together with the International Electrotechnical Commission (IEC), in which it is responsible for the general standards that involve area interface, data history, compliance and performance issues. In the case of radio frequency, the standards developed by these institutions are as follows:

ISO 18000

- ISO 18000-1: General frequency parameters of systems adopted worldwide.
- ISO 18000-2: Parameters for system communications with frequencies below 135kHz;
- ISO 18000-3: Parameters for systems communications with a frequency of 13.56MHz;
- ISO 18000-4: Parameters for system communications with a frequency of 2.45GHz;
- ISO 18000-5: Parameters for system communications with a frequency of 5.8GHz;
- ISO 18000-6: Parameters for system communications with frequency from 860MHz to 960MHz;
- ISO 18000-7: Parameters for systems communications with a frequency of 433MHz;

ISO 11785: Frequency standardization for the use of animal tracking devices; (134.2kHz)

ISO 14443: Standardization of frequency in proximity identification cards; (13.56MHz)

ISO 15693: Frequency standardization on neighborhood identification cards; (13.56MHz)

It may happen that smaller companies do not need an inventory with a high level of detail or a little more elaborate, it may happen that the company does not have so many valuable assets that it needs a great concern in managing everyone. Thus a simple record resolves in an Excel spreadsheet. However, large corporations both nationally and internationally have an immense number of assets and other assets and a record in Excel is not necessary, so an inventory is designed that registers, categorizes and organizes information according to the characteristics of what will be inventoried.

3. Materials and Methods

The implementation project involves the following stages of RFID technology for controlling the business inventory of the company Romaster Engenharia, involving a series of activities, such as the purchase of specific software and hardware. The process is divided as follows.

I Specialized Consulting

- RFID technology system mapping and implementation.
- Training of the team (employees) that will use this technology.

- Specialized technical support.
- Maintenance of management and inventory solution.

II System

RFID reader system that can communicate and integrate with the company's existing system, mostly a modular management system (ERP) to be able to perform intelligently with the customer's existing asset system.

III Physical Equipment

Data readers, antennas, recorders, servers, among other specific equipment.

3.1 Final features of RFID technology

As already mentioned, the main objective of RFID technology to control inventory, and to facilitate the location of company assets.

In short, this identification is made by automatic reading of smart tags, attached to each of the company's equity assets. The location process (asset inventory) must use manual RFID readers to locate the assets and allow the monitoring of the assets from fixed antennas and RFID readers, strategically installed in the company's access places, such as internal corridors, access doors to specific rooms according to the project carried out by the specialized technicians contracted by the company to implement the technology.

4. Results and Discussions

The great benefit of using RFID in inventory management is due to the capture and movement of your assets automatically, in real time you can check the status of the quantity of the company's goods already cataloged or of a specific product lost in a certain place in the company.

Imagine if RFID systems are integrated with other departments of the company, you can automate and intelligently manage by identifying suspicious equipment movements or even theft of company goods. company, previously not noticeable when it disappeared.

The reading of the bar code is done by an optical reader, with a direct view that is (directly on the data), the reading of the RFID tags is carried out even when they are not aligned close (without sight) to the antenna, even inside a The box can read without any problem, even with plastic wrapping or even dust on the TAG, nothing interferes with the reading.

There are several positive points of the RFID system, the ability to store more information in the TAG, this reading can be done at a very great distance compared to previous technologies, besides that it is possible to make simultaneous readings of several TAGs, and the tracking of products on the move, which enables a dynamic inventory in relation to previous inventories using the barcode and the individual spreadsheet reading of the assets.

Table 1. Comparison between RFID and Barcode

Characteristics	RFID	Bar code
Mechanical resistance	High	Low
Formats	Miscellaneous	Hang tags
Requires Eye Contact	No	Yes
Lifespan	High	Low
Possibility of Writing	Yes	No
Simultaneous Reading	Yes	No
Stored Data	High	Low
Additional Functions	Yes	No
Safety	High	Low
Initial cost	High	Low
Maintenance cost	Low	High
Reuse	Yes	No

4.1 Advantages of the RFID Tag

- Única Unique identification as an RFID tag is programmed with a unique code.
- Fast, paperless data collection
- Elimination of typos in reports
- Reduced working hours due to reduced paper work
- Controlada Controlled management of devices and warehouse
- Ability to store more data than bar codes
- Comply with legislation
- Easy to share updated information
- Manage equipment inspections, maintenance services, etc.
- Confiável Reliable operation in harsh environments, for example, wet, dusty and dirty conditions, corrosive environments, vibration and shock
- There is no need for contact or line of sight.

4.2 Negative points of RFID

- Since it is a radio frequency signal, tags suffer great interference when coupled to metal surfaces. As this is a common reality in the industry, it can be a problem depending on what you want to monitor.
- Another characteristic of RFID is that the signal emitted is unidirectional. Although it is not necessary to have a “visual contact” between the reader and the tag, for the tag to be recognized it needs to go in the exact direction that the reader is pointing. In this way, it is impossible to carry out a complete monitoring of the assets throughout the plant. What you have is a solution that

identifies when the monitored object passed through a certain region.

- Finally, the last point to highlight is the price of an RFID solution. The labels are inexpensive, disposable and ideal for monitoring assets with little value. However, reading antennas require a high investment, especially if the operation is complex and requires the implementation of several portals.

5. Conclusion

Technological renewal today is something applied in all areas, where somehow it manages to apply improvement in some processes, the use of radio frequency is becoming more and more common not only in the industrial sector, but also in the daily life of an increasingly technological society, we cannot be left out of this avalanche, so there is a continuous search for improvements in its processes.

In some studies, process optimization and cost reduction were observed, today companies are increasingly prepared for the future with RFID, the system is still being tested in other sectors in companies, we hope that RFID will become increasingly once an instrument of study and improvement, mainly to overcome the problems related to security, to privacy something that we have been able to observe in studies.

However, we are sure of the world that as this technology has more adherence, and makes it a basic need for organizations, the improvement in their security is something that will gradually happen until reaching a desirable status for everyone.

6. Acknowledgments

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Study of the Ponta Negra Beach Surface in Manaus / AM: Evidence and Causes of Mass Movement of the Artificial Beach Landfill

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Abstract

Ponta Negra Beach is located on the banks of the Rio Negro, in the city of Manaus, state of Amazonas, Brazil. In 2012, a revitalization of the beach was carried out, with emphasis on the construction of an artificial beach landfill, in order to perpetuate the population's access to the beach throughout the hydrological year. This work resulted in the formation of several irregularities throughout the terrain, such as cavities, plumbing and pipes exposed on the surface, and sudden cavities between shallower and deeper parts of the bed. These problems have resulted in several fatalities since the opening of the landfill. Given these questions, this study aimed to assess the changes that occur on the beach surface, through analysis of sediments, topography and space, as a result of the construction work, for a period of two to three years, and thus, to identify the cause of these problems to understand what failures occurred in the construction of the landfill that led to the formation of these irregularities. The results showed that the

grounded sediments from the artificial beach are being transported more easily by the force of the river and the rains because they are finer sediments than those of the natural beach, intensifying the erosion rates and resulting in the generation of ravines and depressions along the entire beach, being responsible for the movement of sandy mass of the landfill and in the formation of the irregularities found. This study proves that the anthropic relationships interfered in the natural processes that act on the beach's morphology, warning the importance of serious previous studies in the execution of works with landfills and their continuous maintenance

Keywords: Rio Negro; artificial beach landfill; movement of sandy mass; erosion.

1. Introduction

Ponta Negra Beach, located on the banks of the Negro River, originally inhabited by the Manaós Indians who gave the city its name, is one of the most important tourist spots in the city of Manaus, providing a charming landscape and numerous leisure options for those who visit it. It was built in the 1990s, modernizing about 3 km from the edge of the Rio Negro with pedestrian buildings, sports courts, restaurants, bars and an amphitheater [6].

According to the regional fluvial regime, the surface of the beach became submerged during the months related to annual floods, making access and services impossible. As a result of this, the beach underwent revitalization in 2012, with the highlight being the implantation of an artificial beach embankment, allowing the population access to the beach throughout the year, including in floods. The natural beach was covered in a stretch of 500 meters from the Tropical Hotel to about 60 meters beyond the beach line, with a thickness of 10 to 12 meters in its most proximal portion [1].



Figure 1: Location map of the area. A) Country of origin of the work area (Brazil) on the left, and city of Manaus on the right. The red square indicates the location of the beach. B) Praia da Ponta Negra before construction in 2007. D) Praia da Ponta Negra after construction, in 2017, emphasizing the artificial beach.

However, after the reforms, the artificial beach bed presented irregularities composed of abrupt unevenness between shallower and deeper parts, as shown in the studies prepared by Serviço Geológico do Brasil (CPRM) [1, 2, 3, 4]. According to the technical reports of Ponta Negra, bathymetric studies carried out from 12 November 2012 to 20 October 2015 found that the distance from the beach edge to the risk areas is variable throughout the hydrological year, presenting little regularity in the terrain with the presence of sand banks surrounded by deep depressions and falls, both in the transversal and longitudinal directions, concluding that the constructive form used on the beach generates an irregular surface, and represents a

risk for beach users, being the period most dangerous are those in which the lowest shares are observed [4].

These problems resulted in several related fatal drowning victims, 13 of which were from July to December 2012, just after the construction of the landfill. According to Department Public of Safety [5], there were a total of 55 drowning occurrences from 2012 to 2018.

These accidents may be involved with the landfill work, because when evaluating the submerged area of the beach, it was found that on the natural beach the unevenness of the riverbed happens gradually while on the artificial beach the unevenness occurs abruptly, being a danger for bathers [1].

In this context, topographic, granulometric and space-time characterization of the fluvial banks of Praia da Ponta Negra was carried out in this work, with regard to natural and landfill deposits. The analysis of changes in the surface was intended to assess and understand the behavior of the surface of the Rio Negro margin in response to anthropic interventions in the region, as well as to establish possible modifications of the natural processes in the area and surroundings caused by the landfill work, by a period of two to three years. Understanding the processes responsible for the behavior of the morphology and dynamics of Ponta Negra beach are of fundamental importance for the use of society.

2. Methodology

The methods and procedures performed in this research consisted of some subdivisions, seeking to obtain parameters for studying the region's morphology and dynamics through sedimentary, topographic and space-time analyzes, described below:

2.1 Bibliographic data

The first procedure for carrying out this work consists of acquiring basic information about the area of knowledge and geography, through research and reading of publications, articles, book chapters, dissertations, thematic maps and satellite images.

2.2 Area Monitoring

A systematic observation of the area was carried out during the successive years 2017, 2018 and 2019, through photographic records, which were able to show features on the surface composed of irregularities, their changes and evolution during the course of the project.

2.3 Topographic data

Topographic data were collected during the dry periods, in November, in 2017 and 2018, using the TOPCON Total Station, model GTS-235W. In addition to this device, the TRIMBLE brand geodetic GPS (model R6) was used in order to make it possible to survey the profiles. The collection of these points was carried out through transversal beach sessions, with a distance of approximately 10 m between the points, only in the transition area of the natural and artificial beach (Figure 02).

With the data obtained in the topographic survey profiles and maps were made, using tools from the Google Earth program and the ArcGIS geographic information system.

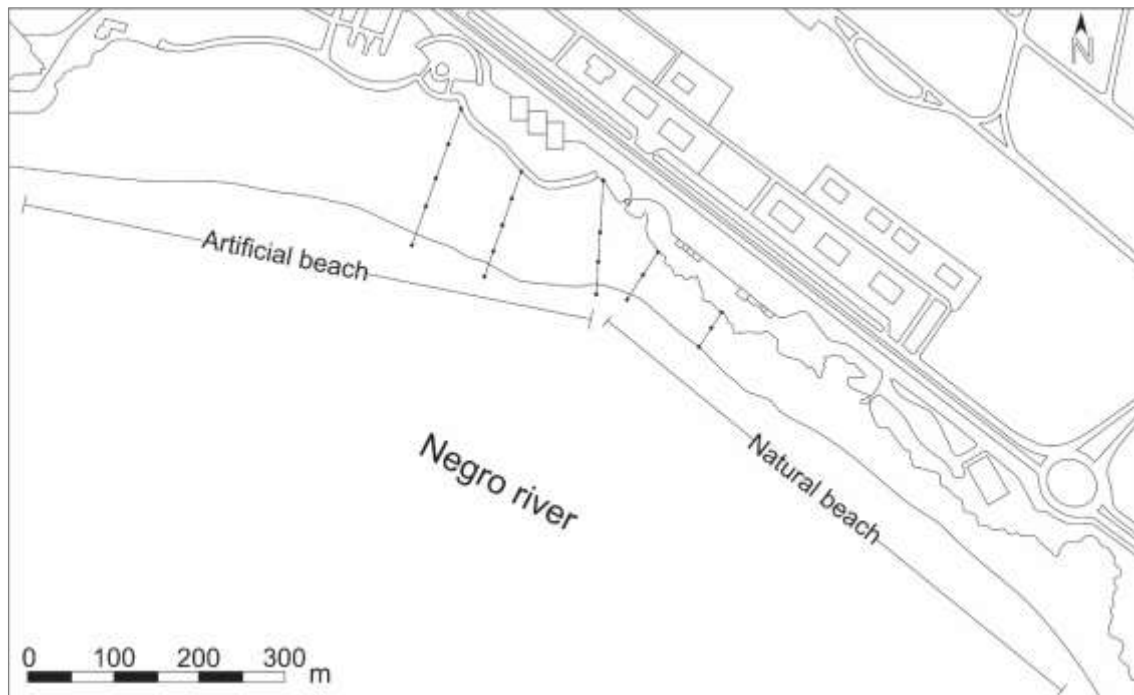


Figure 2: Schematic profile of the area and cross-sections performed in the topographic survey; the black dots were the places where the data were collected.

2.4 Sedimentological data

Sedimentological data were obtained through the collection of 18 sediment samples at scattered and distant points, covering various portions between the transition from the natural beach and the embankment. The collection was carried out during the surveying work, with 9 samples collected during the 2017 survey, and 9 samples collected during the 2018 survey, in locations with elevations similar to the collection points of the previous year.

The sediment samples collected in the field work were properly identified and taken to the laboratory, where they were subjected to granulometric separation by sieving techniques, a methodology proposed by Suguio, 1973 [7]. The collected material was dried in an oven and then sieved on an electric stirrer to be weighed according to each particle size retained in the sieves with the following intervals: bottom, 0.063, 0.125, 0.250, 0.5, 1.0 and 2.0 mm.

With the analyzes made, the weighing results were transformed into percentage values representative of the granulometric distribution, to classify the fractions in very coarse sand, coarse sand, medium sand, fine sand, very fine and fine [7] using the Sysgran 3.0 software. Through these results it was possible to verify the types of sediments prevalent in the different areas of the natural and embankment beaches.

2.5 Space-Time Analysis

Images were collected in the years 2017, 2018 and 2019, from the Google Earth Pro program, using the tool "show historical images", where satellite images were obtained in periods of flood.

After image collection, area calculations were performed using polygons built in the different years. These polygons were processed in ArcGis 10.5 software, where it was possible to acquire the real size of the area through a tool in the attributes table, called “calculate geometry”.

2.6 Data Interpretation

With the data obtained, the study was completed with the interpretation and comparisons between the topographic maps of 2017 and 2018, and of the photographic records of the irregularities found, thus evaluating the surface behavior. Analogies were made between the granulometry of the natural beach and landfill sediments, and the difference between the granulometry found comparing the samples collected in the two years in a row. Comparisons were made to the satellite images analyzed over the years, after the construction of the landfill. And, finally, comparisons between the data found in the landfill area calculations, in order to prove the movement of the grounded sediments.

3. Results

3.1 Area Monitoring

Through visits and analyzes made in the field, it was observed that irregularities are present in the area and that their appearances are constant throughout the terrain. The features found on the beach are formed repeatedly over time and were not present before the construction of the embankment, showing that the work carried out is causing changes on this surface.

Both the natural beach and the artificial beach showed erosion in the area, mainly close to the beach line, during the entire research period. These features come in different sizes, ranging from approximately 10 to 50 cm in depth, and from 1 to 6 m in length, and are caused by processes of ravination and internal erosions due to a greater influence of the river on these banks. (Figures 3.4 and 5).

Along the entire artificial beach, the appearance of open pipes occurs, which are covered by employees with the beach sand itself, and are reexposed according to the weather, especially after rains (Figure 6). It is possible to notice the accumulation of water in some parts of the beach (Figure 7a), and also the presence of sandy movement features, where the grounded sediments are observed being transported from the surface and deposited on the riverbed (Figures 7, 8, 9, 10), forming extensive tracks of crawling sandy material with a depth of up to 30 cm, and also features of micro deltas, which have evolved over the years. These irregularities are linked to poor planning for the runoff of surface water, which in certain points occurs more intensely, such as from stairs and pipes that channel the water. This happens due to the lack of a correct infrastructure in the urban area of the beach that would work more adequately for the applicability of the landfill.



Figure 3: a) Abrupt depression / internal erosion feature in 2017 at the landfill; b) Erosion with the formation of pots on the artificial beach in 2018. c) Erosion on the natural beach, close to the beach line, of almost 6m in length in 2018. d) Cavities about 1 m in diameter in the embankment in 2018.



Figure 4: Features found on the transition surface of the embankment and natural beach, during the drought periods, in 2018 - a and b) Erosions with the appearance of the substrate rocks, approximately 2 meters wide, and 40 cm deep.

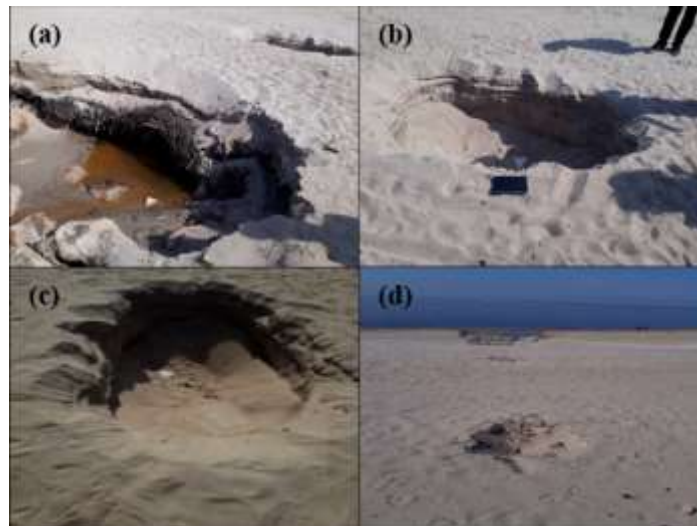


Figure 5: Features found on the landfill surface during low water periods, in 2018. a) Cavity filled with water. b and c) Cavities from internal erosions. d) Cavities being formed in the same direction, the deepest located on the beach line.

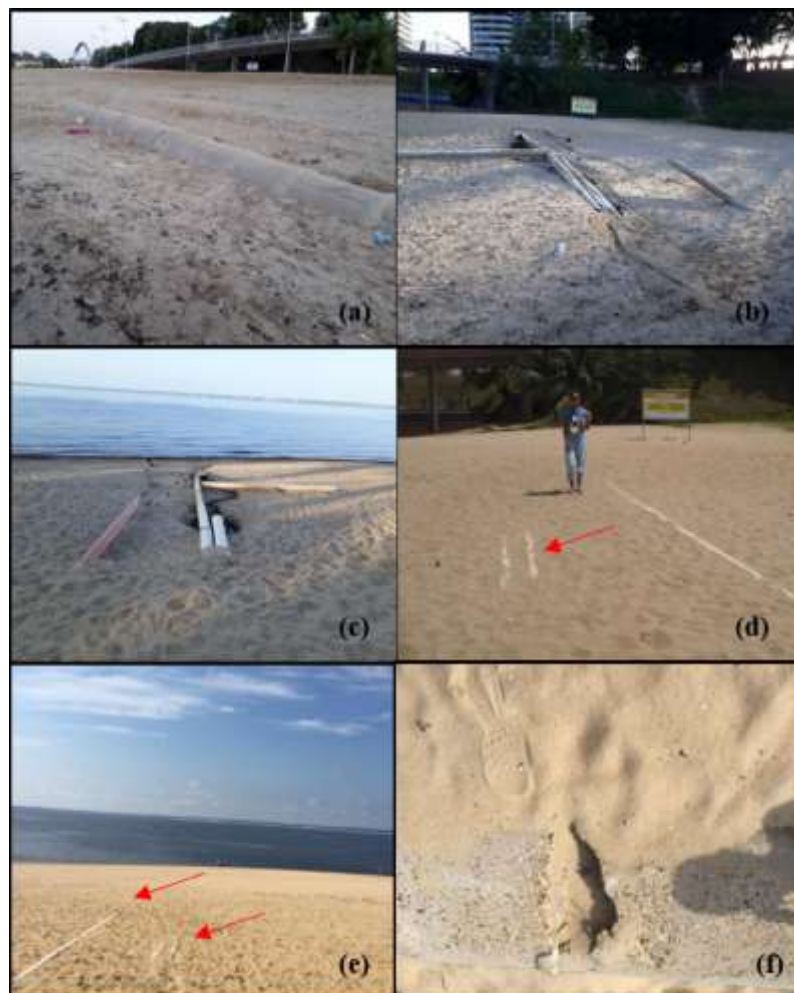


Figure 6: Features found on the landfill surface during low water periods, in 2017- a) Piping almost totally exposed for a 10-meter extension; b) Exposure of pipes above the landfill surface. Features found on the surface of the landfill during ebb periods, in 2018 - c) Resurfacing of uncovered pipes; d) Exposed pipes; e) Pipes exposed at various points in this area. f) Water pipe broken and not functioning

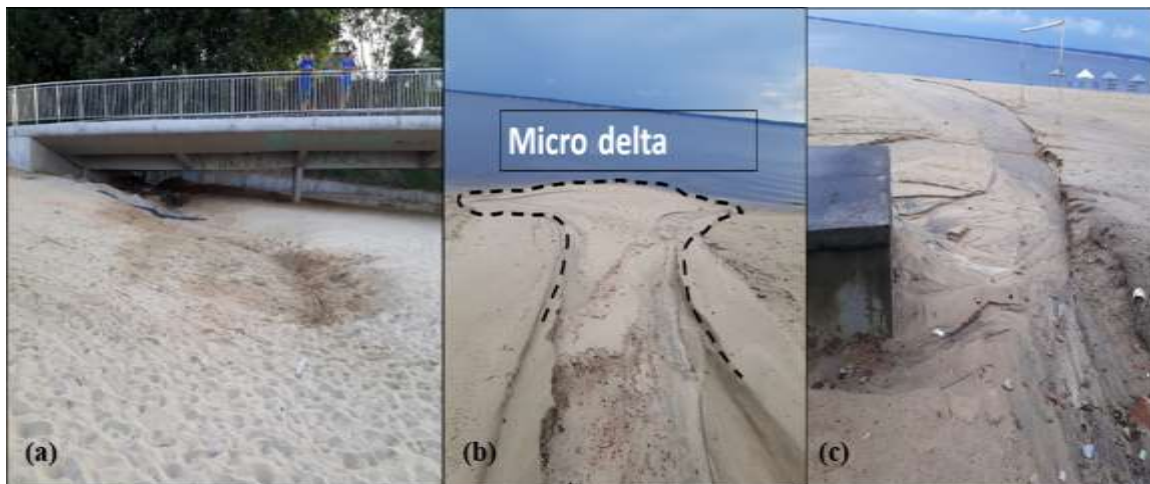


Figure 7: a) Channeling in the most proximal portion of the landfill in 2017. b) and c) Features of sandy movement due to the action of rains in 2018, at the landfill. Photo b) shows a feature formed called micro delta, indicating the movement of sediments and their deposition on the riverbed, a feature that evolved from the feature in photo a) in 2017.



Figure 8: Features found on the landfill surface during low water periods, in 2018 - Features of sandy movement due to rain. Photos a and c) show the sediments towards the river, and photos b and d) show the sediments coming from the beach.



Figure 9: Features found on the landfill surface during low water periods, in 2019 - Features of sandy movement due to rain. Photo a) shows the sediments from the beach, and in photos b and c) show the sediments towards the river. Photo d) illustrates the depth of approximately 30 cm of the path caused by the transport of particles.



Figure 10: Places where the movements of sandy masses in figures 7, 8 and 9 occur, and water accumulation in figure 7a, caused by the presence of pipes and stairs that channel rainwater more intensely.



Figure 11: Features found on the landfill surface during low water periods, in 2019 - a) and b) Beach surface presenting, in general, the sandy mass movement features.

3.2 Topographic Data

With the analysis of the maps generated by topographic survey, highlighted in the transition from the artificial and natural beach, it was possible to study and interpret the dynamics of the beach surface.

In the dry season in 2017, the map generated showed significant differences in the topographic levels of the area (Figure 12), where the artificial beach (west edge of the map) presented the highest levels, with a maximum of 30 meters, and the natural beach (eastern edge of the map), the lowest dimensions with a maximum of 22 meters, presenting an expressive narrowing. The contour lines of the map have a non-linear shape, with numerous ascents and descents on the surface, showing that it is a non-flat terrain, which may have been caused by the movement of sandy masses from the landfill.

It is observed in the upper part, numerous sinuosities that indicate channeling in the land towards the river, being one of the causes for the irregularities in the topography.

Topographic map of Ponta Negra beach - 2017

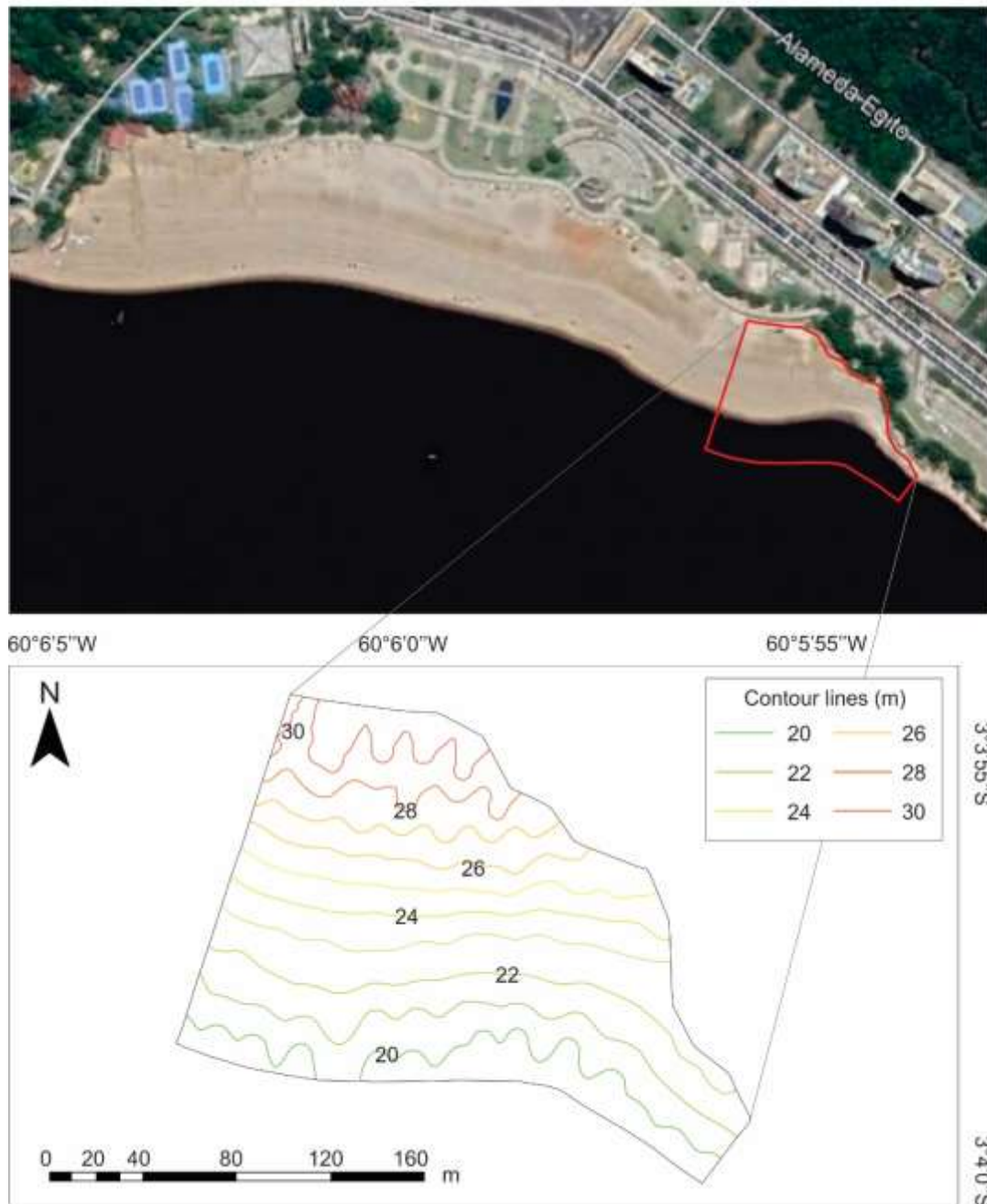


Figure 12: The image shows the place where the topographic survey was carried out, in the transition from the artificial and natural beach; and the topographic map of the area with minimum elevation, represented by the first green color, in the value of 20 m, and the maximum elevation, in red, with the value of 30 m.

From the topographic map generated in the 2018 drought (Figure 13), it can be noted that the relief of the beach has decreasing elevation levels towards the river with a variation of eleven meters. The terrain continues to show significant differences in the topographical levels of the area, which in addition to demonstrating a non-flat terrain, has lowerings and elevations along the terrain, with a maximum height of 30 meters on the artificial beach, and now 21 meters on the natural beach.

Topographic map of Ponta Negra beach - 2018

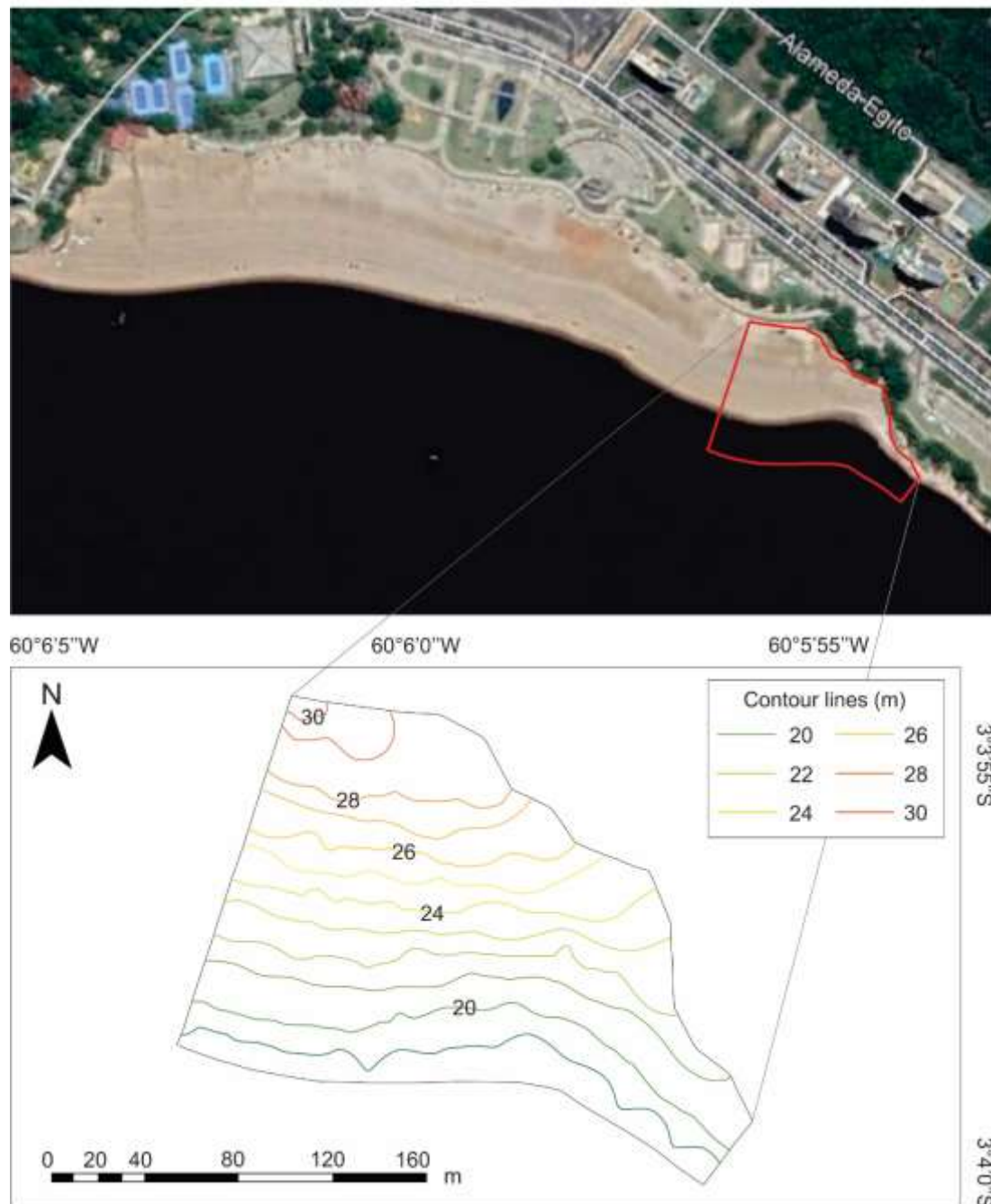


Figure 13: The image shows the place where the topographic survey was carried out, in the transition from the artificial and natural beach; and the topographic map of the area with minimum elevation, represented by the first green color, in the value of 19m, and the maximum elevation, in red, with the value of 30m.

It is important to note that looking at the two maps, it can be concluded that the surface has changed significantly during the two years of research. The shapes of the contour lines showed great variations from one year to the next and some quotas changed, as in the natural beach. In 2017 it is possible to find more apparent sinuosities at the top of the beach, which indicated a greater concentration of channeling on the surface towards the river, in 2018, these sinuosities are no longer present. This shows that the sediments on the surface of the beach terrain are constantly moving and that they generate a major change in the morphology of the beach in a short period of time.

3.3 Sedimentological data

During the topographic survey in 2017, sediment samples were collected at 9 points and taken for analysis in the laboratory (Figure 14). As a result of the analyzes, characteristics of moderately selected sediments, from rounded to angular, were revealed, with the predominant granulometry of medium sand (0.250 to 0.50 mm), being also possible to verify great variations in the presence of silt and clay size sediments.

Samples with a higher content of silt and clay granulometry sediments from the artificial beach occur with greater predominance close to the top line of the land, indicating that the greater quantity of fine sediments placed on the beach may have already been remobilized by the action of the river and rains (Figure 15). It is possible to notice that the granulometry of the sediments varies according to the sampled area, proving that the terrain is composed of heterogeneous material (Figure 15).

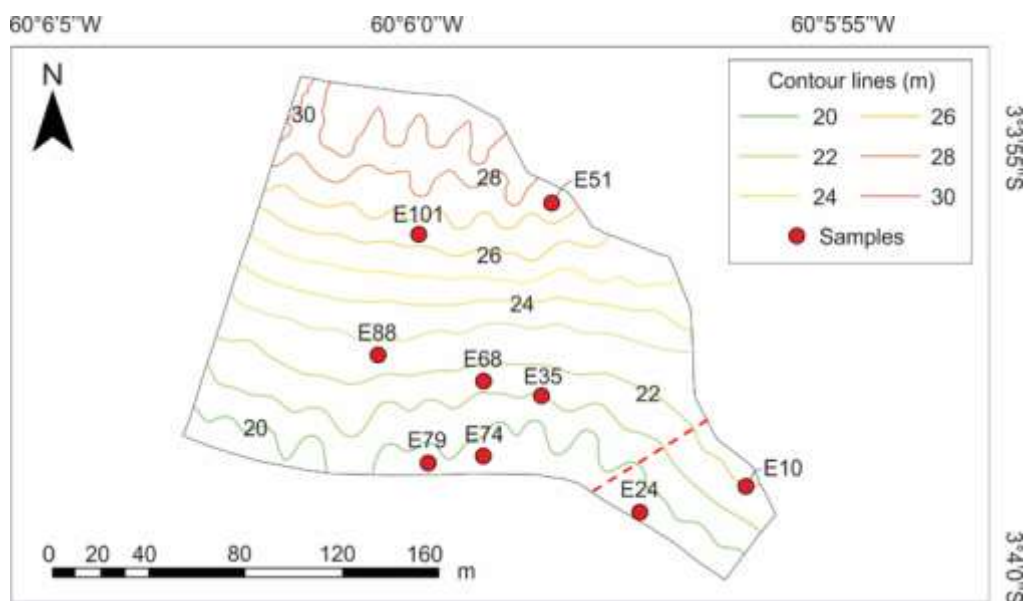


Figure 14: Map of the location of samples collected in 2017, indicated by red dots. The red dashed line shows the transition between the artificial beach (to the west) and the natural beach (to the east).

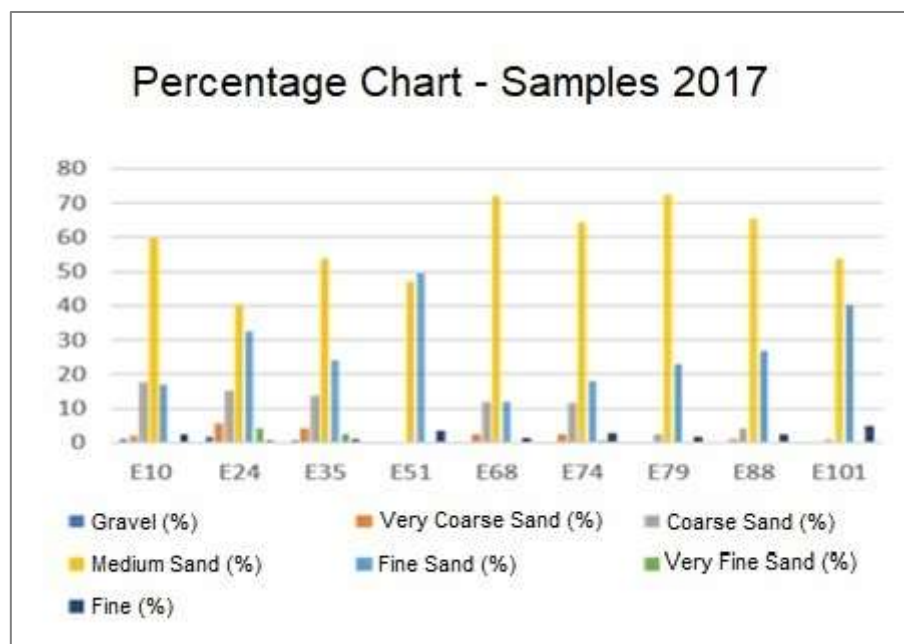


Figure 15: Percentage graph of the granulometry of the samples. The granulometry of the sediments varies widely, and the predominant type is medium sand.

In 2018, sedimentological analyzes of samples collected during this year's topographic survey (Figure 16), revealed that sediments are moderately selected, from rounded to angular, also having predominant grain size of medium sand grains (0.250 to 0.50 mm) in all samples (Figure 17). The sediments still show a great variation according to the collected area, however the fine sediments presented a significant reduction.

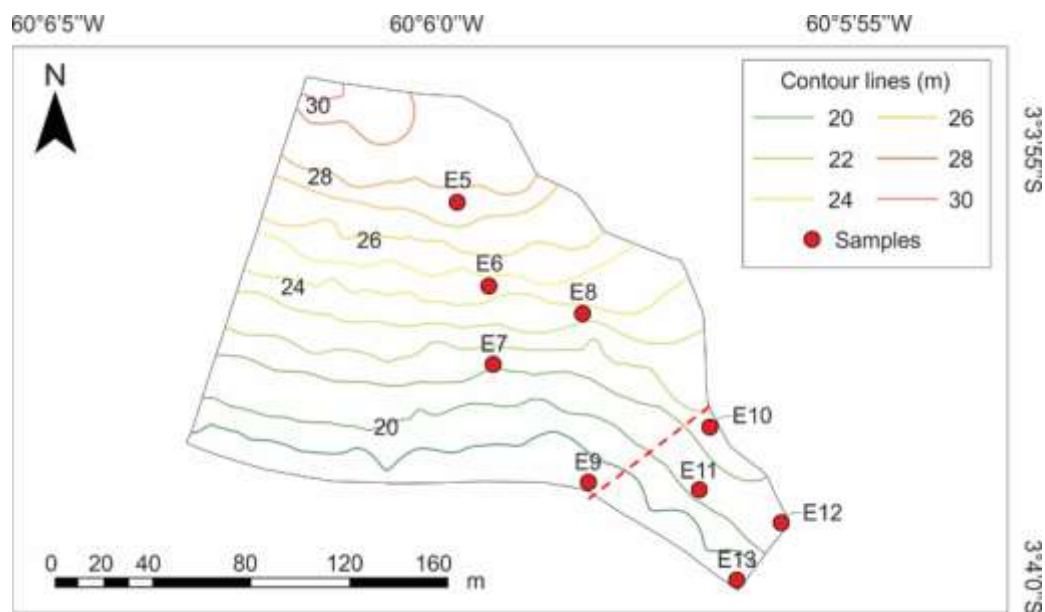


Figure 16: Location map of samples collected in 2018, indicated by red dots. The red dashed line shows the transition between the artificial beach (to the west) and the natural beach (to the east).

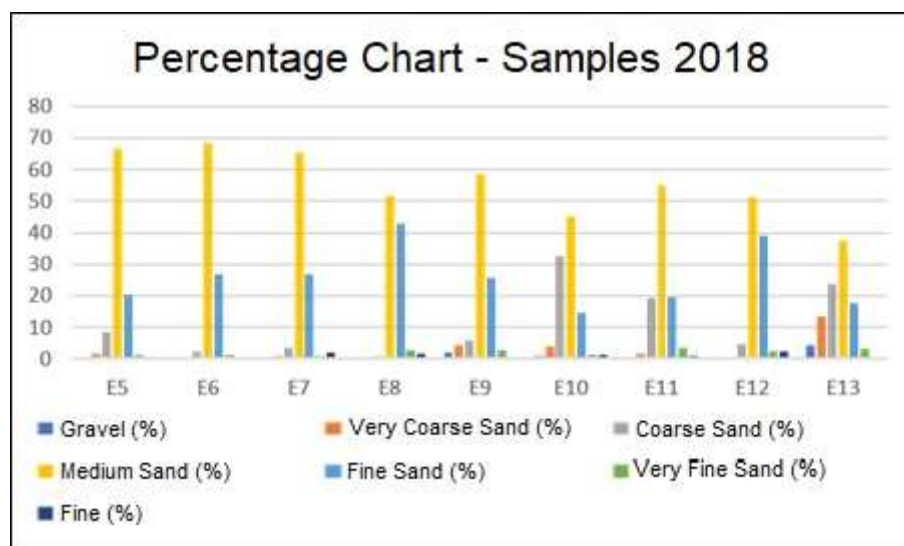


Figure 17: Percentage graph of the granulometry of the samples. The granulometry of the sediments varies widely, and the predominant type is medium sand. There is a reduction in fine sediment (black color) when compared to the 2017 graph (Figure 15).

Comparing the sediments of the two beaches, different granulometries were found. In the natural beach there is a greater presence of sediments of coarser granulometry (samples E24 and E10 in 2017 and; samples E10, E11, E12 and E13, in 2018) showing that the landfill work is made up of finer material than the sediments of the existing beach (Tables 1 and 2).

Table 1: Values as a percentage of each type of granulometry on the natural beach and landfill in 2017, it is observed that there is a greater presence of coarse sediments on the natural beach.

Beach 2017	Gravel (%)	Very Coarse Sand (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Very Fine Sand (%)	Fine (%)
Artificial	0,21	1,49	6,45	61,2	27,61	0,51	2,46
Natural	1,23	3,845	16,425	50	24,75	2,2	1,5

Table 2: Values as a percentage of each type of granulometry on the natural beach and landfill in 2018, it is observed that there is a greater presence of coarse sediments on the natural beach. It is important to note that the amount of fine sediment from the artificial beach has been reduced.

Beach 2018	Gravel (%)	Very Coarse Sand (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Very Fine Sand (%)	Fine (%)
Artificial	0,81	1,54	4,25	62,08	28,5	1,84	1,11
Natural	1,84	4,8	20,07	47,26	22,75	2,55	1,2

Comparing the sediments of the samples from 2017 and 2018, it is possible to see that the amount of fine sediments reduced in almost all samples (Tables 3 and 4). Comparing the top of the beach, in 2017, the samples (E51, E101) were composed of 4% of fine sediments, in 2018 (samples E5 and E6), this value decreased to 0.6%; on the beach line, in 2017, fine sediments (E79, E74) consisted of 2.28% of the samples, in 2018 (E9, E13) this value dropped to 0.5%, showing that the landfill sediments are being remobilized (Tables 5, 6, 7 and 8).

Table 3: Values of very fine and fine sand sediments in 2017.

Samples	Very Fine Sand (%)	Fine (%)
E10	0,3	2,31
E24	4,13	0,8
E35	2,52	0,91
E51	0,11	3,36
E68	0,01	1,42
E74	0,49	2,85
E79	0,36	1,71
E88	0,1	2,28
E101	0,03	4,74

Table 4: Values of very fine and fine sand sediments in 2018.

Samples	Very Fine Sand (%)	Fine (%)
E5	1,36	0,66
E6	1,17	0,56
E7	1,02	1,97
E8	2,77	1,83
E9	2,92	0,57
E10	1,31	1,28
E11	3,44	0,74
E12	2,35	2,34
E13	3,13	0,44

Table 5: Percentage of fines at the top of the beach in 2017.

Samples	Value
E51	3,36%
E101	4,74%

Average: 4.05% of fines in top samples in 2017.

Table 6: Percentage of fines at the top of the beach in 2018.

Samples	Value
E5	0,66%
E6	0,56%

Average: 0.61% of fines in top samples in 2018.

Table 7: Percentage of beach line fines in 2017.

Samples	Value
E79	1,71%
E74	2,85%

Average: 2.28% of fines in samples of the beach line in 2017.

Table 8: Percentage of beach line fines in 2018.

Samples	Value
E9	0,57%
E13	0,44%

Average: 0.49% of fines in samples of the Beach Line in 2018.

3.4 Space-Time Analysis

The following images (Figure 18) were used to perform area calculations in times of floods, in order to state that the landfill is being remobilized, and consequently, decreasing over the years.



Figure 18: A) Flood on 7/29/2017, elevation: 27.69 m; B) Flood on 07/20/2018, elevation: 28.15 m; C) Flood on 7/31/2019, elevation: 28.34 m. The polygons in each image were used for area calculations. Source: Images taken in the Google Earth Pro program and elevations data taken from the Porto de Manaus website.

Area calculation:

Since the analyzes were carried out on dates close to each year and the elevations values are very similar, the calculation created (Table 9) reveals a significant reduction in the size of the areas over the years, inferring that this reduction was due to action to remobilize the grounded material.

Table 9: Comparative data showing the size of the area in each year and the elevations obtained on the respective dates. The colors are in accordance with the polygons of the calculated area represented in each image in figure 19. Source: Elevation data taken from the Porto de Manaus website.

DATE	ELEVATION (m)	AREA (m ²)
29/07/2017	27,69 m	45.526,320206 m ²
20/07/2018	28,15 m	41.014,850545 m ²
31/07/2019	28,34 m	39.103,040328 m ²

4. DISCUSSION AND CONCLUSION

From the results found, it was observed that the beach presents several irregularities arising from the construction of the landfill, proving that its elaboration was done in an improper way, and with the consequence of several fatal victims.

According to Serviço Geológico do Brasil (CPRM) [2,3], due to the fluvial dynamics of the Rio Negro, the environment is strongly influenced by the river and generates strong fluvial erosion. From this, it was already expected to occur changes in the work, such as accommodation of the land and transportation of grounded material, due to the river seeking its natural conditions.

However, these changes have been intensified. In view of the sedimentological analyzes of the work, it was found that the sediments used in the artificial beach landfill are finer than those of the natural beach. This difference makes the river erosion caused by the river to happen much easier and more intensely, and consequently, this contributes to the formation of tunneling processes, causing the depressions found on the surface, and for the removal of material by the river, explaining the irregular subsurface and the abrupt unevenness between the shallower and deeper parts near the banks of the Rio Negro.

Due to the finer material used in the landfill, it is also easier to remove these sediments by draining surface water from the rains, being responsible for the large presence of pipes exposed on the beach and the transport of sediments from the landfill and its deposition in the river. In addition, the construction and transport of water on the surface also affects the adjacent natural beach, where you can see the presence of large cavities close to the beach line (Figure 3c).

Through topographical studies it is possible to observe that this removal of the sandy material from the work generates significant differences in the morphology of the beach and in a short time. In view of the analyzes, it was found that the top part of the topographic map in 2017 (Figure 12), which presented sinuosities, was composed of a large percentage of fine materials (Figure 15, samples E51 and E101), and indicated plumbing in the area. This indicates that a large part of the fine sediments at the landfill had already been remobilized and that the upper part was still in the process of being transported. In 2018, there was a drastic reduction in the amount of fine sediment in the samples, and the sinuosities of the map were no longer observed, indicating that the sediments from the upper embankment were remobilized.

Spatio-temporal studies, through the analysis of images of the area, helped to prove this removal of sandy material. Area calculations have revealed that the size of the artificial beach is decreasing significantly over the years. In addition to the calculations, these studies have shown that the differences in landfill and natural

beach sediments are not only in the granulometry, but also in the color, indicating different compositions, which may influence a greater destabilization on the ground or not. During the temporal analysis, it was possible to identify that the construction of the landfill permanently affected the surface morphology, mainly in the shape of the beach line.

According to the passage of time, the environment seeks its equilibrium conditions, so greater accommodation of the landfill is expected. However, without the containment of the artificial beach, monitoring and revitalization, the beach will continue to present irregularities on the surface, which may cause, in addition to the accidents that have already occurred, greater problems for the environment, such as silting up the riverbed, due to the intense transport of grounded sediments. Continuous monitoring in the area is necessary to avoid the evolution of these problems and more fatal accidents. In addition to these reforms, it is necessary to revitalize the urban area of Praia da Ponta Negra, which can channel rainwater directly into the river, preventing runoff from passing directly through the landfill sediments, thus preventing further transport sediment landed to the river.

The results obtained with the methodology of this work were satisfactory and could prove that the construction of the artificial landfill originated several changes and problems in the Ponta Negra beach. The realization of this project is of vital importance for society, as it serves as an alert for the construction of works in beach environments, which needs sufficient specific studies and elaboration made by specialized professionals.

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Produced Water: An overview of treatment technologies

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Abstract

Produced water is one of the single most significant waste streams in the oil and gas industry, and because it is a residue of complex chemical composition, it can't be simply discarded in the environment, it should receive appropriate treatments before. This paper presents a mapping of the quantitative evolution, referring to the leading publications on the study of water produced with a focus on treatments. A bibliometric method was then adopted to build a structured database with the selected articles and then analyzed the number of publications, countries, areas of impact, authors, keywords, periodicals, and affiliations. The thematic has proved to be an essential line of research over the years. The analysis was considered in the period between 1969 and 2017. Several indicators were observed regarding the development of academic and technological research on water produced as well as its treatment processes. The study was performed in the Scopus database search engine to gather data, and 2434 documents were identified, with 851 articles investigated more specifically. This paper highlights the need for constant future studies about the produced water to minimize not only pollution but also reduce operating costs.

Keywords: produced water; oilfield; produced water treatment

1. Introduction

The oil industry has grown immensely, and, with this growth comes the environmental concern of disposing of the effluent produced by the industry. A typical oil reservoir usually contains oil, natural gas, and water. This water is known for produced water (PW), and it's one of the single most significant waste streams in the oil and gas industry [Sirivedhin and Dallbauman, 2004]. Generally, the ratio of oil and PW is 1:3 for most of the oil well [Munirasu et al., 2016]. The chemical composition of PW is complex. It includes a mixture of various components such as dispersed oil, dissolved hydrocarbons, organic acids, phenols, metals, as well as residues of chemical compounds added to the production line or separation [Utvik, 1999]. There is a wide variation in the level of composition of this water due to geological formation, the lifetime of the reservoir, and the type of hydrocarbon produced [Igunnu and Chen, 2012].

Without proper treatment, the final disposition of PW can pollute surfaces, groundwater, and soil. Therefore, these components need to have their concentrations reduced or completely removed using some type of treatment (chemical, physical, biological or a combination of these methods) so that oilfield produced water can be discarded at sea, reinjected into reservoirs or even use for irrigation [Ahmadun et al., 2009; Weschenfelder et al., 2016; Meneses et al., 2017; Al-Ghouti et al., 2019]. In order to minimize the environmental impact of PW disposal is necessary an effective treatment, which can be reached when different technologies are used together once the specialized literature affirms that sequential processes are more efficient with best results [Almarouf et al., 2015; Ebrahimi et al., 2010; Shamaei et al., 2018]. The legislation establishes rigorous criteria about the maximum permissible levels of contaminants like total oil-grease (TOG), salts, heavy metals, and certain chemicals, independent of the location for disposal. Several effluents with potential for environmental pollution are generated along the entire production chain [Ayotamuno et al., 2007, Pivel et al., 2009, Yana et al., 2010].

Thus, the purpose of this study was to quantitatively and qualitatively evaluate the scientific literature related to produced water and their treatment based on a bibliometrics analysis. This type of analysis has been used in the most diverse areas of research [Geng et al., 2017; Moro et al., 2018; Wang et al., 2018], as it provides results that can help researchers to select their potential research area better, recognize future academic collaborators, and identify journals and institutes that produce the most on the subject. A bibliometric analysis is also helpful to examine weaknesses and strengths, identify research gaps, and future research directions in one specific field.

2. Methodology

2.1 Methodologies and Data Sources

For this study, the Scopus database was used. The Scopus database, founded in 2004 by Elsevier, is one of the largest existing databases. Its library (or catalog) has more than 22,000 titles of papers besides having intelligent tools that can aid in bibliometric research. Also, Scopus has the option of exporting the information obtained from the literature in several formats. RIS (Research Information Systems) is one of the existing forms widely used in bibliometric analytical software. During bibliometric research, it is fundamental that the terms chosen are the most relevant ones; moreover, they should be searched in titles, summary, and keywords in the database (scientific articles). To avoid results that are not related to the subject, the leading search string was: TITLE-ABS-KEY (((("oilfield brine" OR "oilfield water" OR "oil field water" OR "oil-field water" OR "produced water") AND "treatment"))) AND (LIMIT-TO (DOCTYPE, "ar")). A rigorous analysis was carried out in each scientific document found to verify its real integration within the thematic of the treatment of water produced.

2.2 Analysis tools

VOSviewer is an available computer program used for constructing and viewing bibliometric maps. In this study, it was used to visualize the network. This program also can be used to build maps of authors or journals based on co-citation data or to build maps of keywords based on co-occurrence data. VOSviewer also offers a tool that allows you to examine bibliometric maps in full detail [Van Eck and Waltman, 2010].

3. Results and Discussion

The initial search resulted in a total of 2434 documents which 1305 were scientific articles. The period corresponding to the research began with the first articles made available by the database until those made available in December 2017. Although the terms used have correctly restricted the search, articles were found that were not directly related to the topic addressed, such as those presented by Rashed et al. [2012], Beebe et al. [2015], and Mendez et al. [2011]. These unrelated articles were excluded from the obtained material. After a careful analysis of all the scientific documents, a total of 851 papers were selected and exported into RIS format for bibliometric analysis.

3.1 Number of publications by year

Figure 1 shows the distribution of the articles related to the PW treatment over the years. The first article related to this appeared in 1969 with the study of Kerver and Heilhecker [1969], which approaches to the use of inhibitors to prevent the deposition of calcium sulfate on rods and tubing.

Despite the fact that the first article found to be published at the late '60s, there was a higher growth of publications from the end of the 90's, with the most of these studies published between the years 2010 to 2017 (a period when 510 articles were published, representing 59.92% of the total). This result is explained by the interest of finding more efficient and economic forms of treatment to produced water. Even so, in the years 1970, 1972, and 1977 there were no publications in the Scopus database.

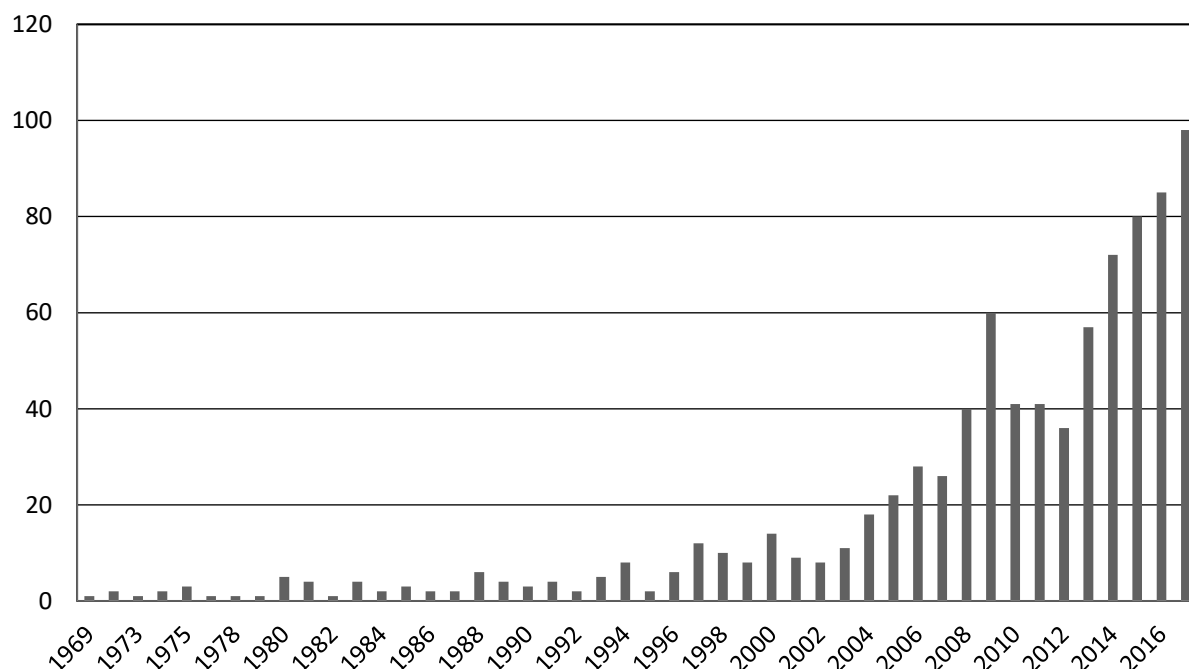


Figure 1. Number of publications by year about PW.

3.2 Countries/territories

From a world perspective, a total of 58 countries/territories published their papers about produced water, although 46,55% of them contributed with a maximum of two papers.

The existence of a small number of countries that dominate the publication of scientific documents was expected. As shown in Table 1, the ten most countries with more significant research development are responsible for 83.43% of all publications. The United States appears first with the most substantial amount of publications, followed by China and Brazil.

It's important to remember the categories are non-exclusive, and its document can be related to more than one country as a consequence of international collaborations.

Figure 2 shows the international collaboration between countries. Out of the total of 89 countries, 28 meet the threshold. The 20 countries with a higher number of partners were selected. According to the analysis, the United States is the country with the higher number of partnerships, 42, which were made with 14 different countries, followed by the United Kingdom with 26 and Canada with 25 collaborations.

Table 1. The top 10 most productive countries in PW.

Raking	Country	Documents	Percentage (%)
1	United States	221	25,97
2	China	216	25,38
3	Brazil	63	7,40
4	Canada	53	6,23
5	United Kingdom	35	4,11
6	Norway	34	3,99
7	Australia	29	3,41
8	Iran	24	2,82
9	Malaysia	20	2,35
10	South Korea	15	1,76

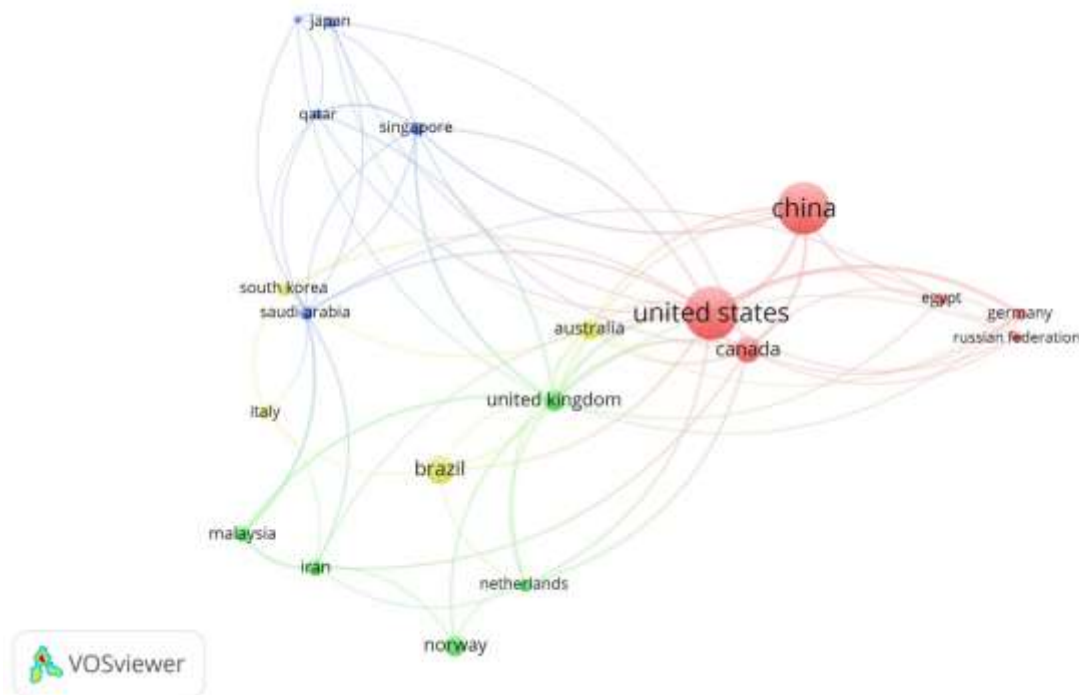


Figure 2. The international collaboration between countries, the minimum number of occurrences of documents, was set to 5. The volume of the circle in the map is the indicator of the contribution of the item (indicates the number of partnerships, the larger, the more that country had co-authorship), and the smaller the distance between two countries, the higher the relationship between them.

3.3 Subject area

According to Scopus, studies about the treatment of produced water involved 18 different academic disciplines. Figure 3 shows some of the strongest academics disciplines found and the percentage by area. As can be seen, Environmental Science appears first with 42.3% of all publications. The most used journal in this research area was Desalination, and the country with the highest contributions in environmental science was United States (120 papers). The second more relevant area was Chemical Engineering (38.3%), followed by Energy (31.5%) and Chemistry (28.1%). Other areas, such as Engineering, Earth and Planetary Sciences, and Materials Science, also contributed to the development of PW related studies. This analysis does not rank the article in only one area, and it is worth remembering that an article can be linked to different areas at the same time.

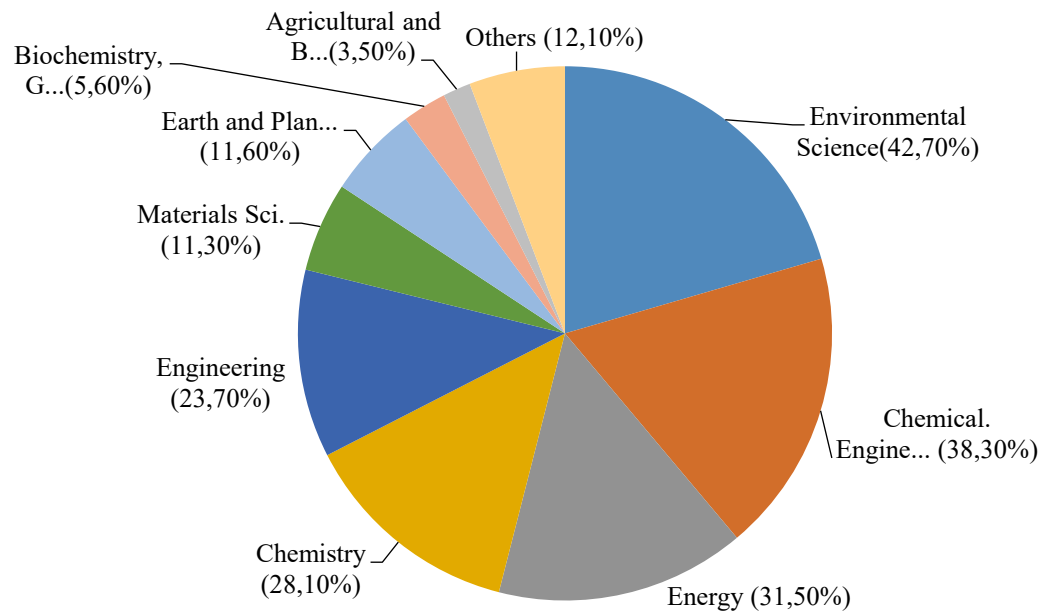


Figure 3. Areas involved in research about PW, as classified by Scopus.

3.4 Citation analysis

Among the bibliometric indicators to evaluate the quality of research, citation analysis is one of the most used ones. If an article is cited by another, this may indicate that its results possibly provide useful and valuable information to others. Therefore, it is credible to state that the more citations an article has, the more expressive it is.

In the present study, it was evaluated the top ten most cited articles related to the treatment of produced water, as Table 2 illustrates. For a better analysis of the scientific value of the articles, citations made from the own author's articles were disregarded in the count. Once more recent articles are not as popular as the older ones, so it was also considered for citation analysis, the number of citations per year (TC/Y). Thus, as observed, the most cited article was also what has more citations per year, and it was corresponding to the work entitled "Water management challenges associated with the production of shale gas by hydraulic fracturing" by Gregory et al. [2011]. This paper had the highest values of TC and TC/Y, showing an excellent value for the scientific area.

Another article entitled: "Produced water treatment by nanofiltration and reverse osmosis membranes" assumed the second most cited article position with 165 citations at the time of data analysis. In this paper, the authors test two nanofiltration and one low-pressure reverse osmosis membrane to treat the PW. The results showed that this treatment might be feasible depending on the quality of the water produced that wants to obtain [Mondal and Wickramasinghe, 2008]. Although the work of Mondal and Wickramasinghe [2008] occupies the second position in the total of citations, it has a low number of TC/Y (18.33) as also Mueller et al. [1997], Nicolaisen [2003], Tellez et al. [2002], Ji et al. [2002], and Deng et al. [2002] (Table 2).

Table 2. Top ten highly cited papers based on Total Citation (TC).

* citation per year (TC/Y): average number of yearly citations.

Ranking	Author	Journal	TC	TC/Y*
1	Gregory et al. [2011]	Elements	257	42.83
2	Mondal and Wickramasinghe [2008]	Journal of Membrane Science	165	18.33
3	Mueller et al. [1997]	Journal of Membrane Science	162	8.1
4	Warner et al. [2013]	Environmental Science & Technology	159	39.75
5	Nicolaisen [2003]	Desalination	121	8.64
6	Tellez et al. [2002]	Advances in Environmental Research	118	7.87
7	Coday et al. [2014]	Desalination	117	39.0
8	Hickenbottom et al. [2013]	Desalination	111	27.75
9	Dlugolecki and Van Der Wal [2013]	Environmental Science & Technology	94	23.50
10	Asatekin and Mayes [2009]	Environmental Science & Technology	92	11.50
11	Ji et al. [2002]	Ecological Engineering	91	6.07
12	Çakmakce et al. [2008]	Desalination	90	10.0
13	Ebrahimi et al. [2010]	Desalination	87	12.43
14	Ji et al. [2009]	Bioresource Technology	86	10.75
15	Deng et al. [2002]	Separation and Purification Technology	83	5.53

3.5 Author keywords

The author's keyword analysis is another topic of great interest because it can provide information on trends in a particular area of research [Li et al., 2009]. VOSviewer was used to visualize the most frequently used keywords. As a result of this analysis, the search returned a total number of 1818 keywords (Figure 4).

As expected, “produced water” appears as the most used keyword among the authors with a total of 238 occurrences and with 60 connections with different keywords followed by wastewater treatment (41 occurrences and 29 connections) and oilfield produced water (36 occurrences and 17 connections). Other keywords also appeared on the map, and they are related to different forms of treatment that represents a significant focus of research, such as desalination (19), adsorption (19), ultrafiltration (17), electrocoagulation (11), and flocculation (7).

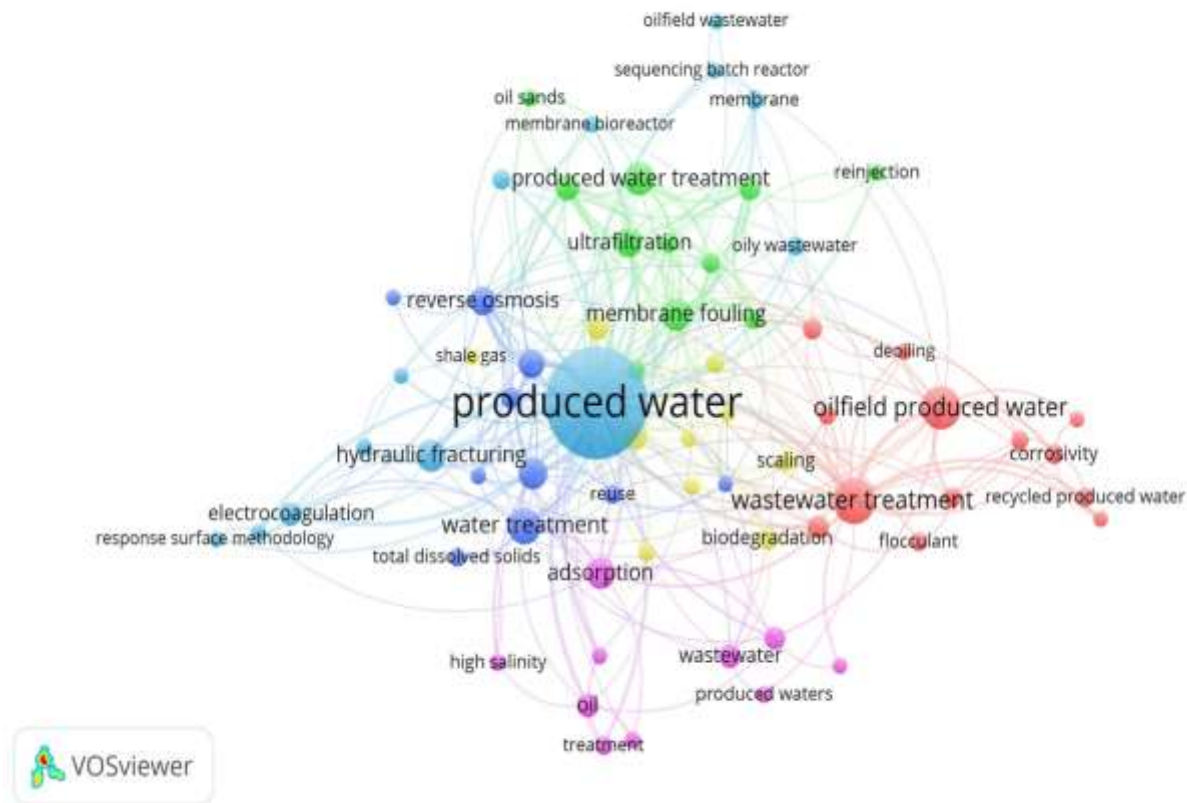


Figure 4. The network map of analysis of co-occurrence of author keywords, the minimum number of occurrences of a keyword was set to 5, of the 1818 keywords: 71 keywords meet the threshold.

3.6 Performance of journals

One hundred fifty-seven journals have published about produced water and treatment; of these, 46 ones (corresponding to 29.3%) contributed with only 1 article. Table 3 shows the top 10 journals (in terms of the total number of publications, TP) that most published on PW. Together, these journals contributed to more than 33% of the total publications.

Table 3. The top 10 most productive journals.

Raking	Journals	TP	%
1	Oilfield Chemistry	66	7.75
2	Desalination	42	4.93
3	Desalination and Water Treatment	38	4.46
4	Journal of Membrane Science	26	3.05
5	Oil & Gas Journal	22	2.58
6	Environmental Science & Technology	22	2.58
7	Separation and Purification Technology	19	2.23
8	Journal of Petroleum Science & Engineering	18	2.11
9	Word oil	17	1.99
10	Jpt Journal of petroleum technology	14	1.64

Oilfield Chemistry is the most influential journal with 66 publications on PW treatment, followed by Desalination (42 articles), Desalination and Water Treatment (38 articles), and Journal of Membrane Science (26 articles).

Other measures can also be used to evaluate the performance of a journal. Figure 5 shows the comparison between three commonly used indicators like Citescore, Scimago Journal Rank (SJR), and Source Normalized Impact per Paper (SNIP). While Citescore measures the average citations received per document published in this title; SJR is a measure similar to the impact factor (IF), but it does not consider all quotes equal and the prestige, quality, and reputation of the journal, which have a direct effect on the value of a citation. In its turn, SNIP is a factor that measures the impact of contextual citation by weighting citations based on the total number of citations in a subject field. Its value is calculated by dividing the number of citations received in a given year by the number of articles published in the journal during the three years above.

It is important to remember that different indicators offer different forms of evaluation, which, consequently, leads to different results. No indicator will provide the best result, so it is essential to use distinct ones to evaluate the performance of a journal better.

Figure 5 shows that, although Oilfield Chemistry has the most significant number of publications, it presents the lowest values of indicators, in addition to illustrating how they are related in some way to the number of citations and the quality of papers. Nevertheless, the articles published are not often cited in other articles, showing that it should not have an excellent indication for research. This fact can also be confirmed in Table 3, which shows the 15 most cited articles, but Oilfield Chemistry published none.

According to the indicators, the journals Environmental Science & Technology, Journal of Membrane Science, and Desalination are the most relevant among the scientific literature. In addition to their indexes are the largest, their publications are the most cited, according to Table 3.

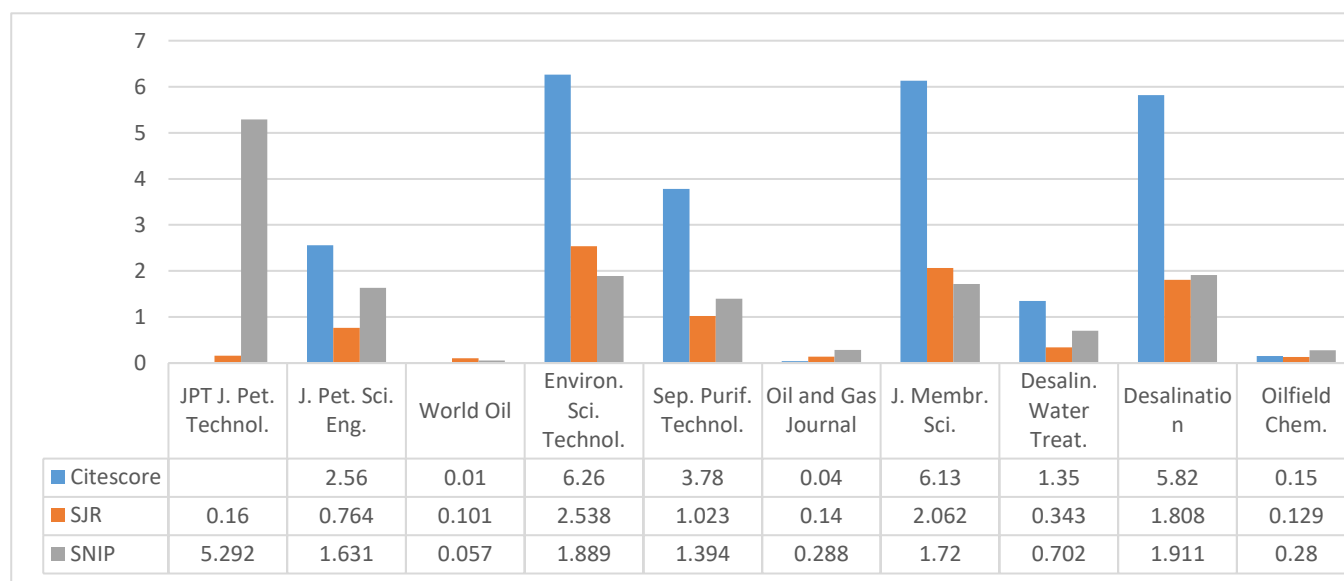


Figure 5. Comparisons of Citescore, SJR, and SNIP scores for the year 2016 for the top ten productive journals on PW.

3.7 Affiliations

In total, 160 affiliations published on produced water and its treatments. Table 4 shows the 12 affiliations that had the most substantial amount published. As can be seen, the Federal University of Rio de Janeiro appears first followed by Petrobras (Petróleo Brasileiro S.A.), and both are located in Brazil. Analyzing Tables 1 and 4, it's possible to realize that these two affiliations are responsible for most publications (about 63%), showing that, in Brazil, the surveys related to water produced are more concentrated in these two organizations. According to Table 1, China appeared with 216 publications, and after, in Table 4, it seems as the country of origin of 7 of the 12 most productive affiliations, showing that it has several institutions researching about PW. The United States also deserves mention having two institutions among the list.

Table 4. The top 12 most productive affiliations/organizations.

Ranking	Affiliation	Documents	Country
1	Universidade Federal do Rio de Janeiro	22	Brazil
2	Petrobras	18	Brazil
3	Chinese Academy of Sciences	18	China
4	Ministry of Education China	16	China
5	Daqing Petroleum Institute	16	China
6	Colorado School of Mines	16	EUA
7	Clemson University	16	EUA
8	China University of Petroleum East China	16	China
9	University of Calgary	15	Canadá
10	Shengli Oilfield Company	15	China
11	Harbin Institute of Technology	14	China
12	Southwest Petroleum University China	13	China

3.8 Types of Treatment

Of the 851 articles related to PW, about 55% of them address some type of treatment, which were classified as physical, chemical, biological, membrane treatment, combined systems, and undefined. Figure 6 shows the percentage of each classification adopted. The articles that were classified as undefined correspond to those that were not possible to identify by a less complicated analysis of the type of treatment used.

It is important to remember that no treatment alone will leave the produced water in the parameters established by the legislation due to a large number of different components present in the composition of the water samples. The chosen treatment process will depend on some factors as capital costs, operating expenses, and waste streams, for example [Arthur et al., 2005].

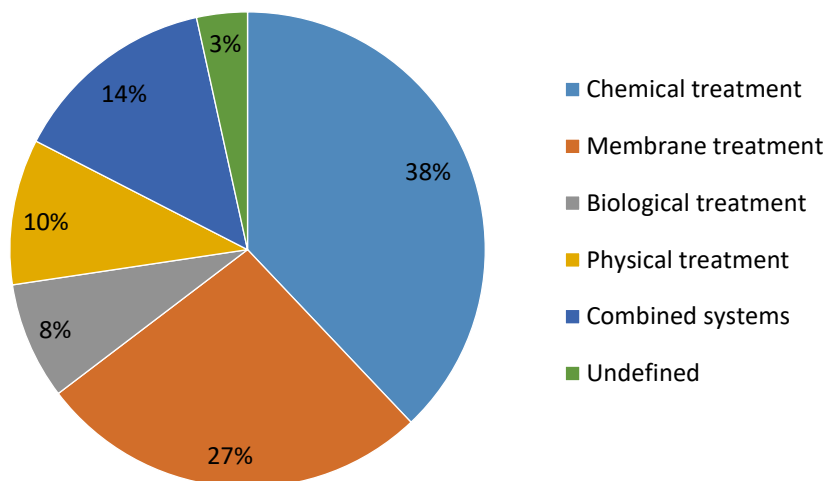


Figure 6. Classification of the articles related to the produced water address some type of treatment, which was separated from the method used to purify the PW.

3.8.1 Chemical treatment

3.8.1.1 Chemical Precipitation

Coagulation and Flocculation are treatments used to remove colloidal and suspended particles but are not effective treatments to remove dissolved components. In a study of the total suspended solids (TSS) from a real produced water, ferric chloride and aluminum sulfate were used as alternative coagulants, and the cationic and anionic polyelectrolyte were used as flocculants in different doses. As a result, the use of aluminum sulfate and cationic polyelectrolyte (DF 492) showed a better performance in TSS removal [Roccaro et al., 2014]. Another study, using alum and ferric chloride, evaluated coagulants for clarification and removal of boron; high doses were used to remove about 80% of the boron, which makes the boron removal process unfeasible [Chorge et al., 2017].

3.8.1.2 Treatment with ozone

Ozone treatment is a process that effectively reduces petroleum hydrocarbons [Chip and Tittlebaum, 1995]. One study used the new ozonation technique coupled with sand filtration to remove oil from water rapidly. This technique incorporates rapid, successive cycles of compression and decompression during ozonation. The parameters evaluated were changes in turbidity, COD, BOD, and sheen presence following treatment. This technique proved to be quite useful because it reduced the established parameters in a way that the water could be disposed of in a safe way to the environment or reused [Cha et al., 2010].

3.8.1.3 Fenton process

Fenton technology is a promising and alternative method for wastewater treatment, using hydrogen peroxide as oxidant and ferrous ions as a catalyst [Huang et al., 2017]. Li et al. [2016] investigated the removal efficiency of BTEX (benzene, toluene, ethylbenzene, and isomers of xylene) using Fenton's reaction and electrolytic oxidation. The results obtained revealed a BTEX removal higher than 95% at pH 4. Moraes et al. [2004] used a photo-Fenton process to the treatment of the saline wastewater contaminated with hydrocarbons. Li et al. [2016] used a cathode Fenton reactor for treating oil-produced water to reduce toxicity and improve biodegradability, resulting in a successful treatment. The COD removal rate was 78.4 %, while the oil rate was 89.6%.

3.8.1.4 Electrochemical process

Ezechi et al. [2015] studied the removal of boron from the water produced by electrocoagulation. By using an iron electrode, the removal efficiency was 97.6% under optimal conditions applied. Gargouri et al. [2014] used electrochemical technology for removing petroleum hydrocarbons from produced water using lead dioxide and boron-doped diamond electrodes. The results were satisfactory, but the energy consumption and process time make useless anodic oxidation for the complete elimination of pollutants from produced water.

3.8.2 Physical treatment

3.8.2.1 Hydrocyclones

Hydrocyclones are equipment used for solid-liquid or liquid-liquid separation. In oil extraction, the water produced usually contains solids. These solids are from reservoir origin and are usually covered with a thin layer of oil [Lohne, 1994]. Some studies have been found on the use of hydrocyclones such as Kharoua et al. [2010], who evaluated the parameters that affect the performance of de-oiling hydrocyclones; and Angelim et al. [2017] who applied computational fluid dynamics (CFD) in the analysis of hydrocyclone as a pretreatment for the removal of oil from PW.

3.8.2.2 Adsorption

Several studies have sought an alternative and cheaper raw materials such as olive leaves powder (OLP), eggplant peel powder (EPP), and coconut pith (CP) to be used as adsorbents in the removal of oil and metals [Ibrahim et al., 2017, Gulistan et al., 2016, Ibrahim et al., 2016 and Saman et al., 2016]. Other studies looked for new adsorbents that remove some specific compounds such as Costa et al. [2012] who investigated the potentials of peat and angico hardwood sawdust to remove BTEX; and Shi et al. [2017] who evaluated the feasibility of using nanostructured $\delta\text{-Bi}_2\text{O}_3$ to remove bromide from PW. The results of this study revealed that $\delta\text{-Bi}_2\text{O}_3$ could be used to remove bromide from water solutions that have a low concentration of chloride.

3.8.3 Membrane treatment

About 27% of the treatments found comprise membrane separation processes such as microfiltration (MF), ultrafiltration (UF), nanofiltration (NF) and reverse osmosis (RO). Among them, MF can be operated in two forms, direct flow or crossflow. Chen et al. [1991] used ceramic crossflow microfiltration to remove oil, grease, and suspended solids from produced water. Zhang et al. [2016] used a polytetrafluoroethylene (PTFE) microfiltration membrane to treat oilfield water produced, and the efficiency of the treatment was enough to meet the standards of water quality reinjected in China.

Making a comparison, UF has more advantages over other methods for treating oily wastewater due to its high oil removal efficiency, chemical additives, low energy costs, and small space requirements (He and Jiang, 2008). Reyhani et al. [2013] and Zoubeik et al. [2017] used the Taguchi approach, which aims to optimize a process, to evaluate the performance of a UF membrane. The former one utilized a polymer membrane while the second one used a silicon carbide (SiC) membrane, but both types of research obtained favorable results. NF membranes are generally designed to be selective for multivalent ions rather than univalent ions [Ahmadun et al., 2009]. Pages et al. [2013] studied this selectivity of ion rejection theoretically and experimentally. He found that rejection crucially depends on their environment. RO is a widely used process for the total removal of dissolved solids. Several researchers used this type of treatment, such as Melo et al. [2010] and Le [2017], who studied the use of RO to desalinate PW to be reused in irrigation or other beneficial forms.

3.8.4 Biological treatment

Aerobic and anaerobic microorganisms have been studied to treat PW biologically. This type of treatment is generally regarded as the most cost-effective method for organics removal [Janson et al., 2015]. In these treatments, it's important to control the presence of salts in PW once it may end up inhibiting the biological process [Sharghi et al., 2013].

Tellez et al. [2005] used an activated sludge system to remove hydrocarbons from PW, obtaining a removal efficiency of 99% at a produced water flow rate of 1890 L/day and a mean cell residence time of 20 days. Pendashteh et al. [2010] studied the efficiency of a sequential batch reactor (SBR) to remove hydrocarbon compounds in samples of real and synthetic produced water. The reactor was inoculated with isolated tropical halophilic microorganisms capable of degrading crude oil. The results obtained with synthetic water varied according to the salt content present since the real water produced showed that the removal rates of the main pollutants from wastewater, such as COD, TOC, and OG, were above 81%, 83%, and 85%, respectively.

Paz et al. [2012] studied the efficiency of removal sulfides and phenols from oil field produced water (OPW). The experimental design consisted of two FSFCW (FSFCW I and FSFCW II) with gravel and soil (as media) and emergent aquatic plants. *Cyperus luzulae* and *Cyperus ligularia* were planted in FSFCW I while *Cyperus feraz* L, *Paspalum* sp., and *Typha dominguensis* were planted in FSFCW II. In both cases, aquatic plants did not perform a good removal of the compounds from the water produced.

In another research, the changes in the profile of a microbial community used to remove ammonia from the produced water were evaluated when subjected to a gradual salt increase (NaCl), and the complete inhibition of the removal occurred at 125 g/L NaCl [Quartaroli et al., 2017].

4. Conclusion

It can be observed an increase in the quantities of publications about the treatment of produced water around the world, which can be attributed to (i) an environmental concern by imposing legislation on the disposal of produced water and (ii) an increase in the quantity generated due to the maturation of the oil reservoirs. Currently, ten countries with the most extensive development in PW researches are responsible for more than 80% of the publications. Besides, 30% of the publications direct information relevant to the scientific and technological community.

One hundred fifty-seven journals have published about produced water, but according to the indicators, the journals Environmental Science & Technology, Journal of Membrane Science, and Desalination were the most appropriate.

Physical, chemical, biological, and combined treatments were adopted as technologies to investigate and minimize contaminants of the PW. As previously stated, no treatment alone leaves the water produced in the standards for disposal or reuse. The best choice of the combination will be one that does not pollute the environment and is not too expensive for the industry.

There was no doubt that this type of study based on massive data can reveal the macrostate of the development of the field and still serve as a base for future investigations into the identification of influential authors, journals, works, institutions, and subjects in the field of produced water and treatment.

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Evaluation of the bibliometric scenario of the Delphi method with Brazilian affiliations

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Abstract

The Delphi method is a technique used to reach consensus among specialists in an area who will be able to predict demands or analyze conjunctures about strategic themes. Within this context, the present work consisted of a bibliometric evaluation performed in the Scopus database with the aid of VOSviewer software, prioritizing journals with an affiliation of Brazilian institutions and that made use of the Delphi method for the development of their research. Data collection went through validation stages, and the results obtained showed that this tool was used in several areas of knowledge, with great emphasis on health, more specifically in Medicine, Nursing, and Public health. Together, these three areas accounted for more than 60% of publications made available.

Keywords: Delphi method; bibliometric analysis; VOSviewer

1. Introduction

Named in reference to the Delphic Oracle and developed by RAND Corporation, the Delphi method is used to seek consensus among ideas from experts who anonymously voice their opinions through questionnaires, from which several rounds are interspersed with feedback based on the researchers' answers, which configures one of the central characteristics in the technique [DALKEY e HELMER, 1963; DALKEY, 1969].

The Delphi method has a qualitative and quantitative nature since the data obtained can be collected by qualitative and/or quantitative techniques [JOHN-MATTHEWS et al., 2017]. For Melander [2018], Delphi can be combined with other known techniques for safer and more efficient data acquisition, besides adding higher value to the final result. According to the literature, this is one of the most effective existing methods; however, some variables, such as researcher and expert fatigue, as well as the rigor of study and consensus,

make the method relatively time-consuming in terms of completion. Another relevant point is the lack of a definition about the exact number of specialists who should participate, usually being defined underfunding and logistics criteria, as well as strict inclusion and exclusion criteria [DEVANEY; HENCHION, 2018]. On the other hand, bibliometrics is a tool that uses statistical and quantitative analysis techniques to describe information, such as terms, countries, and authors, which are present in documents, identifying, for example, those emerging countries and the existence of a relationship among them. This way, it's possible to use the acquired data to map the surveyed area [WANG et al., 2014]. Nevertheless, the indicators generated do not replace the knowledge of experts in the field under study, and, for practical reasons, these indicators can be combined with other types. The current demand for bibliometric indicators underscores the importance of these data to assist in decision-making and may also serve as a basis for scientific actions [OKUBO, 1997]. In the studied literature there is a diversity of articles that use bibliometric techniques to analyze scientific productions, without being restricted to a specific area, according to the works developed by Kozak, Bornman, and Leydesdorff [2014], which dealt with how research was affected by the demise of the Soviet Union; Romanelli et al. [2018], who presented analyzes on ecological restoration; and Sweileh [2018], who dealt with the use of drugs related to HIV (human immunodeficiency virus).

Bibliometric techniques are known to be used to analyze scientific branches, but these analyzes are not considered infallible [WANG et al., 2014; KHALIL; GOTWAY CRAWFORD, 2015]. The lack of perception by databases in the case of the same words and acronyms, that is, the same words with only different spellings, is one of the limitations of bibliometrics that must be circumvented by careful analysis of the data collected in search of synonyms. Another problem linked to the indicators used in bibliometric studies refers to the fact that the analysis of these indicators is quantitative, so they do not provide a qualitative analysis of the contributions of each work to the literature [KHALIL; GOTWAY CRAWFORD, 2015; OKUBO, 1997].

In this context, the objective of the present study was to evaluate the use of the Delphi method in scientific articles with authors with affiliations in Brazilian institutions. For this, bibliometric methods and VOSviewer software were used for the quantitative analysis and better visualization of the data used, since it was through this software that there was the generation of clustering maps (citations and terms) enabling the perception of emerging terms and interconnections. Therefore, the data were treated independently of their quantity.

The selection of focus on researchers with affiliation with Brazil is related to the economic importance of the country and its position in the research ranking. More specifically, Brazil is one of the emerging powers that make up the BRICS, having growth in its protagonism in the globalized world [PETRONE, 2019]. Besides that, Brazil has relevant positions in search ranking, with 31 institutions ranked according to the World University Rankings [2018], while in the Academic Ranking of World Universities [2018], Brazil presented six institutions in its top 500 and 17 institutions in the rest of the ranking. Regarding Latin American countries, the Nature Index database [2018] reported that Brazil is in the best position among the others, occupying the twenty-third general position.

2. Methodology

The material analyzed was collected from the Scopus database, in which scientific publications were searched through Boolean operators using terms such as “Delphi method”, “Delphi technical” and “Delphi analysis”, in the search field restricted to abstracts, titles or keywords, also having restrictions for only scientific articles, as well as articles that contain at least one researcher with Brazilian affiliation, but in this case, without restrictions about language. Data were collected in February 2019 and contained all articles published up to 2018. After the search procedure, all articles made available by the database were carefully analyzed throughout their scientific text, and the data obtained exported from the Scopus database in the “csv” format for use in VOSviewer software.

For the development of this work, the indicators chosen for the bibliometric analyses were: publications per year, areas of publications, keywords, authors, journals, and institutions. These analyses were performed based on data initially obtained from Scopus, which were subsequently processed using Microsoft Excel software and presented with the results of VOSviewer. In the latter, it was also used a thesaurus file, which refers to a dictionary used to join synonyms, an essential technique in the bibliometric analysis as presented in the literature by other authors [VAN ECK; WALTMAN, 2010; VAN ECK; WALTMAN, 2017].

3. Results and Discussion

3.1 Distribution of articles by year

Regarding the evolution of publications within the limitations presented in the objective of this paper, the first publication in Scopus occurred in 2000, presenting at the end of 2018 a total of 285 publications and thus demonstrating that the presence of works related to the application of the Delphi method in scientific articles authored in Brazilian institutions began to emerge only in the current century (Figure 1).

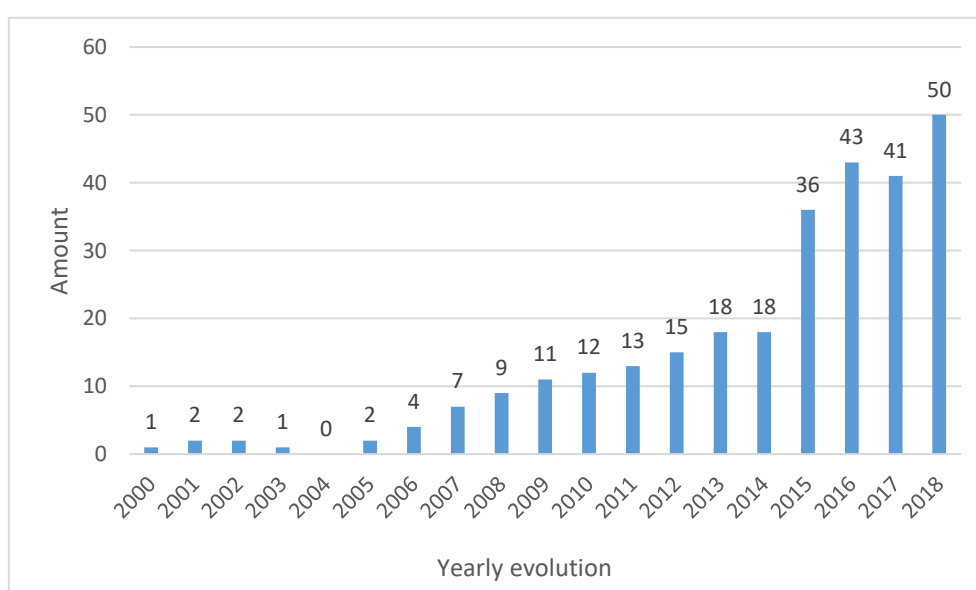


Figure 1. Distribution of scientific articles present in Scopus Base related to the application of the Delphi method with Brazilian affiliations.

It was also possible to observe in Figure 1 a continuous growth in the publications found from 2005 to 2013, with a second higher jump period between 2015 and 2018, representing an approximate total of 60% of the publications in the last four years within the study range. This result indicates an intensified and current interest of researchers in the Delphi method with the expectation of even higher growth over the coming years, because of the constant advancement and development of scientific research in Brazil, as already indicated by several organizations, such as the Nature Index [2018], Academic Ranking of World Universities [2018], and The World University Rankings [2018].

3.2 Research Areas

In the collected articles, 39 different areas of knowledge with Brazilian affiliations were observed. It is important to highlight that these areas were defined by the authors of this work, whose classification was defined after a careful analysis of each of the selected articles, which involved a complete reading of the same. Based on the identified areas, it was observed that several of them widely used the Delphi method, with research found in the health, social, and exact areas.

According to the results shown in Figure 2, the areas of health that stood out in terms of the number of publications were Medicine, with 36% of the total percentage, Nursing, with 19%, and Collective Health, with 6%. Together, these three areas represent about 60% of the publications available. When summing up the publication percentages of all ten areas related to Health Sciences, it was found that 70% of the articles that used the Delphi method are centered in these areas, indicating that such a tool is quite widespread. In contrast, areas such as Engineering represent approximately 14% of publications that fit the criteria defined in the search methodology.

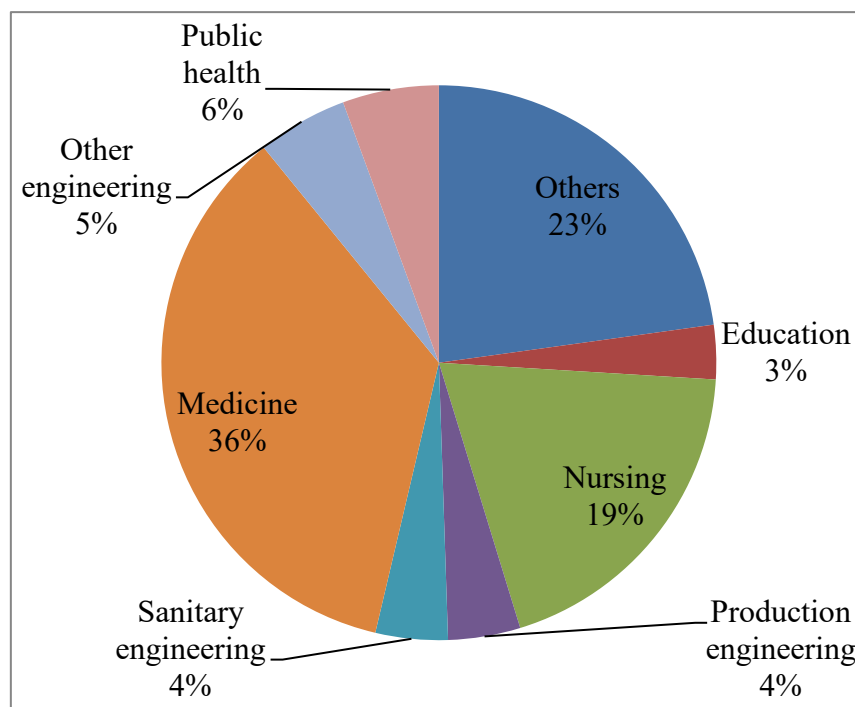


Figure 2. Distribution of areas of knowledge in scientific articles related to the application of the Delphi method with Brazilian affiliations in the Scopus Base.

3.2.1 Applications of the Delphi Method among Knowledge Areas

In areas of knowledge such as education, the Delphi method has been found in articles that address topics regarding the evaluation of performance indicators of postgraduate courses [PAIXÃO et al., 2014]; and evaluation of education program applied in universities [FONSÊCA; JUNQUEIRA, 2014].

Among Engineering, Production Engineering and Sanitary Engineering stood out with the most significant number of publications, both representing approximately 4% of total publications (Figure 2). When considering other engineering studies, the data obtained showed a lower number of publications for the same period analyzed in this work, with a maximum value of only three publications. Among the topics addressed in this group, there was the development of a waste management system [SCHAMNE; NAGALLI, 2018], the improvement of a quality tool [BATTIROLA FILHO et al., 2017], the analysis of perspectives on the use of microalgae as raw material for biofuels [RIBEIRO; DA SILVA, 2015], and the evaluation of policies to promote smart grids [DANTAS et al., 2018].

The various areas of Health Sciences that together accounted for 70% of the total publications that made use of the Delphi method denote the widespread dissemination of the tool between topics ranging from the search for trends to the study and validation of clinical indicators and the development of diverse skills. More specifically, the following works stand out: search for health sector trends in Brazil [PIOLA; OLIVEIRA; MACHADO, 2002], study of indicators for a patient classification instrument [MARTINS; FORCELLA, 2006], skills development professionals [GOUVEIA; BRAGA; HERÁCLIO, 2016], development and evaluation of care protocols [PEDROSA; OLIVEIRA; MACHADO, 2018], identification of trends in health unit management [ANDRÉ; CIAMPONE; SANTELLE, 2013], and competence identification of individual professionals in the Brazilian health system [RODRIGUES; WITT, 2013].

3.3 Countries authoring the articles that applied the Delphi Method

Among the scientific publications related to the application of the Delphi method with at least one affiliation belonging to Brazil among the authors, 78 countries were found within these parameters, as illustrated in Figure 3.

Based on the similarity calculated by VOSviewer, clusters of the keywords were generated in the country co-authoring map (Figure 3). Thus, the cluster that stood out concerning the number of countries was the one that obtained 24 grouped countries, identified in Figure 3 by the reddish color. This result indicated the variety of international collaboration within the grouping, consisting mainly of European countries, with France and Germany presenting respectively 31 and 29 documents each and thus corresponding to the two countries with the most present affiliations in the documents. In the Brazil cluster, formed by Brazil and 11 other nations spread across the continents of Europe, America, Asia, Africa, and Oceania, the United States and Canada were the countries that were closest to Brazil, indicating greater collaboration between researchers from these countries.

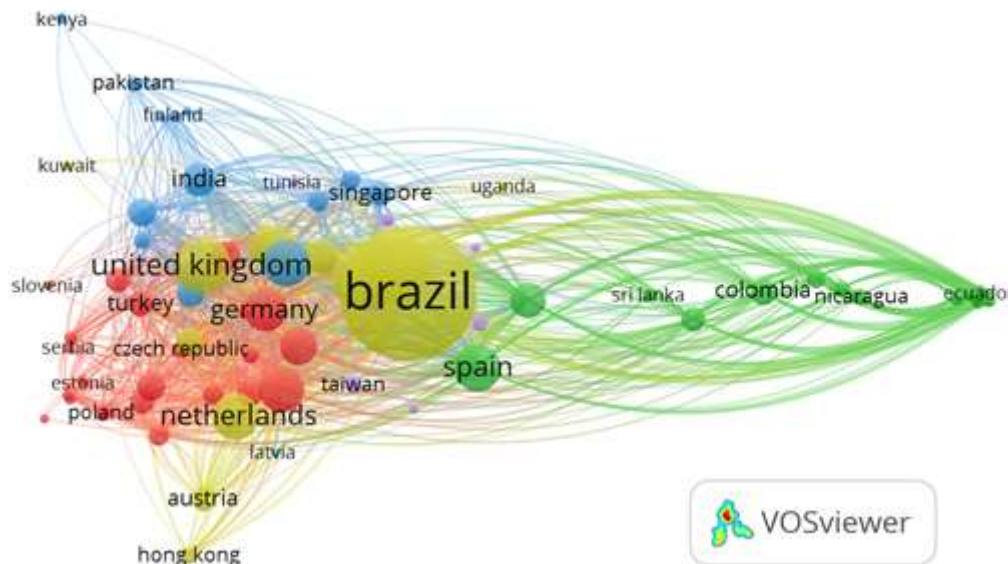


Figure 3. Cluster of countries with scientific publications related to the application of the Delphi method with Brazilian affiliations among the authors in Base Scopus.

Except for Brazil, which was affiliated with all the authors of the research, 76 documents were identified in the United States, followed by Canada and the United Kingdom, with 55 and 50 documents, in this order. The sum of these countries represents more than 60% of the total number of documents, demonstrating the great synergy of these countries in scientific research. Adding to the fact that there are 78 countries in this network, it is possible to notice that in published scientific research there was a collaboration between researchers from different countries, indicating a strong interaction characteristic of these researchers with Brazilian affiliation and other international authors when it comes to the use of the Delphi method.

3.4 Organizations and authors

Among the institutions with scientific publications related to the application of the Delphi method with Brazilian affiliations, the University of São Paulo (USP) is the institution with the most significant number of publications, totaling 77 publications, followed by the Federal University of São Paulo (UNIFESP), with 28 publications, and by the Federal University of Rio Grande do Sul (UFRGS), present in 20 publications. It is noteworthy that among the ten most recurrent institutions are those located in Canada and Australia. All these institutions, shown in Table 1 are found in almost 70% of the documents, showing the concentration of their participation in research on the topic under study.

Table 2 listed the authors with the most significant number of publications about the Delphi method, whose publication had, among the authors, at least one Brazilian affiliation in Scopus. These authors are Health Sciences researchers from eight different nationalities, which reinforces the statement established in previous items that the tool in question is widespread in discussions and studies raised in the health area.

Table 1. Institutions that stood out in scientific publications related to the application of the Delphi method with Brazilian affiliations among the authors in Base Scopus.

Position	Institution	Country	Number of Publications
1	University of Sao Paulo	Brazil	77
2	Federal University of Sao Paulo	Brazil	28
3	Federal University of Rio Grande do Sul	Brazil	20
4	The University of British Columbia	Canada	16
5	Oswaldo Cruz Foundation	Brazil	15
6	Federal University of Rio de Janeiro	Brazil	14
7	Federal University of Rio Grande do Norte	Brazil	14
8	Paulista State University	Brazil	13
9	University of Toronto	Canada	12
10	The University of Sydney	Australia	12

Table 2. Authors with scientific publications related to the application of the Delphi method with Brazilian affiliations among the authors in Base Scopus.

Position	Author	Number of Publications	Country
1	R.R. Witt	7	Brazil
2	M. Boers	4	Netherlands
3	L. Brosseau	4	Canada
4	R. Buchbinder	4	Australia
5	E. A. Burdman.	4	Brazil
6	A. Ravelli	4	Italy
7	J. P. Regnaud	4	France
8	A. Aburub	3	Jordan
9	L. Agulto	3	United States
10	K. L. Bennell	3	Australia

3.5 Keywords used in published articles

With the help of VOSviewer, the keywords present in the selected scientific articles were identified and, then, co-occurrence maps of the authors' keywords and also indexed were generated, constituting, respectively, terms defined by the authors themselves and proposed terms by the database regarding the theme of each article. Thus, these maps were used to analyze the most recurrent terms in research involving the Delphi method with researchers with Brazilian affiliation. The generated network maps aim to discover the themes most used by researchers within these researches.

We found 626 terms in the co-occurrence network of keywords presented by the authors themselves,

grouped in a total of 48 clusters, as shown in Figure 4. The parameter used for the generation of this map was the presence of at least one occurrence per term. The clusters that have the most significant number of terms are red, green, and blue clusters, with 31, 29, and 25 terms, respectively. These three clusters have in common the fact that they are all dominated by Health Sciences terms, such as "children", "treatment", "drug prescriptions", and "morbidity".

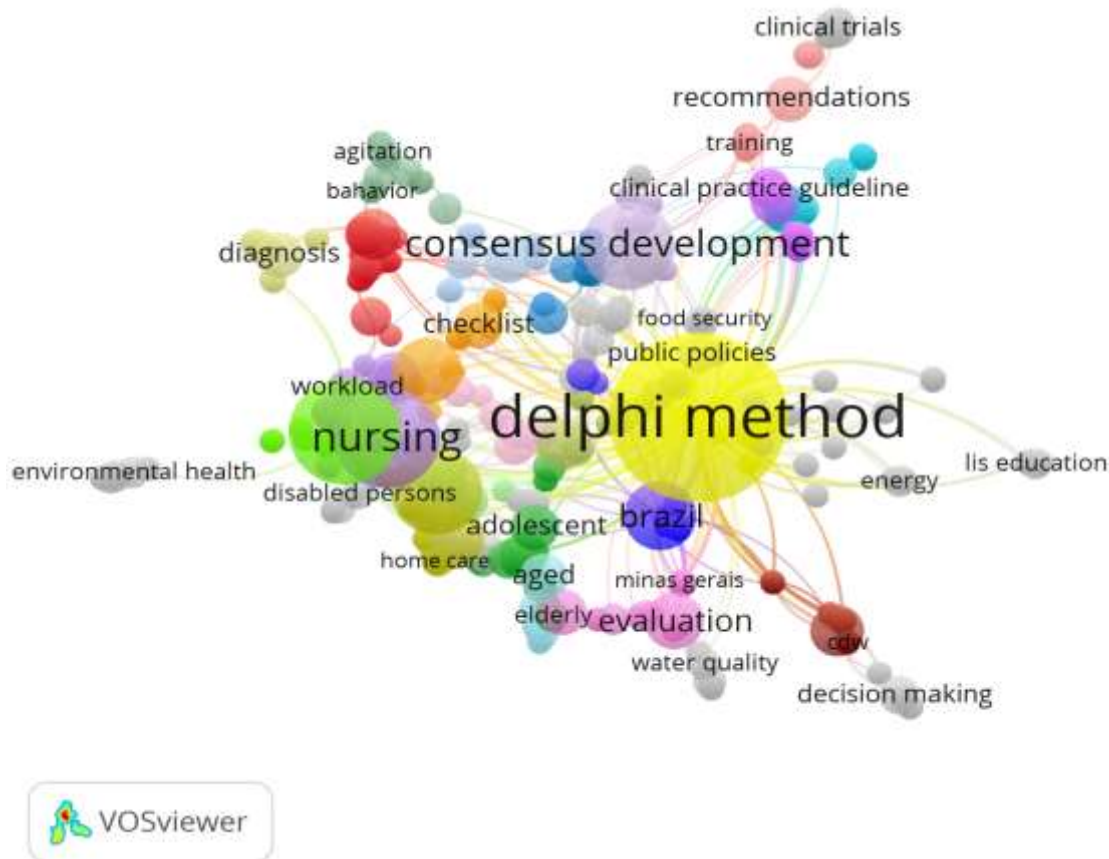


Figure 4. Keywords cluster presented in scientific publications about Delphi method with at least one Brazilian affiliation among authors in Base Scopus.

The Table 3 ranked the ten most frequently occurring keywords identified by VOSviewer. Among these terms were those associated with the object of study, such as “Delphi method”, “Brazil”, and “consensus development”, with half of them having direct interaction with health areas, such as “nursing” and “primary health care”.

Table 3. Most recurring keywords in scientific articles about the Delphi method with at least one researcher with Brazilian affiliation in the Scopus Base.

Position	Keywords	Occurrence
1	Delphi method	54
2	Validation study	21
3	Nursing	19
4	Consensus development	15
5	Primary health care	14
6	Brazil	9
7	Professional competency	8
8	Patient safety	8
9	Evaluation	6
10	Analytical hierarchy process (ahp)	5

When analyzing the indexed keywords, that is, those provided by the database about the respective selected articles, 2019 of them were found in the co-occurrence network, composing a total of 35 clusters, illustrated in Figure 5. The parameter used to generate the map was that of at least one occurrence per term, with clusters of red, green, and blue with 102, 100, and 93 terms, respectively.

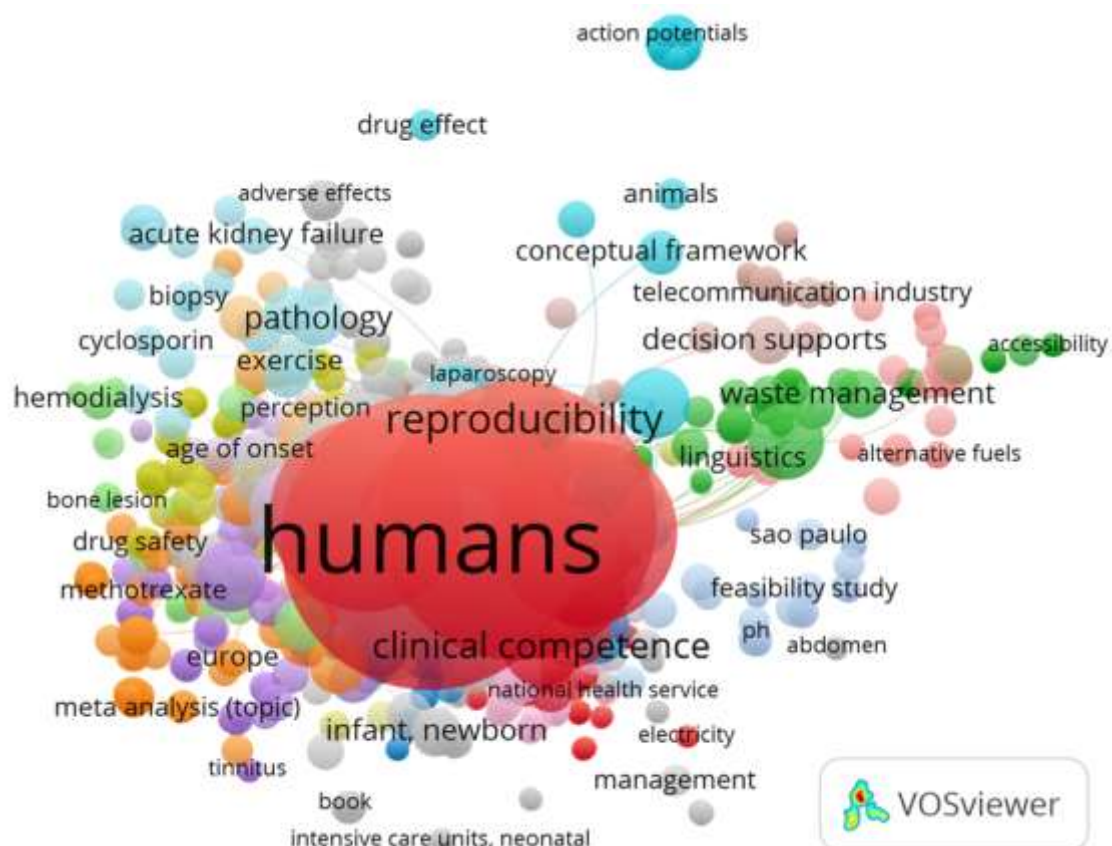


Figure 5. Keywords clustering indexed in scientific publications in Scopus database about Delphi method with at least one Brazilian affiliation among authors.

The analysis of Figure 5 denotes that the red cluster has several noticeable areas related to engineering, urban planning, chemistry, and health. Some of the most recurring terms are present in this cluster, which, by having terms common to all (“Delphi method”, for example), resulted in a diversity of terms from different areas in the same cluster. The green cluster, as far as it is concerned, is strongly linked to environmental issues with keywords such as “waste energy”, “environmental”, and “clean production”, as well as some other health-related keywords. However, the terms present in the blue cluster are predominantly related to the Health Sciences area. Table 4 describes the ten terms related to the most frequently indexed keywords identified by VOSviewer. Among the terms in question, some were seen as “humans”, “female”, and “adult”, which, when associated with health areas, once again reinforce the diffusion of the Delphi method.

Table 4. Most recurring terms in the co-occurrence map of keywords indexed to scientific articles about the Delphi method with at least one researcher with Brazilian affiliation in Base Scopus.

Position	Terms	Occurrence
1	Humans	176
2	Delphi method	156
3	Consensus development	76
4	Brazil	69
5	Female	66
6	Standards	66
7	Male	59
8	Questionnaire	53
9	Priority journal	48
10	Adult	45

4. Conclusion

Based on the quantitative and qualitative analyses performed on data extracted from the Scopus database and involving only scientific articles on the Delphi method application considering the presence of at least one researcher with some kind of affiliation in a Brazilian institution, it was possible to notice a growth in the number of publications over the years, mainly between 2015 and 2018, in almost forty different areas, with a concentration of studies in health. Researchers from the United States, Canada, and the United Kingdom presented a higher number of interactions with Brazilian institutions. Among the ten institutions with the most significant number of publications, the public institutions’ policies have gained prominence in strategic areas such as health, indicating the importance of a more consolidated discussion for strengthening research. Therefore, through the bibliometric analysis presented, it was possible to verify that the application of the Delphi method in research is a widely used and widespread tool in the health field, especially for the discussion of cases involving, above all, decision making, development of indicators and professional skills.

5. Acknowledgement

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ACCEPTANCE AND USE OF A VIRTUAL LEARNING ENVIRONMENT (VLE): STRUCTURAL EQUATIONS MODELING OF THE UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY

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ABSTRACT

UTAUT 2 is a model designed to be a starting point for investigating IT adoption and can be used to identify the factors that influence the intention to use it, as well as to be adopted by an organization. The main objective of this research is to validate the Unified Theory of Acceptance and Use of Technology (UTAUT2) model by applying the questionnaire to students of a university that has gone through the process of implementing a virtual learning environment. The method is the quantitative one, through the survey strategy. As for the time horizon of the survey, a transversal cut was chosen. The techniques and

procedures adopted were the modeling of structural equations with partial least squares in the Smart-PLS 3 software. The instrument used in this article is an adaptation of the questionnaire of Venkatesh et al (2012). The results point to evidence of converging and discriminating validity. This research contributes to the Unified Theory of Technology Acceptance and Use (UTAUT) as it is applied in different environments, evidencing characteristics that may allow its generalization. Finally, in the practical scope, it is possible to use this tool to evaluate and plan the acceptance of a new technology in the organizational scope.

Keywords: Intention to use information systems; Virtual Learning Environment; UTAUT 2.

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INTRODUCTION

UTAUT is a model designed to be a starting point for investigating IT adoption and can be used to identify the factors that influence the intention to use it, as well as to be adopted by an organization. The Unified Theory of Acceptance and Use of Technology (UTAUT) is considered the most complete model, since it encompasses eight other studies on technology acceptance and unifies them into a single model and centralizes the determining factors in critics and contingencies related to the prediction of the behavior intention to use a technology and use of technology, mainly in organizational contexts (VENKATESH et al., 2003). In the Brazilian context there are still few studies published on UTAUT2. The general objective of this research is to validate the Unified Theory of Acceptance and Use of Technology (UTAUT2) model by applying the questionnaire to students who use a Virtual Learning Environment. This research is justified by the lack of in-depth research on this topic. The importance of generating knowledge in the area of measurement and development of scales for the Brazilian scope is highlighted (COSTA, 2011).

THEORETICAL FRAMEWORK

UTAUT 2 was designed to verify the acceptance and use of technology in the context of consumption. It used a structural model, in which the variables, Performance Expectation, Effort Expectation, Social Influence, Facilitating Conditions, Hedonic Motivations, Price and Habit sought to explain the behavior of the Intention of Behavior variable, as well as the Facilitating Conditions and Intention of Behavior variables sought to explain the Use variable. In addition, the moderating variables were: gender, age and experience. The model explained 74% of the variance of Intention of Behavior and 52% for behavior of use, being considered effective to predict the acceptance and use of technology in the context of consumption. UTAUT emphasizes the importance of utilitarian value (extrinsic motivation). The construction linked to utility, knowledge, performance expectation, has been consistently shown as the strongest predictor of behavior intention (VENKATESH et al., 2003). Complementary to this perspective of motivation theory is intrinsic or hedonic motivation (VALLERAND, 1997). Hedonic motivation has been included as a

predictor in many consumer behavior surveys (HOLBROOK and HIRSCHMAN, 1982) and previous Information Systems surveys in the context of consumer technology use (BROWN and VENKATESH, 2005).

In the construction of the effort expectation, in the organizational configurations, the employees evaluate the time and effort in the formation of points of view about the general effort associated with the acceptance and use of technologies. In a context of using consumer technology, price is also an important factor, since, unlike workplace technologies, consumers must bear the costs associated with purchasing devices and services. Consistent with this argument, many consumer behavior researches have included cost related constructions to explain consumer actions (DODDS et al., 1991). Finally, UTAUT and related models depend on intentionality as a fundamental underlying theoretical mechanism that drives behavior. Many, including detractors of this class of models, have argued that the inclusion of additional theoretical mechanisms is important. In one use, rather than initial acceptance, the context habit has proved to be a critical factor in predicting the use of the technology (KIM and MALHOTRA, 2005; KIM et al., 2005; LIMAYEM et al., 2007). Based on the gaps mentioned above in UTAUT and the associated theoretical explanation provided, the hedonic motivation, price and habit in UTAUT were added to adapt it to the context of consumer technology use.

METHODOLOGY

This research is part of a post-positivist philosophy, with a deductive approach, where a theory is used and a strategy is sought to test the hypotheses (SAUNDERS, 2012). The method is the quantitative one, through the survey strategy. As for the time horizon of the research, a transversal cut was chosen. The techniques and procedures adopted were the modeling of structural equations with the partial least squares (MEE) in the Smart-PLS 3 software. The MEE made it possible to test the validity of the measurement scale by confirmatory factor analysis, Pearson's coefficient of determination (R^2), calculation of Cronbach's Alpha coefficient (α), compound reliability (CR), analysis of mean extracted variances (AVE), values of cross loads, path coefficients, predictive validity (Q^2) and effect size (f^2). In this research the steps described by Ringle (2011) and Hair (2014) are used in order to check the adequacy and validity of the proposed UTAUT2 model. The tool used in this article is an adaptation of the questionnaire of Venkatesh et al (2012) and it is applied to university students who use a Virtual Learning Environment.

RESULTS AND DISCUSSION

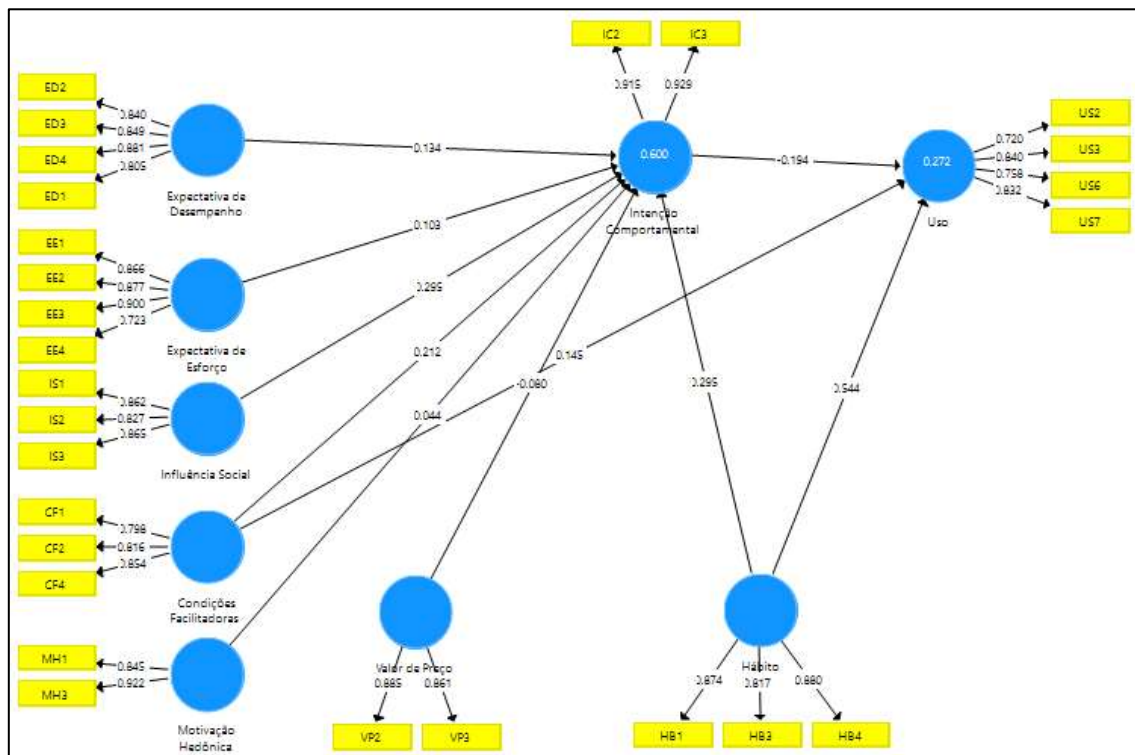
The sample was estimated as described by Ringle et al (2014) using G*Power 3.1 software (FAUL; ERDFELDER; BUCHNER; LANG, 2009). The frequencies of responses on age, gender, experience of the mid-sized company were calculated in order to describe the characteristics of the sample. The sample consisted of 62% female and 38% male respondents; 100% were aged 19 to 29 years.

Model

From the data collection, a measurement model was estimated (Figure 1), in which the latent variables of UTAUT2 are predictors of Behavioral Intent and Use, according to the hypotheses indicated in this article.

In the analysis of the validity and reliability of the structural model, the factor loads of the items, the Alpha de Cronbach coefficients, the Mean Variances Extracted, the Composite Reliability and the R2 were generated, as shown in Table 1.

Figure 1- Structural Equation Model .



Source: Authors (2020).

In the model, we chose to use only those items with loads greater than 0.700 (HAIR et al ,2014) indicated in Table 1. In the evaluation of the structural model the Pearson coefficient of determination (R²) calculated for the latent variable Entrepreneurial Intent was 0.28, considered a large effect (COHEN, 1988). The values of the Mean Extracted Variances (AVE) were higher than 0.500, confirming the convergent validity (FORNELL & LARCKER, 1981; HENSELER; RINGLE & SINKOVICS, 2009). For the reliability analysis, the Alfas de Cronbach coefficients were calculated, where we obtained values greater than 0.700 and the Composite Reliability (CR) with values greater than 0.500, both evidencing the optimum reliability of the model (HAIR et al ,2014). All calculated values can be seen in Table 1.

Table 1 - Values of the quality of fit of the MEE model.

Variable	Itens	VIF	Cargas ^a	α Cronbach ^b	AVE ^c	CR ^d	R Square ^e
Use	US2	1.529		0.720	0.805	0.868	0.272
	US3	1.586		0.840			
	US6	2.055		0.758			
	US7	2.185		0.832			
Behavioural	IC2	1.965		0.915	0.824	0.850	0.600
Intention	IC3	1.965		0.929			

Expectation	ED1	1.901	0.805	0.866	0.713	0.908	-
Performance	ED2	2.250	0.840				
	ED3	2.701	0.849				
	ED4	2.689	0.881				
Expectation	EE1	2.277	0.866	0.863	0.712	0.908	-
Effort	EE2	2.742	0.877				
	EE3	2.834	0.900				
	EE4	1.491	0.723				
Habit	HB1	1.863	0.874	0.821	0.736	0.893	-
	HB3	1.711	0.817				
	HB4	2.025	0.880				
Social	IS1	2.083	0.862	0.814	0.726	0.888	-
Influence	IS2	1.871	0.827				
	IS3	1.622	0.865				
Hedonic	MH1	1.488	0.845	0.728	0.782	0.878	-
Motivation	MH3	1.488	0.922				
Facilitating	CF1	1.728	0.798	0.770	0.678	0.863	-
Conditions	CF2	1.713	0.816				
	CF4	1.418	0.854				
Price Value	VP2	1.379	0.885	0.688	0.762	0.865	-
	VP3	1.379	0.861				

Source: Authors (2020).

a. All items with loads greater than 0.700 (HAIR et al ,2014).

b. Alpha Cronbach coefficients greater than 0.700 optimal reliability indicators (HAIR et al, 2014).

c. All mean extracted variances (AVE) greater than 0.5 converging validity indicators (FORNELL & LARCKER, 1981; HENSELER; RINGLE & SINKOVICS, 2009).

d. All Composite Reliability (CR) indicators greater than 0.5 (HAIR et al ,2014).

e. R2 greater than 26%, indicating a large effect (COHEN, 1988).

* Only the variable "Price Value" obtained the coefficient a little below the parameter 0.688. We chose not to exclude the variable because it is considered regular acceptable (COSTA, 2011).

To check the discriminant validity of the model, the Cross Load Values were analyzed. For the Cross Load Values analysis, the loads should be higher in the original latent variables than in others (RINGLE et al, 2014). In this study, all calculated loads were higher in their respective latent variables when compared to the others (Table 2), indicating discriminant validity for the model (CHIN, 1998).

Table 2 - Cross Load Values

	FC	PE	EE	HB	BI	SI	HM	US	PV
CF1	0.798	0.312	0.399	0.379	0.387	0.335	0.369	0.155	0.234
CF2	0.816	0.192	0.422	0.485	0.386	0.359	0.425	0.301	0.298
CF4	0.854	0.278	0.423	0.450	0.599	0.276	0.343	0.312	0.120
ED1	0.181	0.805	0.497	0.334	0.436	0.396	0.411	0.265	0.375
ED2	0.200	0.840	0.284	0.308	0.382	0.350	0.383	0.145	0.397
ED3	0.314	0.849	0.284	0.343	0.394	0.441	0.457	0.184	0.389
ED4	0.356	0.881	0.365	0.459	0.482	0.493	0.459	0.265	0.421
EE1	0.459	0.318	0.866	0.282	0.412	0.184	0.304	0.365	0.107
EE2	0.399	0.454	0.877	0.352	0.391	0.303	0.152	0.386	0.128
EE3	0.389	0.484	0.900	0.324	0.455	0.314	0.320	0.384	0.235
EE4	0.471	0.147	0.723	0.464	0.330	0.162	0.381	0.429	0.162
HB1	0.460	0.414	0.429	0.874	0.590	0.412	0.463	0.475	0.371
HB3	0.497	0.417	0.222	0.817	0.496	0.408	0.458	0.326	0.360
HB4	0.426	0.290	0.383	0.880	0.536	0.359	0.399	0.464	0.320
IC2	0.520	0.446	0.431	0.516	0.915	0.611	0.409	0.144	0.269
IC3	0.543	0.485	0.443	0.647	0.929	0.500	0.478	0.281	0.283
IS1	0.350	0.403	0.219	0.426	0.454	0.862	0.474	0.252	0.345
IS2	0.193	0.307	0.131	0.304	0.439	0.827	0.206	0.192	0.108
IS3	0.406	0.533	0.353	0.425	0.608	0.865	0.425	0.210	0.390
MH1	0.347	0.472	0.325	0.423	0.351	0.370	0.845	0.304	0.468
MH3	0.444	0.437	0.284	0.477	0.486	0.408	0.922	0.249	0.459
US2	0.242	0.073	0.338	0.301	0.217	0.168	0.189	0.720	0.125
US3	0.237	0.164	0.193	0.527	0.155	0.217	0.246	0.840	0.175
US6	0.252	0.309	0.425	0.261	0.161	0.137	0.300	0.758	0.235
US7	0.304	0.297	0.585	0.389	0.225	0.259	0.244	0.832	0.140
VP2	0.208	0.433	0.214	0.353	0.273	0.296	0.446	0.120	0.885
VP3	0.225	0.384	0.111	0.358	0.249	0.306	0.462	0.251	0.861

Source: Authors (2020).

To test the hypotheses it was necessary to evaluate the causal relationships of the latent predictor variables in the Behavioral Intent and the Use variable (Table 3). Hypotheses 6 and 7 were rejected because they did not obtain a significant causal relationship ($P > 0.05$) (HAIR et al, 2014). The values of path coefficients, T-values and significance are shown in Table 3, below.

Table 3 - Path coefficient values of the adjusted model.

Hypotheses	Relationship	Path Coefficients	T-Value	P-Value	Decision
H1	Performance Expectation -> BI*	0.134	2.391	0.017	Accepted
H2	Expected Effort -> BI *	0.103	2.036	0.042	Accepted
H3	Social Influence -> Intenção IC*	0.295	5.108	0.000	Accepted
H4	Facilitating Conditions -> IC*	0.212	4.467	0.000	Accepted
H5	Facilitating Conditions -> Use	0.145	2.110	0.035	Accepted
H6	Hedonic Motivation -> BI *	0.044	0.550	0.582	Rejected
H7	Price Value -> BI *	-0.080	1.256	0.209	Rejected
H8	Habit -> BI *	0.295	5.936	0.000	Accepted
H9	Habit -> Use	0.544	9.985	0.000	Accepted
H10	Behavioral intention-> Use	-0.194	2.984	0.003	Accepted

* Behavioral intention

Source: Authors (2020).

CONCLUSION AND LIMITATIONS

The main objective of this article was to validate the Unified Theory of Acceptance and Use of Technology (UTAUT2) model from the application of the questionnaire in students of a university that went through the process of implementing a virtual learning environment. The items of each factor, in general, showed results considered satisfactory. However, it is recommended the elaboration of new items for the factors "Facilitating Conditions" and "Intent of Use" and new validations of the UTAUT2 theory scale, since the constructs may vary according to the researched environment and the variation of time. The meanings that constructs have at certain times may change with the passing of the years, due to the breakdown of paradigms and behavioral changes of societies.

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Pillars of Technological Advancement and Indicators of Scientific Production of Industry 4.0

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Abstract

From the first Industrial Revolution to Industry 4.0, technological advances have had a great influence on the increase in industrial productivity, highlighting characteristics such as the incorporation of information and productivity gains through the connection between University, Industry and Government, to measure the indices of scientific production and dissemination of knowledge, helping to develop the innovative potential of a nation, a quantitative and statistical technique called bibliometrics is used. In this context, this research proposes to identify the pillars of technological advancement and the indicators of scientific production in Industry 4.0. In order to verify the panorama of the exploration of the theme and to reach the objective of the research, quantitative and descriptive analysis was carried out with bibliometric procedures in the Scopus and Web of Science databases, from which 259 and 280 scientific articles were extracted respectively. The analysed data allowed the identification of pillars of technological advancement of Industry 4.0 and provided indicators of the quantity of articles published between 2013 and 2019, of countries with greater and less research prominence, and of quantitative distribution of publications by University. The results proved to be promising for the development of new research on this theme.

Keywords - Industry 4.0, Technological, Bibliometrics.

1. Introduction

Since the beginning of the Industrial Revolution, technological advances have been considered driving engines in increasing industrial productivity, since the 19th century with its steam-powered factories, through the conductive electrification of mass production in the 20th century, until its automation in the 1970s. The subsequent incremental industrial technological advances show a comparative disparity in relation to the transformation that occurred in mobile communications, electronic commerce and information technologies. In the present century, we are immersed in the middle of a fourth wave of technological advancement marked by the emergence of new digital industrial technologies known as Industry 4.0 with the potential to revolutionize and transform design and manufacturing into single cells for integrated and automated installations for data analysis, failure prevention aimed at communicability, increased flexibility, speed of operations, product services and production systems 30% faster and 25% more efficient with the use of connectivity between machines, human beings leading mass customization

to new levels of technological innovation (Rüßmann, Lorenz, Gerbert, Waldner, Justus, Engel, & Harnisch, 2015).

Industry 4.0 has been referred to as the 4th Industrial Revolution, as in a similar way to other previous revolutions, technological innovation is the starting point for breaking the old paradigms towards intensified remodelling of production systems, showing characteristics such as the incorporation of technology information with a capacity to promote substantial gains in productivity, flexibility and the transforming nature of industrial work (Tessarini & Saltorato, 2018).

This research is justified in the understanding that the formation of the pillars of technological advances in Industry 4.0 and the process of transferring information technology occur in a constant, gradual and complex way, connected through the relationship between University, Industry and Government. In this sense, the dissemination, assimilation of information and scientific and technological knowledge is achieved by Universities through their scientific production, directly contributing to a nation's innovative potential. To measure the production and dissemination rates of knowledge, as well as to monitor the development of several scientific areas, the standards of authorship, publication and use of research results quantitative and statistical technique called bibliometrics is used (Silva, Kovaleski, Pagani, 2019; Palleta, Silva, Santos, 2014; S. Lopes, Costa, Fernández-Llimós, Amante, & P. F. Lopes, 2012).

Therefore, this research aims to identify the pillars or bases of technological advancement and indicators of scientific production, showing the quantity of world production, main countries, main universities and main areas of knowledge which approach the theme Industry 4.0.

2. Industry's Historical Process

Industry 4.0 is a milestone in a new industrial scenario with its origins rooted in the Internet. This new industrial revolution potentially holds the capacity to impact manufacturing projects, making products more intelligent and more endowed with individualized identification processes involving the generation, storage, recovery and use of data connected to production resources (Grotti, 2019).

This new revolutionary trend of breaking the paradigm in world production known as Industry 4.0, researched and applied with avidity mainly in Europe, is based on a system of automation and integration between the internet and the factory in a cyber-physical space, connecting and interconnecting machines in an equal way in all social organization (Freitas, Fraga, & Souza, 2016).

The historical process of the Industry, according to Coelho (2016), begins with the first industrial revolution in 1760 and 1840, culminating in the present century with Industry 4.0, as can be viewed in Table 1:

Table 1. Industries's historical process

Industry 1.0	Industry 2.0	Industry 3.0	Industry 4.0
The first Industrial revolution began somewhere between 1760 and 1840 in England, with the progressive replacement	In the decades that followed the end of the Second World War (1945), developments were	In the 1950s and 1970s, what was to be considered the third Industrial Revolution, the	In the beginning of the 21st century, with the development of the internet, with increasingly smaller

of artisanal methods by machines and tools, through the exploitation of coal as an alternative energy to wood and other biofuels, and through the increasing use of steam energy. Changes in production processes cause significant economic and social consequences. The craftsman who, until then, controlled the entire production process, from the exploration of the raw material to the commercialization of the final product, started to work for a master who controlled the process, the raw material, the final product and the profits.	significant in the area of chemical, electrical and steel industries, as well as improvement was significant in existing techniques. The first steel boats appeared, powered by powerful steam engines, revolutionizing the freight transport. The first production lines also appeared, which would allow mass production at low costs. Invention and innovation went hand in hand in what has been known as the second Industrial revolution.	digital revolution, began to be designed, with the proliferation and use of semiconductors, computers, automation and robotization in production lines, with information digitally stored and processed., with the communications, with mobile phones and the internet.	and powerful sensors, with increasingly affordable prices, with increasingly sophisticated software and hardware, plus the ability of machines to learn and collaborate by creating gigantic networks of “things”, a transformation in industry has begun, whose impact on competitiveness, society and the economy will be such that it will transform the world as we know it.
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Source: Adapted from Coelho (2016).

Industry 4.0 will cause profound changes in economic society, in values, in forms of relationships in the choice of products and services, in collaborative innovation, additional manufacturing, networks and digital platforms, constituting a promising environment for opportunities to create competitive advantages among the vanguard industry and the others. Although these changes may take 20 years to materialize, in the next 5 to 10 years the most important technological advances will be established, making it possible to gather and analyse data between machines, faster, more flexible and efficient processes in the production of goods with higher quality and cost reduction, increasing manufacturing productivity, promoting industrial growth, changing the profile of the workforce, influencing the competitiveness of companies and regions and consequently impacting the economy (Coelho, 2016; Rüßmann, *et al.*, 2015).

2.1 Pillars of the Technological Advances of Industry 4.0

The technological advancement, considered as one of the five global megatrends, is causing profound social transformations and disruptions in all sectors of the economy and in the generation of value for companies that find in innovation its main growth engine. Assuming that these new technologies will require

substantial changes in the standards of the businesses we know, the identification and understanding of the pillars of technological advances is essential for adoption, adaptation and use in the competitive business environment at this special moment in history called the 4th Industrial Revolution or Industry 4.0 (PWC Brasil, 2016).

Seeking to explore impressive technologies for global and intersectoral business, among more than 150 technologies, explored (with data from companies, startups, academia and research institutes), evaluated (in terms of intersectoral relevance, technical feasibility, global scalability) and selected (those whose impact is considered greater in the next 3 to 7 years), PWC Brasil (2016) identified eight essential technological advances, as can be seen in Table 2.

Table 2. Technological Advances

1. Artificial intelligence (AI)	Software algorithms capable of performing tasks that normally require human intelligence, such as visual perception, voice recognition, decision making and language translation. AI is a broad concept, which includes several subfields, such as machine learning, aimed at developing programs capable of teaching the computer to learn, understand, reason, plan and act (that is, to become more "intelligent") when exposed to new data in proper quantities.
2. Augmented reality (AR)	Adding information or visual aids to the physical world, through a graphic and/or audio overlay, to improve the user experience in relation to a task or a product. This "increase" in the real world is achieved with supplementary devices that transmit and display information. AR is different from virtual reality (VR), conceived and used to recreate reality within a confined experience.
3. Blockchain	Distributed electronic accounting that uses software algorithms to record and confirm transactions reliably and anonymously. The event log is shared between several parties. Once entered, the information cannot be changed, as the new elements of the chain reinforce previous operations.
4. Drones	Aerial or water-based devices and vehicles, such as unmanned aerial vehicles that fly or move without a human pilot on board. Drones can operate autonomously (via on-board computers), according to a predefined flight plan or by remote control. (Note: This category is different from autonomous ground vehicles).
5. Internet of things	Object network - devices, vehicles, among others - with built-in sensors, software, network connectivity and computing capacity. They can collect and exchange data over the Internet. IoT allows devices to be connected and remotely monitored or controlled. The term IoT represents any "connected" device accessible via a network connection. Industrial IoT (IIoT) is a subset of IoT and refers to the use of this technology in the industrial and manufacturing sectors.
6. Robots	Electromechanical machines or virtual agents that automate, expand or assist human activities, autonomously or according to defined instructions - usually a computer program.

7. Virtual reality (VR)	Computer generated simulation of a three-dimensional image or a complete environment, within a defined and contained space (as opposed to AR), where viewers can interact with this image in a realistic way. VR is intended to be an immersive experience and requires equipment, usually a helmet or headset.
8. 3D printing	Layered manufacturing techniques used to create three-dimensional objects based on digital models, arranging or “printing” successive layers of materials. 3D printing uses innovative “inks”, such as plastic, metal and, more recently, glass and wood.

Source: adapted from PWC Brasil (2016).

Aligned with this same line of reasoning Oliveira (2017) highlights the constant need for organizations to seek competitiveness, stimulate the search for systematic changes, aiming to meet the desires of avid and demanding consumers with ever more diverse and continuous demands. In this context, the search for the adaptation of business processes aiming at a more efficient production leading to the path of Industry 4.0, which conditions, among other factors, the intensive use of the Internet of Things (IoT), Cyber-Physical Systems, Big-Data etc., in production environments. The main expectation is the increase in level of monitoring capacity and control of the equipment distributed in order to positively impact the costs and quality of the products offered.

In Industry 4.0, intensely focused on continuous progress in terms of efficiency, safety and productivity of operations, especially in return on investment, several technologies are available, in Table 3 the pillars of the intelligent industry will be highlighted in Coelho's view (2016); they are: Internet of Things and Services (IoT); Cyber-Physical Systems (CPS); Big data (Table 3).

Table 3. Pillars of Intelligent Industry

Internet of Things and Services	Cyber-Physical Systems	Big-Data
The term “Internet of Things (IoT)” refers to physical and virtual objects connected to the internet. It has its roots in MIT (Massachusetts Institute of Technology) when, in 1999, a group developed work in the area of connected radio frequency identification (RFID). Since then, it has been driven by the appearance and widespread use of increasingly smaller and cheaper sensors, as well as a breakthrough in mobile devices, wireless communications and cloud technologies.	Cyber-Physical Systems (CPS) are systems that integrate computing, communication networks, embedded computers and physical processes interacting with each other and influencing one another. It is the result of the technological evolution of computers, sensors, and communication technologies, which, by evolving towards greater agility, processing capacity and increasingly accessible prices, have allowed them to be combined effectively and in real time.	The term BIG-Data refers to large amounts of data that are stored at every moment resulting from the existence of millions of systems currently connected to the network (IoT), producing real-time data on a multitude of subjects and almost anywhere.

Source: Adapted from Coelho (2016).

In a realistic and practical view of the potential of technological advances in Industry 4.0, Collabo Brasil (2016) presents a business environment using available technologies (Internet of Things and Services (IoT); Cyber-Physical Systems (CPS); Big-Data, etc.), starting from digitalization, connectivity from the factory floor to the logistics system, in an environment where machines talk to machines, with tools, parts and human beings, where interaction and exchange of information occur when machines act as decision makers for the best flow of the production process aiming at cost reduction.

In turn, Rüßmann *et al.* (2015) outlines 9 pillars of technological advancement as the basis of Industry 4.0, which are described and explored for their technical and economic benefits along with their potential for transforming production through the union of isolated and optimized cells as a fully integrated and integrated system in search for greater efficiency between traditional production relationships between suppliers, producers and customers, humans and machines, namely:

Big Data and Analytics

It consists of the process of collecting and comprehensively evaluating countless different sources, equipment and production systems, and management systems for companies and customers that are increasingly standardized and aims at assisting decision making in real time, optimizing production quality, saving energy and improving equipment services.

Autonomous Robots

Robots are already used in several sectors to perform complex tasks. The process of robotic evolution with increasingly lower costs and resources for their production is heading towards a dizzyingly wide use with the development of more autonomous, flexible and cooperative robots, aiming at mutual robot-human interactivity in a continuous learning process.

Simulation

3D product simulations are already used in engineering, materials and production processes, pointing to a future with the possibility of including machines, products and humans, simulating plant operations more extensively, taking advantage of real-time data, reflecting the physical world in a virtual model, allowing operators to test and optimize machine configurations, reducing machine setup time and increasing quality.

Horizontal and Vertical System Integration

Today, most IT systems, the company's functions at the shop floor level and product engineering itself are not fully integrated. In Industry 4.0, The evolution of universal data integration networks between companies enables genuinely automated and more coherent value chains.

The Industrial Internet of Things

Allows devices, including unfinished products, to be connected, enriched and incorporated with computers using standard technology, allowing communication and interactivity of field devices with each other and with central controllers, decentralizing analysis and decision making in real time.

Cybersecurity

The use of standard communication protocols and increased connectivity accompany Industry 4.0, resulting in the need for sophisticated identity management and access to users/machines that essentially guarantee safe and reliable communications against cyber security threats.

The Cloud

Industry 4.0, aiming at a greater sharing of data between sites and aspects of the company, mainly in production-related ventures, will increasingly demand the performance of more improved cloud technologies reaching reaction times of a few milliseconds; consequently, the data and the machine functionality will allow more data-driven services for production systems.

Additive Manufacturing

The additive manufacturing methods in Industry 4.0 will be widely used in the production of small customized batches providing advantages in the construction of light and complex projects, with decentralized and high-performance additive manufacturing systems and the potential to reduce transport distances and available stock.

Augmented Reality

Systems based on augmented reality are currently taking their first steps. In the future, they will be used more widely to provide information to workers in real-time to improve decision-making and work procedures.

The 9 pillars of technological advances, previously described, share levels of similarity with the Pillars of Industry 4.0 presented by Falcão (2019), however, this latter author understands that the migration process to Industry 4.0 requires changes in the management model and in the culture of organizational and technological decision makers that led to the systematized development of the Pillars of Industry 4.0 in a matrix proposal, as can be seen in Figure 1:

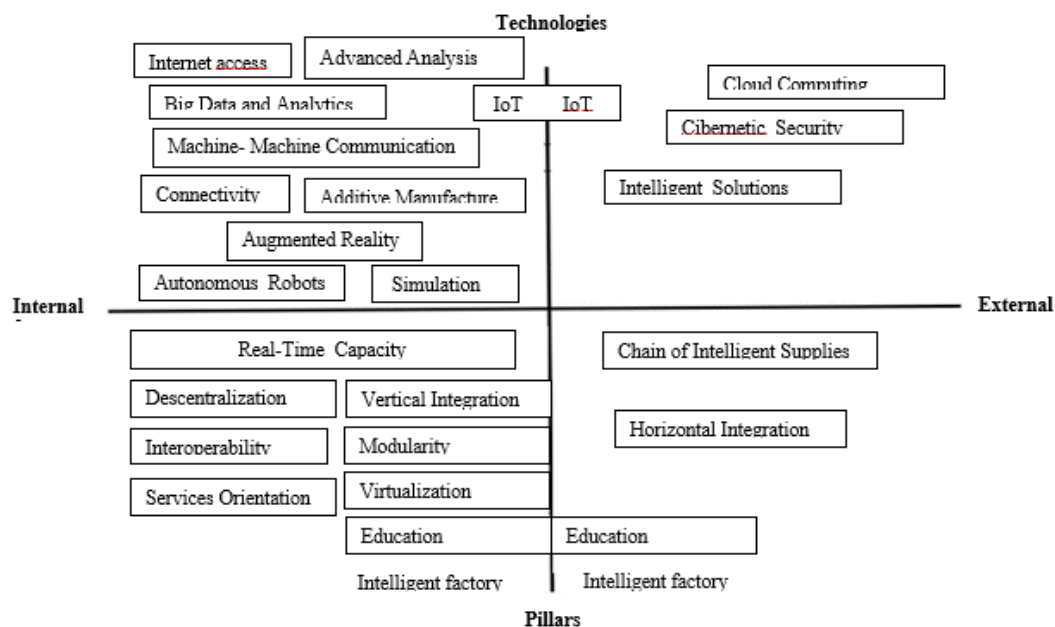


Figure 1. Matrix proposal for the systematization of the pillars of industry 4.0.

Source: Falcão (2019)

The Intelligent Factory, in relation to its implementation, was considered an internal pillar (due to significance of the adequate internal structure) and external pillar (due to dependence on external factors

such as improvement on the internet, cyber security). Horizontal integration consists of connectivity between the links in the supply chain in which the industry is inserted, and its plausibility depends on the participatory work of everyone in smart factories, that is, the emergence of the smart supply chain that comes from horizontal integration. In the matrix, internal technologies were listed, such as: internet access focused on working with the Internet of Things (IoT), use of elements (such as Simulation, Augmented Reality, Autonomous Robots and Additive Manufacturing) in order to assist the company in connected work and integration of people (Machine-Machine Communication). Big Data and Data Analysis for data collection and analysis, synchronized with the decentralization pillar aim to assist the company in reaching the peak of capacity in real time. In turn, external technologies (Cloud Computing, Cybersecurity and Intelligent Solutions, IoT) build Industry 4.0, linking its development to dependence on external incentives from companies. In view of the widespread business concern regarding the prevention of cyber-attacks and the like, Cybersecurity and Intelligent Solutions potentially present themselves as responses (Falcão, 2019). The generation of new knowledge of technological advances in Industry 4.0 and various areas of scientific production is achieved by the Universities. The analysis of the production of this scientific knowledge is carried out through research with bibliometric approaches with the potential to identify theoretical trends and outline methodological trends (Vasconcelos & Santos, 2019).

3. Methodology

In order to achieve the objective, a descriptive and quantitative analysis research was carried out, with bibliometric procedures, in articles of scientific journals that addressed the subject matter of this study, that is, "Industry 4.0". Data collection was carried out through the Capes Periodical Portal, specifically in the Scopus and Web of Science databases. These bases are sources of scientific information, with a multidisciplinary character, with international scope. In addition, they favour metric research through indicators. The search strategy was through the combination of the terms: "Industry 4.0", "Fourth industrial", in the advanced search field all fields were used as a filter. Subsequently, the following variables were defined for measurement: Year of publication of the research, Country, Knowledge Area and Periodical. The research covered a time period that encompassed the years from 2013 to 2019.

For the measurement of the data, the variables were listed in a database, using the Excel Software, where it was possible to construct the graphs and the quantitative analysis of the results.

Table 4. Scopus and Web of Science searches.

Keywords	Scopus	Web Of Science
"Industry 4.0"	Publications found: 259	Publications found: 280
"Fourth industrial"		

Source: Own authorship (2020).

4. Results

The combination of the terms searched, "Industry 4.0" and "Fourth industrial", culminated in 539 articles published in scientific journals, indexed in the Scopus and Web of Science databases. The data represented

in the Figures below illustrate the panorama of this research, by measuring the variables: Year of publication; Countries; Knowledge area and Universities.

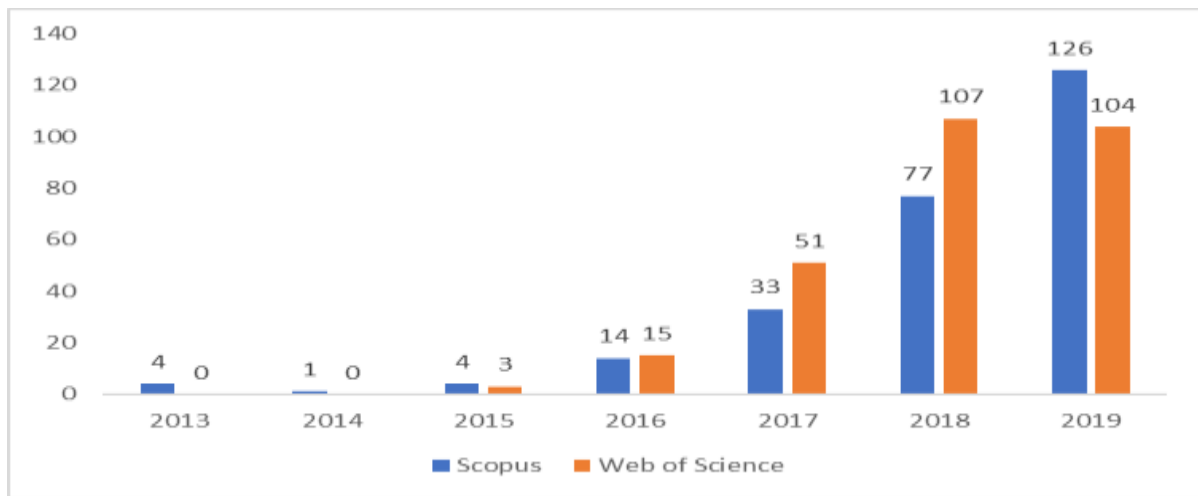


Figure 2. Distribution of publications by year on Web of Science and Scopus database.

Source: Adapted from the Web of Science and Scopus database (2020).

The evolutionary process of publications per year was verified in the years between 2013 and 2019. A gradual evolution and a quantitative increase during the researched period, in both bases was perceived; see figure 2; however, the Scopus database has fewer articles indexed in relation to the Web of Science, yielding respectively 259 and 280.

With regard to the number of surveys by countries, Figure 3 presents the 17 most prominent countries that conduct research on Industry 4.0. It is possible to see that, in the Web of Science and Scopus database, Italy is ahead of the other countries presented with 29 and 27 publications, in sequence, Germany, United Kingdom, United States, Poland and Brazil stand out.

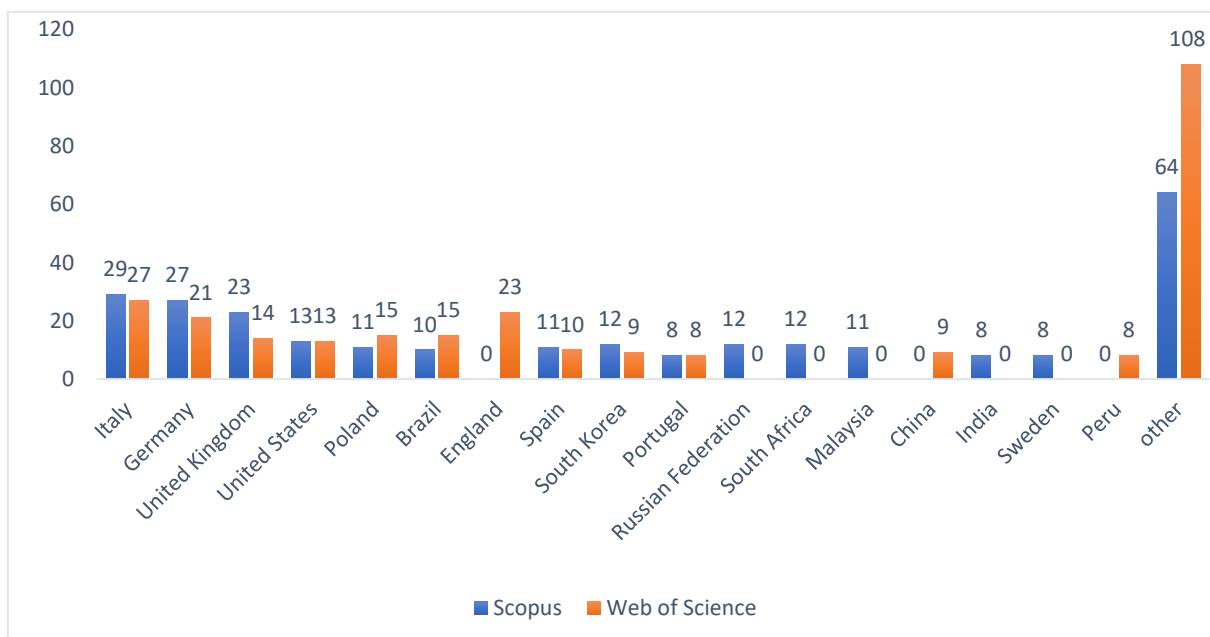


Figure 3. Distribution of publications by country in Web of Science and Scopus database.

Source: Adapted from Web of Science and Scopus database (2020).

On both bases, it is worth noting that Brazil occupies the sixth place with 10 and 15 publications, standing out as a potential for qualitative and quantitative growth that fosters the national and international academic framework in the theme of Industry 4.0.

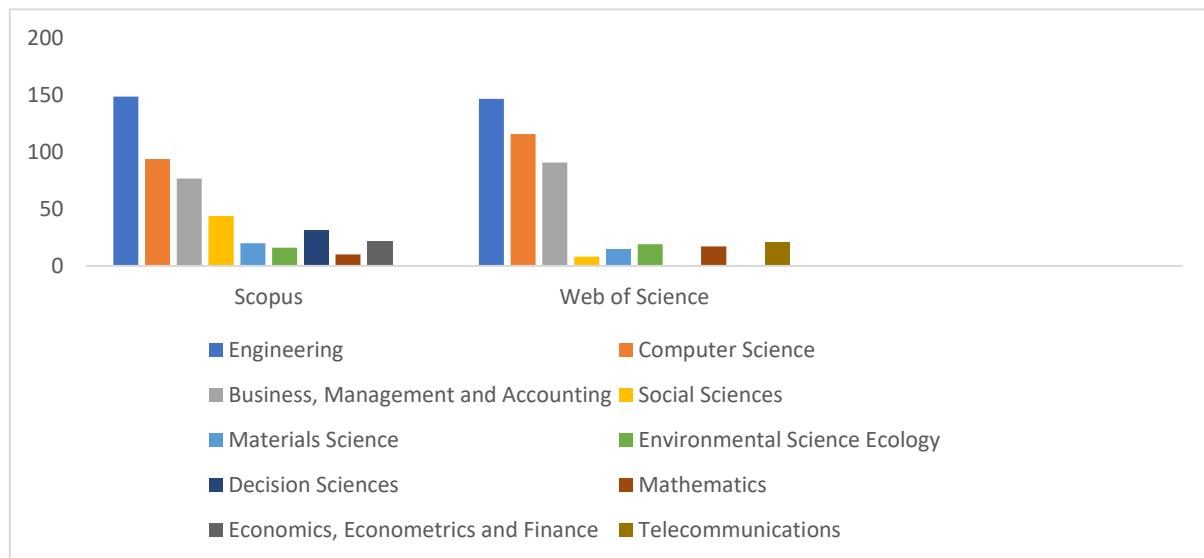


Figure 4. Distribution of publications by area of knowledge in the Web of Science and Scopus database.

Source: Adapted from Web of Science and Scopus database (2020).

Regarding the distribution of publications in the ten largest areas of knowledge, it can be seen in Figure 4 that in the Web of Science and Scopus database, the areas of Engineering, Computer Sciences, Business, Management and Accounting, Social Sciences, stand out. Material Sciences, Environmental Sciences and Management Sciences, in turn, the areas with less distribution, namely: Economics, Econometrics and Finance, Telecommunications and Mathematics.

In Figure 5, it appears that both databases of this research share journals and articles in common. Regarding the quantitative distribution in a decreasing order of 50% of publications by Universities, especially the University of Minho, North-West University, Rheinisch-Westfälische Technische Hochschule Aachen, Pontifical Catholic University of Paraná, Università degli Studi di Napoli Federico II and Russian Academy of Sciences, among other Universities, the percentages of publication of articles are equally distributed, with national prominence for Universidade de São Paulo and Universidade Federal de Santa Catarina. Thus, mentioning the remarkable and relevant presence of 3 (three) Brazilian Universities, representing significantly an average (15%) of the articles published in Universities worldwide, demonstrating the continuous effort of Brazilian (or Brazil-based) academic researchers towards the construction of a relevant national and international scientific knowledge on the theme of Industry 4.0.



Figure 5. Distribution of publications by university in the Web of Science and Scopus database.

Source: Adapted from Web of Science and Scopus database (2020).

5. Conclusion

This research aimed to identify the pillars of technological advancement and indicators of scientific production, indicating the quantity of world academic production, main countries, main universities and main areas of knowledge within the theme of Industry 4.0.

Regarding the identification of the pillars of technological advancement, the researchers consulted listed convergent and complementary views, which clearly indicates a quantitative growth of new pillars concomitant with technological evolution.

The combination of the terms searched, "Industry 4.0" and "Fourth industrial", culminated with the result of 539 articles published in scientific journals indexed in the Web of Science and Scopus databases. In the period ranging from 2013 to 2019, there was a significant and impactful evolution of articles indexed in the databases of this research, with quantitative prominence in the publication of articles mainly in the following countries: Italy, Germany, United Kingdom, United States, Poland and Brazil.

It is important to highlight that within the theme of industry 4.0, the Brazilian scenario deserves to be highlighted among the 17 countries with greater and more significant relevance in the publication of articles. Representing an average quantitative percentage of 15% of the Universities' articles published worldwide, the Brazilian presence of 3 (three) Universities stands out, namely: Pontifical Catholic University of Paraná, University of São Paulo and Federal University of Santa Catarina, towards the

construction of an expressive national academic framework with an international impact on the theme of industry 4.0.

Engineering, Computer Sciences, Business, Management and Accounting, Social Sciences, Materials Sciences, Environmental Sciences and Management Sciences are the areas of knowledge with the greatest distribution of publications. On the other hand, the areas with the least quantitative distribution are Economics, Econometrics and Finance, Telecommunications and Mathematics.

For the purpose of future works, research related to a larger number of databases is suggested. This research can, nonetheless, serve as a basis for future professional works that can potentially provide research related to bibliometric indicators or for the deepening of the theme of Industry 4.0 in Academic circles.

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SUSTAINABILITY IN ELEMENTARY EDUCATION: CONSCIOUSNESS AND LEARNING

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Abstract

This work reports a didactic experience through the assumptions of Project-Based Learning, Interdisciplinarity and Significant Learning in the teaching-learning process in years initials of Elementary School, using the Design Science Research methodology. The study contextualizes the reflection about the necessary promotion of sustainable actions with the intention of mitigating environmental impacts. The general aim is to associate the concerns related to the Environment with the construction of events (Science Fair) and promote the integration between the curricular components and the school community. The analysis of the data showed that the student has a greater participation and involvement in daily activities when he builds his own knowledge. It can be concluded that the results obtained in this work prove the effectiveness of the adopted methodologies, which consequently contributed to the achievement of the proposed aims.

Keywords: Sustainability, Science, Experiments, Science Fair.

1. INTRODUCTION

The contemporary educational scenario is composed of several challenges, among them, making sense of the school in view of the ease of obtaining information, knowledge sharing and access to practices, specialists and collections from around the world through the internet. Bacich and Moran (2018) state that school makes sense when it follows the students' own lives and not only teaches them how to live it. The school must go hand in hand with the experience of the student and his community, collaborating with psychological relationships, generating knowledge and, mainly, protagonism. Fazenda (2008, p. 20) states that “we are referring to issues such as: aesthetics of the act of learning, space of learning, intuition in the act of learning, design of projecting, time to learn and the symbolic importance of learning”.

Based on this assumption, it is evident the need to take to school questions related to the students' daily lives, as well as using resources that are within their reach, creating meaning for the classes. This change in educational paradigm can be developed through the use of active methodologies and differentiated pedagogical practices that, in addition to generating knowledge, encourage the creation of skills and competences, both technical and transversal. Capri et al (2014) state that Project Based Learning (ABPj) is one of these methodologies, as well as Fazenda (1998) which indicates Interdisciplinarity and,

Ausubel (2000) indicating Learning by Significant Reception or, commonly called here in Brazil, Significant Learning.

Thus, the present work was developed in a public school, in the interior of the state of São Paulo, in the school and family context, providing opportunities to students to carry out some reflections on the necessary promotion of sustainable actions with the intention of mitigating environmental impacts.

This study aimed to associate information on the necessary concerns with the Environment through the construction of Events (Fairs) and Laboratories, generating a possibility to promote a work of interaction and integration between the curricular components and the school community, in order to disseminate all debates to society.

In a more specific context, there is a conjunction of factors that point clearly the contemplation of other objectives: promoting dialogical interactions and conclusions that occurred in the classroom, developing technical skills on the subject (sustainability and environment) and transversal skills, such as teamwork, resolution of conflicts and oral communication.

The interdisciplinary work “1st Science Fair - Sustainability!” it was justified because part of the initiative to work on the Environment theme, a subject present in the National Curriculum Parameters (PCN) and in the National Common Curricular Base (BNCC) for students in the 5th year of elementary school. Considering that the Science Fair is a scientific event, which aims to implement inside the classroom and, outside of it, works and activities that allow to students to leverage their knowledge, through projects that qualify their learning and also, can share their knowledge (BRASIL, 2006; BRASIL, 2017).

The methodology used for this work was the DSR (Design Science Research) which, according to Sarmiento (2017), refers to knowledge about how to develop and create solutions to improve existing systems and that contribute to a better human performance, both in front of the community and in institutions. Bax (2015, p. 111) states that DSR is a “meta-theory that investigates the generation of knowledge in the artifact design process” and “should be seen as one of the most appropriate methodologies to guide the conduct of scientific research” in management information and knowledge.

Although DSR is commonly applied to the management and engineering area, Dresch et al (2015) states that this is a research method that has been applied in several areas of knowledge, including education. Also according to the authors, this methodology used prescribed methods, employed the concept of Design Science (project science) and also considered interdisciplinarity, which could provide a broader view of what was studied, increasing the relevance of the research.

2. THEORETICAL FOUNDATION

2.1. PROJECT-BASED LEARNING

According to Bacich and Moran (2018) methodologies are specific guidelines and techniques that guide the teaching and learning processes, whereas active methodologies are teaching strategies centered on the effective participation of students in the construction of this process, in a flexible, interconnected and often hybrid. The application of an active methodology can be developed in several ways: Flipped Classroom, Think Pair Share (TPS), Research Based Learning (ABIn), Problem Based Learning (ABPro), Project Based Learning (ABPj), among others.

The ABPj methodology, according to Bender (2014) is one of the most effective ways to engage students with the didactic subject, since this method normally uses real projects and with meaning for students.

According to the author, the starting point of ABPj is a guiding question or challenging task, with which it is recommended to identify students to guide the final product of the methodology. It is convenient for the student to generate a product (not necessarily tangible, it can be an idea, a campaign or even an explanatory video).

Then, an anchor was provided to the students, in which Bender (2014, p. 32) states that it is the “introduction and basic information to prepare the ground and generate the interest of the students”, which can come in the form of an expository class, narratives by expert professionals, newspaper or magazine articles, technical visits or resources that support the intended concepts.

However, Bender (2014) and the Buck Institute for Education (2008) guide the following structure: the elaboration of a well-defined plan, which contains a schedule, a type of evaluation that will be applied, information about the group and the product Final.

For the authors, the present structure was crucial for this methodology was successful, since, it is up to this structure to guide its own development.

Bender (2014, p. 129) states that “many evaluation alternatives are provided in almost all discussions” of ABPj, and they propose the inclusion of self-reflection, product / work evaluation, peer and teacher evaluation. Two tools widely used in ABPj evaluations are the Analytical Rubric and the Likert Scale.

Next, the Buck Institute for Education (2008) advises the development of a Project Map, which guides students and teachers in relation to the sequence of activities. In general, the Project Map is composed of Support Activities, Schedule and the Project Launch Event.

Now regarding the importance of the teacher, Bender (2014, p. 39) ensures that “instead of serving as providers of information, in ABPj the teachers must act as facilitators and educational advisors, according to students evolve in their project activities ”.

In other words, for the author, the main importance of the professor is to mediate the administration of the work and, before starting it, it is fundamental to have a reasonable notion of the size of the same, its importance and their students, as shown in Tables 1 and 2 (highlighted the characteristics that surround this study).

Table 1. Scope of the Project (*Buck Institute for Education, 2008*).

	Small project	Ambitious project
Duration	Five to Ten days	Most of the semester
Amplitude	One topic	Multiple subjects
	One standard	Multiple standards
Tecnology	Limited	Extensive
Reach	Classroom	Community
Partnership	One Teacher	Multiple teachers and Community members
Public	Class or School	Team of experts

Table 2. The formulation of the project and the importance of students (*Buck Institute for Education*, 2008).

Limited student participation		Maximum student participation
Professor selects topic	Teacher asks students to participate	Students select a topic
Teacher defines learning results	Teacher and students negotiate learning results	Students define learning results

2.2. INTERDISCIPLINARITY

Based on the thinking of Fazenda (2008), interdisciplinarity cannot be defined only as the union of two or more disciplines, the term interdisciplinary is much greater than that, it is attitude, it is boldness, it is believing in the search for knowledge. It is the relationship of epistemological concepts and procedures of the disciplines involved, which will lead “to the search for disciplinary scientificity and with it the emergence of new epistemological motivations, new existential frontiers” (FAZENDA, 2008, p. 18).

The author highlights the need for a meticulous review of the disciplines included in the method, as well as the knowledge they attend and train, which often makes the teacher to reconsider his own practices and skills. Fazenda (1998) states that it is necessary to abdicate the colloquial way of the teacher to conduct his discipline and to overcome the deviations from this change.

Of equal importance, Tavares (2008, p. 136) lists interdisciplinarity in contemporary times, stating that it is one of the requirements of the modern world. The author highlights dialogue as the basic assumption of the method and recommends it to be “reflective, critical, enthusiastic, who respects and transforms”. The teacher starts to “contribute to awakening the search, research and development of new skills” and not only transmits information within the classroom. Currently, both are points of construction for individuals in relation to their identity, autonomy and experience.

2.3. SIGNIFICANT LEARNING

Ausubel, Novak and Hanesian (1980, p. 34) state that “the essence of the significant learning process is that the ideas expressed symbolically are related to the information previously acquired by the student” inside and outside the school and among his peers.

The authors suggest that learning can be contained in two dimensions, the significant and the receptive, and they call receptive (expositive) learning as automatic and learning by discovery as significant and link them, although both are considered significant.

Taking into consideration significant learning, the authors highlight the need to create two conditions: the student should be able to relate the information obtained by his / her existing knowledge structure and, “if the learning task itself is potentially significant” (AUSUBEL, NOVAK and HANESIAN, 1980, p. 3 and 4).

In this context, the authors emphasize that, although the students are the protagonists of their learning, the school and the teacher are not extinguished from their obligations. They must be prepared to

guide classes and provide a planned school curriculum, so that it is possible to identify the correct learning method for each moment.

3. METHODOLOGY

3.1 Methods

This academic work was carried out through the application of ABPj and DSR methodologies, leading the students in the laboratory of a “Science Fair”, whose theme was Sustainability. The work was developed based on the teaching strategy of Significant Learning (AUSUBEL et al, 1980) and Interdisciplinarity (FAZENDA, 2008; TAVARES, 2008).

Students, as a group, developed tasks in order to create a solution or an idea for the problem and its product, such as: sharing responsibilities, researching, collecting and synthesizing data and information, discussing, making decisions, correcting deviations along the way, etc.

Thus, students were offered the opportunity to develop various skills and competences, for example: communication, technology, group process, planning, problem solving, critical thinking, task management and self-management (BENDER, 2014; BACICH and MORAN, 2018).

3.2 Development

The target audience was 27 students from the 5th year of elementary school at a public school in Vale do Paraíba, state of São Paulo. The interdisciplinary work was developed during 4 weeks, adapting the schedule according to the number of classes of each discipline.

Initially, the Project Map (Table 3) was created, which is an indispensable schedule to guide teachers and others involved. Then, it was made an analysis of the previous knowledge of the Sustainability theme with the 27 students, through a questionnaire with five dissertation questions and an illustrative question (Appendix A).

Table 3. Project Map: Science Fair - Sustainability.

Phases		Tasks
Project creation	Stage 1	Meeting with the coordination and direction to present the idea
	Stage 2	Elaboration of the project map
	Stage 3	Meeting with teachers, coordination and direction to present the project
Initial accompaniment	Stage 4	Survey of previous knowledge of the theme "Sustainability"
	Stage 5	Historical understanding of the context to be studied
Starting the project	Stage 6	Lecture with the Secretary of the Environment
Interdisciplinary and interventional actions	Stage 7	Search: Garbage Collection
	Stage 8	Presentation of statistics and creation of materials (tables and graphs) with data collected (garbage collection)
	Stage 9	Conversation circle: Being sustainable
	Stage 10	Textual production: Being sustainable

Deepening the theme	Stage 11	Production of sustainable games with recyclable material
	Stage 12	Formation of productive groups
	Stage 13	Research and choice of sustainable experiences to be presented at the event
	Stage 14	Conversation between teachers and groups - mediation
	Stage 15	Study and test of experience - extra-class
	Stage 16	Presentation of reports with the script of the works (experiences)
	Stage 17	Making recyclable note blocks - a souvenir of the fair
	Stage 18	Donut production - sustainable dynamics
	Stage 19	Science Fair - Sustainability
	Stage 20	Conscious disposal of materials used at the fair
	Stage 21	Evaluation in Likert scale

The students answered the questions based only on their prior knowledge, without the aid of research or any external and / or supplementary content. Subsequently, the data were treated and analyzed quanti-qualitatively, thus establishing the starting point for preparing this study.

Continuously, the work of teachers with students in promoting interdisciplinary interventional actions was contemplated, through different didactic strategies: historical understanding of the need for sustainable actions; lecture with the municipality's environment secretary addressing the topic in question; research on selective garbage collection; presentation of statistics and creation of tables and graphs with data of garbage collections by capitals of the Brazilian states and types of garbage (blue: to papers and cardboard; green: glass; red: for plastics; yellow: for metals; brown: for organic waste; black: for wood; gray: for non-recycled materials; white: for hospital waste; orange: for hazardous waste and purple: for radioactive waste), conversation circles and textual productions about the quality of “Being Sustainable”, encouraging the exercise of environmental education; elaboration of entertainment games with recyclable material “Sustainable Games”, for the whole school community to play on the day of the “Science Fair” and the elaboration of the event.

As a first step for the elaboration of the “Science Fair” event, the students were divided into productive groups and, with the help of the Informatics teacher, they researched and chose the experiences they would like to study and present during the work. The main criterion for choosing experiences was loyalty to the theme “Sustainability”.

After choosing the experience, there was a conversation between the teachers and the small groups to resolve the remaining doubts about the work. The study of the experience was carried out extra-class, the small groups had a week and a half to prepare for the presentation and, during this period, they were asked to build reports with the dissertation of the work scripts at each meeting (Appendix B).

In class, students made notepads with recyclable materials and produced donuts for the entire school community through a “Sustainable Dynamics”.

In the “Sustainable Dynamics”, the students explained to their colleagues that they could not eat all the donuts in the pot without first ensuring that everyone had acquired at least one donut to taste. As a result

of this action, we sought to arouse the interest of other children in the theme of the Science Fair, as well as to work on some of the skills of BNCC - empathy, cooperation, responsibility and citizenship (BRASIL, 2017).

The holistic presentation of the study occurred on the day the culmination of work, entitled “1st Science Fair - Sustainability”. In this sense, the students presented the studied experience to colleagues in the school community, encouraged the public to play with the 15 “Sustainable Games” (handmade work with recyclable material carried out by students directly involved in the work) and distributed souvenirs: diaries with recyclable material (another artisanal work, with recyclable material, carried out by the students directly involved in the work) and cactus seedlings (donation from third parties), planted in pots adapted in egg cartons.

After the end of the event, there was a concern by the students to perform the proper disposal of all material used at the fair. A separation of the material used was carried out and a disposal was offered to the sector responsible for collecting recyclable waste in the municipality.

The project was assessed using the Likert Scale, as shown in Table 4 (an example of a result from the data in group 7).

Table 4. Group 7 evaluation on a Likert scale.

	Group 7 - Plastic made with milk				
	I totally disagree	I disagree	I neither agree nor disagree	I agree	I totally agree
The group demonstrated clarity in the concepts presented in its work					X
The group organized an appropriate presentation that made everyone understand the presentation clearly					X
Presented science, sustainability and environment concepts in a fun and engaging way with the use of new technologies					X
Did the students demonstrate teamwork?					X

Concomitantly, students also evaluated their own work and the method, according to Table 5 (an example of a result from the data in group 1).

Table 5. Group 1 evaluation on a Likert scale (Adapted from Buck Institute for Education, 2008).

	Group 1 - Soil permeability				
	I totally disagree	I partially disagree	I neither agree nor disagree	I partially agree	I totally agree
ABPj facilitated learning of the concepts of science, sustainability and environment				X	
The use of ABPj made learning more motivating				X	
All group members participated effectively in all stages of the project			X		
The success of my group depended on the union between its members				X	
Everyone in the group fulfilled the tasks established at the beginning of the project				X	
All conflicts experienced by the group were overcome in a coherent and respectful manner			X		
I consider my participation to be important and highly relevant, attending the needs of the group					X
My ability of written and oral communication was challenged in this group					X
The tasks were well defined and everyone worked on the assignments received					X
My ability to use new technologies was challenged in this project					X
The necessary knowledge for the development of the project was found in several ways					X
The presentation of the work to teachers and colleagues helped in my learning					X

4. RESULTS AND DISCUSSIONS

The questionnaire answered by the 27 students included basic questions regarding the need for sustainable actions for living and surviving on the planet.

Through the questionnaire, it became evident that, in general, the student did not know the meaning of "Environmental Sustainability" and the functionality of a "Science Fair".

It was important to note the enthusiasm and commitment students to prepare, organize and execute the first Science Fair of the institution, using only simple and reusable materials, with the function of minimizing environmental problems in nature. This activity also included practice, a fundamental element in Significant Learning (AUSUBEL, 1980), in an interdisciplinary way (FAZENDA, 2008).

Figure 1 shows the dedication of the students, preparing the donuts for "Sustainable Dynamics".

Figure 1. Preparation of donuts for "Sustainable Dynamics".



During the development of the dynamics, observed in Figure 1, it was noticeable the adequate and respectful attitude of the students towards the other classes of the institution. The students, directly involved in the work, did not hesitate to explain to their colleagues that the scarcity is generated from the moment when some individuals take possession, accumulate and retain resources without observing and without being responsible for the needs of the group.

These students, with behavioral maturity, explained to their colleagues that each individual is responsible for the living conditions of the group to which he belongs. They added that the individual attitude is reflected in the whole: the greater the centralization of resources, the greater the general scarcity. The greater the awareness of the whole and the importance of sharing, the greater the abundance in distribution and fostered that, using natural resources with the consciousness that all people in the community, animals, plants, the health of water, air and soil depend on personal attitude and this can be called a sustainable attitude.

Figure 2 shows the environment prepared for the execution of the "1st Science Fair" and the expectations of students from the school community.

Figure 2. Expectation of the audience for the beginning of the presentations.

Figure 2 shows the expectations of the students indirectly involved in the work and the organization of the environment, as this was an important moment for everyone.

During the presentations (Figure 3), there is a significant involvement of the students, mainly by bringing playful elements, which were given opportunities within a context more artistic. The children were able to use their creativity to represent different situations, according to the subject worked, along with the teachers' interventions, making the presentation of sustainable experiences.

Figure 3. Presentation of students at 1st Science Fair of the institution.

Using sustainable experiences: wall paint with clay, plastic of milk and potatoes, water purification, soil permeability, milk glue, deodorant and homemade filter, students were able to demonstrate the appropriation of their knowledge on the subject through suggestions designed to solve or minimize problems in the relationship between man and the environment.

This type of presentation, more freely and without strictly traditional elements, was one of the highlights of the work, in view of which allowed an expansion of the imagination of the students involved (directly and indirectly at work). The presentation of the concrete provided an analysis beyond the measurements, with which it was possible to capture the enchantment of those involved.

Still in this context, it was interesting to notice the students' ability to demonstrate to their colleagues, in a protagonist way, what they had built up from learning.

In general, observing the presentations, it was possible to verify that the class developed within the learning process, demonstrating consciousness to control the impact of environmental problems in the coming years.

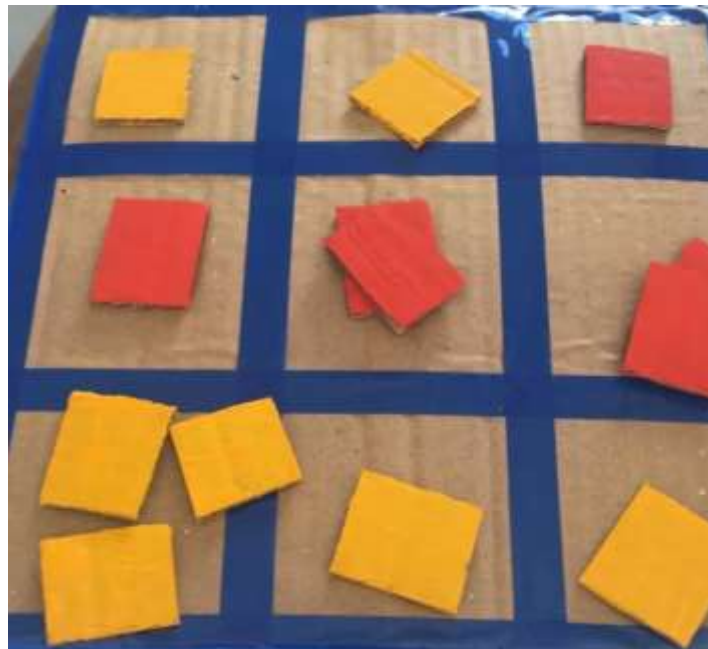
Another conscious practice could be observed in offering playful activities with “Sustainable Games”, such as puzzles (Figure 4) and Tic-tac-toe (Figure 5).

Figure 4. Sustainable Game: Puzzles.



The puzzle game (Figure 4), made with popsicle sticks painted with the rest of fabric paint and the Tic-tac-toe game (Figure 5), made with cardboard box painted with gouache paint and adhesive tapes, were the girls' favorites.

Figure 5. Sustainable Game: Tic-tac-toe.



Another favorable point of the event was the distribution of souvenirs (Figure 6) to students in the school community.

Figure 6. Souvenirs from the “1st Science Fair - Sustainability”.

During the distribution of souvenirs at the event: diary, made with leftover fabric and shoe boxes, as well as cactus seedlings in egg cartons (Figure 6), the students had the opportunity to show a little more about the works that they developed with the help of Portuguese and Art teachers.

Considering the results of the evaluations and relating them to the applied methodology based on Significant Learning and Interdisciplinarity, it is possible to verify the effectiveness of the activities developed and the success in achieving the objectives of this work. In general, this was corroborated in the questions of the test during the work, in which the students demonstrated to have acquired greater apprehension of the knowledge when they are placed in the center of the teaching-learning process.

According to the observations made in the course of the work, it is possible to affirm that the practical activities considered non-traditional, that is, those that distanced themselves more from the usual and everyday models linked to the simple transmission of concepts by the teacher, showed greater commitment from students with regard to their participation. When the practice was more evident, for example in the presentation of experiences, there was clearly greater interest and involvement of the students.

Another factor that should be highlighted positively was the target audience, 5th grade students in elementary school, a good choice for applying the work, as this school level responded satisfactorily to the type of method chosen and to the proposal for consciousness, guidance, education and re-education environment, in a playful and didactic way, favoring the construction of knowledge by students in the protagonist guise.

5. CONCLUSION

Considering all stages of the work and the effective participation of students due to the application of a methodology that allows the centralization of students in the production of their own knowledge, student participation was significantly productive, demonstrating the importance of expanding this type of methodology in classes.

It was possible to notice that during the development of the work, specifically when school subjects are worked in a different format from traditional expository classes, students have a greater participation and involvement in daily activities, which allows them to build their own knowledge.

In this way, the results obtained in this work confirmed the effectiveness of the methodologies adopted, which consequently resulted in the success and the achievement of the proposed objectives.

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Appendix A. Questionnaire to survey previous knowledge.

Student's name: _____	Age: _____
Responsible name: _____	Age: _____
Date: __ / __ / 2019	
<h2 style="color: red; margin: 0;">What I know!</h2>	
1. What is environmental sustainability? Explain.	
<div style="border-bottom: 1px solid black; height: 1.2em; margin-bottom: 2px;"></div> <div style="border-bottom: 1px solid black; height: 1.2em; margin-bottom: 2px;"></div> <div style="border-bottom: 1px solid black; height: 1.2em; margin-bottom: 2px;"></div>	
2. Why should you care about the environment? Argue.	
<div style="border-bottom: 1px solid black; height: 1.2em; margin-bottom: 2px;"></div> <div style="border-bottom: 1px solid black; height: 1.2em; margin-bottom: 2px;"></div> <div style="border-bottom: 1px solid black; height: 1.2em; margin-bottom: 2px;"></div>	
3. Tell me some of your ecologically correct attitudes.	
<div style="border-bottom: 1px solid black; height: 1.2em; margin-bottom: 2px;"></div> <div style="border-bottom: 1px solid black; height: 1.2em; margin-bottom: 2px;"></div> <div style="border-bottom: 1px solid black; height: 1.2em; margin-bottom: 2px;"></div>	
4. What is a "Science Fair" for? Opinion.	
<div style="border-bottom: 1px solid black; height: 1.2em; margin-bottom: 2px;"></div> <div style="border-bottom: 1px solid black; height: 1.2em; margin-bottom: 2px;"></div> <div style="border-bottom: 1px solid black; height: 1.2em; margin-bottom: 2px;"></div>	
5. Have you participated and/or attended a "Science Fair"? Comment.	
<div style="border-bottom: 1px solid black; height: 1.2em; margin-bottom: 2px;"></div> <div style="border-bottom: 1px solid black; height: 1.2em; margin-bottom: 2px;"></div> <div style="border-bottom: 1px solid black; height: 1.2em; margin-bottom: 2px;"></div>	
6. Sustainability serves as an alternative to guarantee the survival of the planet's natural resources, while allowing human beings and societies ecological development solutions. Illustrate what you understand about the term sustainability.	

Appendix B. Report of the extra-class study.

Student's name: _____	Age: _____
Responsible name: _____	Age: _____
Data: __ / __ / 2019	
<h2 style="color: red; margin: 0;">Work Script</h2>	
1. Experiment Title: _____	
2. What did the pair think of this experience? Justify.	
_____ _____ _____	
3. How did the duo develop the proposal? (Observations that were made as the duo structured the experiment.)	
_____ _____ _____	
3. From the experiment, what could you prove?	
_____ _____ _____	
4. Draw the duo's experience.	

TRADEOFF IN THE MANAGEMENT OF THE CULTIVATION SYSTEM IN THE AGRICULTURAL PRODUCTION UNIT OF CHARDONNAY VINIFERA.

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SUMMARY

The study analyzed the variables that interfere in the choice of the soil cultivation system, using conventional and/or biodynamic agricultural practices for the production of Vitis vinifera grapes. The method was an exploratory and descriptive quali-quantitative analysis study. The intentional sample, for convenience and non-probability, included 26 vineyards of Vitis vinifera Chardonnay, 19 of which were conventional vineyards and seven in transition to the cultivation system using biodynamic farming practices. It was concluded that economic variables are the driving force in decision making, rather than environmental or social issues in the management of the cultivation system, as well it has also been noticed that some properties are seeking new cultivation practices. In the case of biodynamic agriculture, however, there is a faint signal that environmental issues may gain greater value in equalizing alternatives for decision-making in vineyard management and especially in soil care.

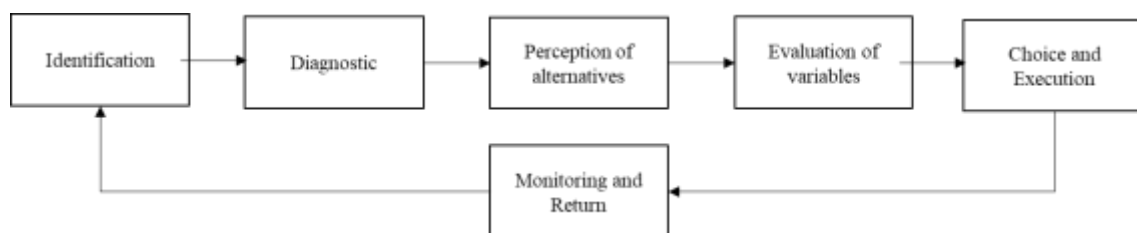
Keywords: Biodynamic; conventional; intuition; cognitive; rationality.

1. INTRODUCTION

The present study consists in analyzing the variables that interfere in the choice of the soil cultivation system using conventional and/or biodynamic agricultural practices for viniferous production. To this end, the data under analysis consisted of two bases, as follows: a) the reports in the interviews, relating them to cognitive biases and errors arising from the limitation of rationality; and b) technical information during the participation in field activities in the vineyards participating in the study. The theoretical framework was based on the Theory of Limited Rationality (SIMON, 1955; 1970; 1991; 1979a); and the Theory of Contingency (CHANDLER, 1962; DONALDSON, 2001).

The identification of the variables that influence the tradeoff in the management of the agricultural production unit is of paramount importance, which is justified by the need for the manager to be able to find mechanisms that allow for a more satisfactory decision making or in line with the objectives proposed for the business. Many times the scenarios show that the objectives proposed are adverse, and the manager needs to make choices that best meet the cost-benefit ratio for his property. These are alternatives to what is known as the classic model of rational decision-making. Cognitive and bias influences can, however, privilege decisions based on intuition which, at that moment, are enough to meet the expected results. In that case, one is in a situation that may be associated with the model based on the theory of contingency (SIMON, 1955; 1991).

Figure 1 - Decision-making process



Source: Adapted from Sobral and Peci (2008).

The process, whatever the reference model, is a sequence of at least six phases or steps (Figure 1), becoming, at the moment the decision result is evaluated, systemic. Phases or steps can be sequential or present internal systems to the process when, for example, a step presents a limitation or inconsistency due to a previous step, and when the alternatives prospected in the next step do not satisfy the decision maker, it would be the case to redo the diagnosis more often and more thoroughly. It is important to raise this alternative of internal subsystems to the complete system, of six stages, because it approaches the way in which the process of organizational decision making takes place, mainly, in the process involving agricultural activity, where the number of intervening variables is, theoretically, infinite. In this scenario, the decision maker needs to choose those variables he considers relevant at that moment and for that situation, dismissing the others so that he can respect the time he has to make that decision.

The difference in the processes lies in the way the information is used. The balance between the information gathered and the choices made by managers is what can guarantee an optimal or sub-optimal outcome of the decision-making process. In parallel, the manager's perceptive, reactive and adaptive skills

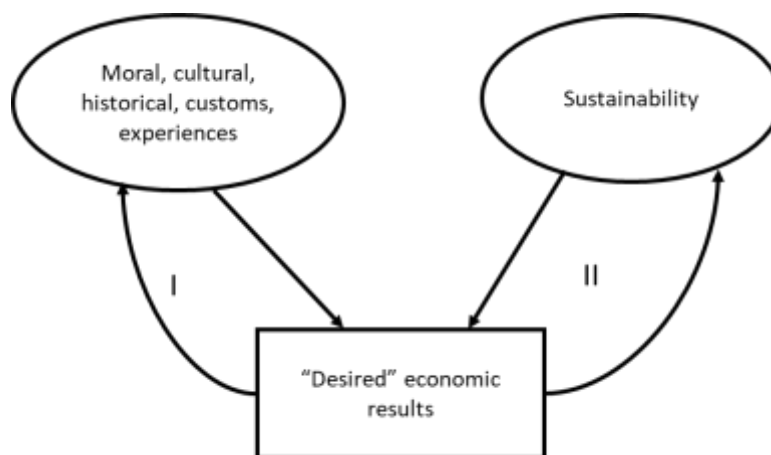
can contribute to the decision-making process when making choices in the management of the agricultural unit, including those related to the management of agricultural land use in vineyards.

The management decision process is influenced by variables that can be classified as internal and external influences on production units. The important thing is to equalize the opportunity cost before the trade off of the internal variables that are the questions: a) what to produce? b) how to produce?, and the external variables that are represented by the questions: a) how much to produce? and b) when to produce? It is observed that the use of sub-optimal choice can be seen as the result of a rational cost/benefit approach to strategy selection (CHRISTENSEN-SZALANSKI, 1980).

Tversky and Kahneman (1974) call attention to human limitations in the decision-making process, because both the emotions before the facts and the lack of knowledge can influence the understanding of the facts. In this case, the search is for a satisfactory solution rather than an optimal one.

The decision should be seen as a set of aspects that can be controlled and others that cannot. These aspects are identified as internal and external variables and serve as indicators for weighing the alternatives to make the choices in driving the soil unit. These aspects compete with each other and some of them end up weighing heavily at the decision-making stage. At the same time, the decision-making process never fails to prospect the possible and likely results related to the choices. This is the step that can be called "result". The process and the prospected result, in turn, influence each other, forming at this level a system that is also flexible and dynamic. These two systems reinforce the personal aspects of the internal decision making of subsystem "I", as well as their convictions as to the internal sustainability of subsystem "II", as can be seen in Figure 2 below.

Figure 2 - Variables involved in the decision-making process



Source: Prepared by the authors (2020).

For Andrade et. al (2007), in certain situations, decision makers may be acting on the basis of restricted information. In addition, they may be conditioned on the ability of the human mind to process, formulate and solve complex problems. A rational and structured decision, in this case, would lead to the use of specific, systematic and directional biases to make choices. It is therefore argued that a satisfactory solution will be adopted with a high frequency.

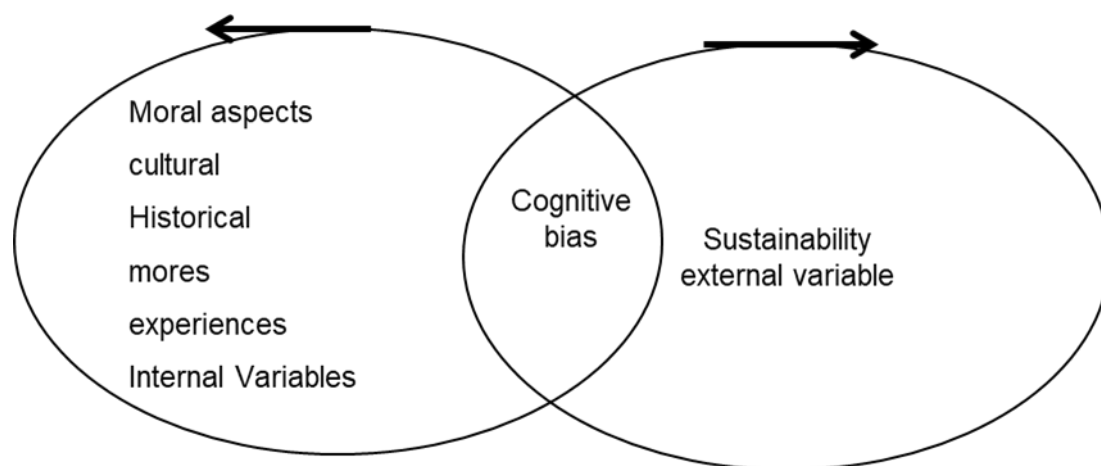
Because of this, the matter in question that underlies this study is: how can the evaluation of the variables interfering in the decision-making process help in the choice of the cultivation system in the agricultural unit? For this, internal and external variables that are part of the opportunity cost will be evaluated, which are present in the equalization of alternatives in the decision-making process of any organization. These, theoretically, are independent of the economic segment or its size. Later on, it was applied to *Vitis vinifera* production units.

2. CONTINGENCY THEORY IN THE CONVERGENCE OF DECISION MAKING

Contingency Theory allows the understanding of organizations in a dynamic environment, requiring an interpretation of the variables external and internal to the system, as they are mutually influenced in the behavior of organizations in the macro environment. For Donaldson (2001), internal and external variables interact dynamically, which makes it difficult to accurately predict the results of choices, making it necessary to measure the risk and the ability to be predisposed to uncertainty. In order to understand the functional relationship between environmental conditions, Contingency Theory seeks to be effective in identifying environmental conditions and administrative practices so that they are always in harmony (DONALDSON, 2001).

The dynamics of the indoor and outdoor environments show that nothing there can be considered absolute, because everything is relative and everything depends. This means that the techniques and the environment provoking influences are not related to cause and effect, but as a system, because regardless of cause or effect the choices are justified by “it all depends” without a methodological sequence. Because in the theory of contingency, everything will depend, including the adaptive or reactive capacity the cognitive biases may have a preponderant influence on the choices of the manager, resulting in new effects and causes that influence the environment that will present adverse or favorable reactions to the objectives and results expected in the decision making.

Figure 3 - Cause effect system in decision making



Source: Own elaboration (2020).

According to Donaldson (1999), the Structural Contingency Theory developed as a puzzle in which the insights of various theorists contributed to its empirical support. Burns and Stalker (1961) analyzed the mechanical and organic external environment, Woodward (1958) approached technology as a contingency factor, Lawrence and Lorsch (1973) studied the relationship between structure and environment, Hage (1965) and Perrow (1967) wrote about technology and structure, and Chandler (1962) analyzed the strategy - structure relationship, providing the background for this theory and offering support from real organizations.

The organizational structure has been continuously adapted to its marketing strategy. In Chandler's perception (1962), the time of decision-making processes in a company's internal environment, as choices of raw materials and production processes, remains relatively invariable, business decisions have less impact on the corporate structure due to greater control of internal environmental variables that are "what to do?", and how to do it.". However, when technology, markets and sources of supply change, which are considered the external variables "when to do?" and "how much to do?", the structure dysfunctions become more evident and strategies end up focusing on the architecture of the organizational structure (CHANDLER, 1962).

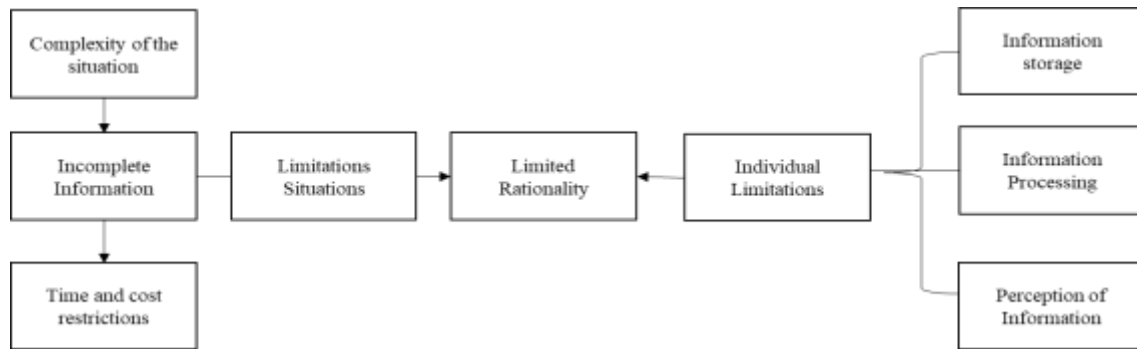
Contingency Theory can help farmers in their relationship with care in the agricultural unit, improving their ability to choose in the face of the uncertainties of the external environment and the exposed risks of the internal environment. Beach and Mitchell (1978) identify the steps that allow a decision maker to be guided, and they are related to the following questions: a) what to do?, and b) how to do it? These questions allow one to look at the internal environment of the property and thus not only assess his strengths and weaknesses, but direct its efforts to achieve the established objectives and purposes as well.

Other questions that allow a perception and quantification and qualification of the variables that are present in the environment outside the organization are: a) how much to do?, and b) when to do? These enquiries allow the potential and threats of the external environment to be analyzed. They show alternatives to market behavior over a given period of time. At the same time, decisions can interfere with the organizational microenvironment and vice versa. For Beach and Mitchell (1978), the categories of opportunity cost variables are based on a strategy to realize the choices in the unit's soil care with the aim of achieving maximum utility in agricultural cultivation systems. Information gathering, as well as costs and benefits provide an attractive framework because it considers task efforts and contingent processing behavior (PAYNE; BRAUNSTEIN; CARROLL, 1978).

Thus, the process that makes the permanent interaction of internal and external aspects opportune is in the four issues of opportunity cost: What to do?, How to do it?, When to do it?, How much to do?, which somehow sustain the interaction of purposes and direct prospects of possible results.

Contingency Theory is very similar to Limited Rationality. The first one uses the "all depends" of "n" variables that, in this case, could result in an "optimal" or sub-optimal" decision. The role of decision can be seen as the result of a rational cost/benefit approach related to strategy selection (CHRISTENSEN-SZALANSKI, 1980). In particular, it assumes the existence of Simon's Limited Rationality (1955) on the part of the decision maker.

Figure 4 - Limited Rationality



Source: Adapted from Sobral and Peci (2008).

A decision process conditioned by Limited Rationality requires choices with a certain degree of certainty, a certain degree of limitation of information, time, cost and cognitive ability as well, which, many times, can cause ruptures in the alignment of objectives and purposes. The individual believes limitations are part of the contingency and, at the same time, from his decision everything will depend on the new actions that are not yet possible to realize.

In this situation, the decision maker is limited to the time and information available in a state of *trade off* where it is possible to rationalize the usefulness of the choice for the desired results. This being said, the Limited Rationality is constituted by: a) situational limitations, which are a function of the complexity of the situation itself and of the set of restrictions; and b) individual limitations, which are a function of the capacity of the decision maker with regard to the perception and processing of information. Thus, decision-makers try to be rational, but they can hardly manage and act with full rationality which is due to factors such as incomplete data and even the inefficiency of technical advice. The decision-maker, in opting for an alternative in the resolution of the issues, abdicates others that could be better, if the knowledge of the variables was greater.

For Schneider (2003), decision making in agriculture results from strategies that occur conditioned by social, cultural, economic and spatial factors. These factors exert constant and variable pressure on the agricultural production unit. Therefore, the decision-making process has a benchmark that, in exercise, materializes through the social, cultural and economic relations constituted between people. Thus, the author ponders that, although they are conscious and theoretically rational strategies, this awareness is mediated by a rationality informed by the reality that is both the expression of the material relations present and those inherited and transmitted culturally.

Therefore, it is feared that the strategies are not causal or teleological, but rather the result of human action in the face of objective contingencies (SCHNEIDER, 2003). The author also points out that among the factors that seek social, economic and cultural reproduction resulting from the relationship between individuals and their families are: a) improvements in housing; b) well-being; c) progress in the production unit; and d) material possibilities of achieving certain objectives. This shows that social reproduction in family agriculture is the result of a set of factors that can be reinforcing or antagonistic that vary over time and have flexible relative weights.

2.1 *TRADE-OFF*, A QUESTION OF LIMITED RATIONALITY OR INTUITION?

The *trade-off*, an equalizing question between present and future results in a decision-making process, can be used to quantify and qualify the alternatives in the choices made in the management of the cultivation system.

Decisions in farm management can be formulated as multi-stage decision making. The process is characterized by a sequence of decisions taken to meet the objectives of the business. The choices are linked to periods of time that divide the decision-making process, and which can be called stages, representing the moments in which decisions are made.

Decision-making is a dynamic process sustained over time (BELLMAN, 1954; MJELDE, 1986; OSMAN, 2010). Each stage requires a choice of alternatives, so, the technical coefficients need to be updated and reassessed for the next choices. In the face of this, there is a behavior of adaptation and reaction of the farmers.

The *trade-off* variables in agricultural land use decisions, for Slovic et al. (2007), affect heuristics, "risk as feelings". According to this theory, intuitions about risky decisions are linked to previous experience by feelings or affective states (e.g. the feeling that if I do not carry out the pest treatment, it can influence the amount of grape produced). In the use of the decision maker's cognition, Kahneman and Tversky (2012) emphasize heuristics and biases in the decision-making process. They are: a) an intuitive and or emotional, rapid response, little effort (System 1); and b) another of "laborious mental activities", "complex calculations", "choice and concentration" (System 2) considered rational.

The Theory of Limited Rationality, on the other hand, has the advantage of "providing satisfactory descriptions of real human behavior" (SIMON, 1979a). With it, it must be considered the factors that influence decision making such as: a) past experiences; b) a variety of cognitive biases; c) an escalation of commitment and unrecoverable outcomes; and d) individual differences, including age, income, beliefs, and local customs. All these factors influence, to different degrees, the decision-making process and the decisions taken. Thus, both intuition and limited rationality participate or can participate in the *trade-off*, forming systems that reinforce themselves simultaneously.

2.2 THE CHOICE OF VARIABLES IN THE DECISION-MAKING PROCESS

For Simon (1970), the selection of information for decision making can be influenced by both the internal and external environment of the organization. The decision maker is often limited by his or her cognitive ability, and the decision-making process is also limited by this ability (SIMON, 1970).

For Juliusson, Karlsson and Garling (2005) past decisions influence the decisions people make in the future. It is expected that when something positive results from a decision, people are more likely to decide in a similar way given a similar situation. On the other hand, people tend to avoid repeating past mistakes (SAGI; FRIEDLAND, 2007). This is significant in that future decisions, taken on the basis of past experience, are not necessarily the best decisions.

For Marques et al. (2019), the influence of information on the decision also depends on the management characteristics of farmers and more specifically on their theoretical models, formal or otherwise. The authors believe that:

"...the decision maker, when making a decision, expects a certain result, or rather: a set of results associated with a set of probabilities and objectives. It is therefore feared that the consequences of a decision, be it 'to do' or 'not to do', can be considered as 'predicted' (MARQUES et. al, 2019).

The decision-making process is complex and requires multiple assessments, with the formulation of variables and biases to parameterize the decision making. This process takes place through decision making models. Models exert considerable influence on decisions, as individuals decide on the basis of specific mental models (PEREIRA; FONSECA, 1997); however, they should not be seen as a recipe to be followed but rather as a tool for understanding complex elements.

When several complicated decisions come together and interact, the variables are difficult to quantify or weigh against each other. Decisions become complex, such as deciding what type of farming practice to adopt for a viniferous system. For this, it is necessary to consider some variables such as: a) type of climate; b) soil; c) grapevine; d) driving system; e) equipment; f) technology; g) available manpower; h) market demand; and others. This involves risks and uncertainties that may be present both in the conventional agricultural system with synthetic and chemical treatments and, in the case of biodynamic agriculture, with its phototherapeutic and non-conventional treatments with the use of a calendar based on astrology that seeks a balance of the forces of nature. The variables are many and extremely difficult to equalize in a simplified way.

A choice about the type of cultivation system that, at the very least, leads to a desired result needs to consider the choices made in conducting grape growing and, at the same time, the expectations of producing wines with identity. It is also desirable to have and consider information on the natural, human and financial resources available and appropriate to the type of vinifer growing system chosen, which would facilitate the management of the production unit, regardless of the type of cultivation system to be used to assess the potential for proper use of natural resources. What the business requires are decisions that, at the very least, meet moral requirements with environmental sustainability and that the economic and social results meet the purposes of the actors involved in the production chain. Choice issues can also be an expression of reaction or just a condition of adaptation of the farmer to the issues of the production chain macro system.

Therefore, the decision making takes place through action in the choices of alternatives that best fit the characteristics of the business and the profile of the manager who brings in his perceptions cultural and social factors, economic desires and concerns with natural resources. With this, it is possible to perceive the need for alignment of the perceptive, reactive and adaptive capacities in a harmonic and dynamic way in the management of *Vitis vinefera* cultivation.

Gasson (1973) shows that the personal characteristics of the producer influence his decision-making process. Brandt (1980), in his studies on agricultural product supply, points out economic, technological, ecological, institutional factors and uncertainties (arising from externalities beyond the farm gate). These factors and the information between them refer to the decision making circumstances of producers, which are often sources of uncertainty (e.g. climate, biological aspects, pests, diseases, etc.), and market conditions.

Uncertainties subject to misalignment in the prediction of results in the agricultural sector, in the decision-making process, such as the accentuated complexity of agrarian systems, have their origin in soil chemistry and physiology as well as the technologies employed. This also reinforces the differentiation of productivity and market performance of farmers (KAUTSKY, 1972). Some strategies may be appropriate to minimize uncertainties when using an adaptive and reactive profile in the face of complexity and uncertainty, as, for example, to seek people to exchange experiences and guidance. Often this person can be the cooperative's technician, the consultant, a neighbor, experiential courses, or technical trips. Seeking help and not someone to transfer his/her responsibilities and penalties for choices can be a desirable behavior for the decision maker.

3. DECISION MAKING IN THE CULTIVATION UNIT MANAGEMENT

Decision-making in the management of the cultivation unit requires experience, knowledge, as well as clarity of objectives. For Choo (1998), the objectives have an impact on priorities, choices and the amount of information about the methods and processes by which tasks are to be accomplished, as well as the objectives that need to be achieved. In other words: decision making is hardly the result of a structured, sequential, solution-oriented process. In this case, Nutt (1986) considers the opinions of people who can intervene in the decision-making process, since their experiences and choices lead to an acceptable decision-making process.

March (1994) considers decision making an objective-oriented and problem-driven act in which the behavior of choice is guided by norms and routines, leading organizations and individuals to act in a procedural and intentionally rational manner.

According to Simon (1965), there are six basic elements to be considered in the decision making process: a) the decision maker: it is the individual who makes a choice among several action alternatives; b) objectives: what the decision maker wishes to achieve with his or her actions; c) preferences: or criteria used to make the choice; d) strategy: the focus of the action that is chosen to achieve the objectives according to the available resources; e) situation: all aspects of the environment in which the decision maker is inserted and directly interfere in his/her choice; and f) result: the immediate effect of a decision strategy. Therefore, there is a systematic or random order, technical or intuitive, which will lead to a final choice.

For Carrieri (1992), rural producers, as agents of a production system, need to be aware of their agricultural reality and understand their real situation in alignment with business objectives. The objectives can be rationally defined as focused on profitability, but indifferent to the choice of the agricultural cultivation system. Many farmers consider agriculture to be a people-based industry with a family history. These characteristics are present in the properties that cultivate vines in the region of Serra do Nordeste, southern Brazil.

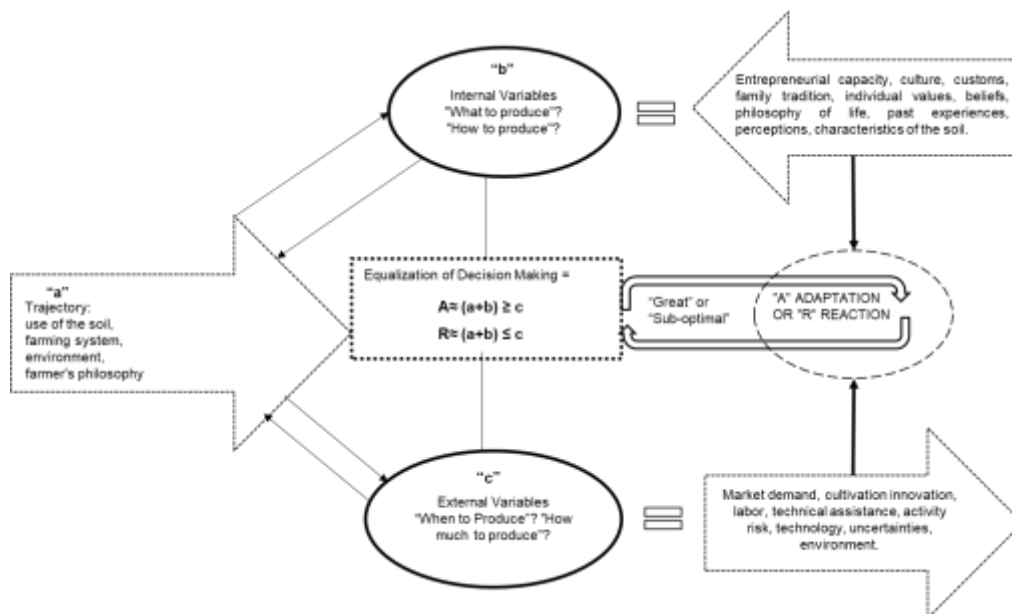
The history of the vineyards is confused with that of the families living there, being more than a simple business with a lucrative purpose. The practice adopted in the execution of agricultural activities in the vineyard portrays very much the relationships of friendships, social coexistence among neighbors, family members, the values and customs of ancestors. Thus, the trajectory of the people who live there connects with the history of each grape harvest. Then, the decision profiles have as a basis of information the global

vision of its environment, which means to be in accordance with the objectives it intends to achieve. So they take action and manage their production system by giving it a logic, which is in line with a rationality of its own and conditioned by a physical, environmental, social, political, and economic environment.

Decision making in this way, can be based on the influence received from social groups, neighbors, relatives. It can be said it is based on beliefs and/or based on "facts" or faith and acquired from various sources, including formal information such as education, experience, colleagues, and cultural environment (e.g. religion, education). This decision-making profile is close to the behavior of wine growers who make use of biodynamic agriculture, since they form a system of interpersonal and collaborative relationships for the elaboration of compounds and nutrients to carry out the care of the crop and the soil on their properties. To do this, the component elements of every decision must be understood.

For Simon (1965, p.53), "... every decision is made up of two types of elements, called elements of fact and elements of value, respectively". In Jones' view (2006), decisions made by farmers are influenced in part by an expectation of financial gain and in part by family and cognitive factors. In this case, Ocaña, Vecino and Avilés (1998) emphasize that the farmer, as a decision maker, is the result of a profile that is defined by the junction of socioeconomic factors (age, income, schooling, information, associative, management time, the succession process and others) and psychosocial factors (values, customs, religiosity, beliefs).

Figure 5 - The variables in a decision-making context



Source: Authors (2020).

The decision making context is one in which the farmer tries to equalize the variables in order to find a more relevant and satisfactory solution in a given time and which represents a great opportunity for the expected results of his vine growing system, such as: the relation with "what" to plant. This choice is often limited to crops that have been proven to produce good yields in the region or that ensure their subsistence under soil-based climatic conditions. Alternatives can also be defined in "how to", being a reference to the infrastructure of the property. According to MANDELLI (2003), the cultivation of the

grapevine goes through several stages from sprouting, pruning, phytosanitary treatments, flowering, and ripening of the grapes, which allows the organization of field work.

The decision-maker also considers situations of externalities that depend on the market behavior at a given moment that are "when to plant", which indicates the most appropriate period for the planting or increase in the cultivation of a certain vine which is classified as a perennial plant, but requiring attention to the climatic conditions in the regions of production, as well as the question of "how much", which becomes a guideline for the amount of area to be dedicated to the cultivation of vines. If the ideal is the quantity of kilos of grapes or the degree of sugar or slime in the vineyard that will be responsible for the added value that will indicate the expected financial result at the time of the decision-maker in the management of the land use of the vineyard.

The farmer, in many cases, is able to develop the adaptive capacity to cope with the high levels of uncertainty and risk offered by the environment, elements that, in most cases, are not controllable by farmers. These and other factors can be internal and/or external to the property, which is an open system (DUTRA; MACHADO; RATHMANN, 2008). Farmers need to know that a defective decision is as damaging to a vineyard as a contaminated vine graft and/or a type of vine that is not adaptable to the type of soil.

In the case of the use of intuition for decision making, the individual adopts conceptual representations and the use of logic that makes sense to a context, but with processes similar to perception, giving speed, little effort and even the ability of the individual to devote himself to multiple tasks while using this system. When this individual uses rationality (SIMON, 1955), the process is slower and demands more effort. This is where criticism happens, for example, since his/her ability to identify logics in different contexts makes him/her capable of doubt, which is nothing more than the ability to think two or more alternatives of divergent choices, which does not happen at times when the individual uses intuition (KAHNEMAN, 2003).

4. MATERIAL AND METHODS

As for typology, the research can be considered an exploratory and descriptive quali-quantitative analysis study. For Gil (2008), the main objective of the exploratory research is to develop, clarify, and modify concepts and ideas. The sample was intentional for convenience and not probabilistic. This type of data collection of a sample is used in exploratory and descriptive studies (FONSECA, 2002).

The steps of this study were: a) bibliographic data collection; and b) data collection to analyze the choices in view of the criteria of weighting the opportunity costs in the inquiries for the choice of the conventional or biodynamic cultivation system regarding the care and treatment of the soil and with the vine in the vineyard. The criterion for the choice of the sample was the willingness of producers of *Vitis vinifera Chardonnay* to participate. Obeying this delimitation, 19 vineyards were found in the conventional cultivation system and 07 in transition to the cultivation system using biodynamic agriculture practices, totaling 26 vineyards.

The interviews were conducted individually, with visits to winegrowers on their properties from 6 to 28 June 2018. With this, it was possible to make a direct and extensive observation. The questionnaire

used was structured, formed by questions that help in the equalization of *trade off*, such as inquiries about the opportunity cost. This collection tool was adapted from the validated study in Dalcin (2010).

The data treatment was performed using the *Statistical Package for the Social Sciences* 18 (SPSS) with correlation tests for analysis of the data obtained from the collection of interviews performed on the properties of conventional and biodynamic viticulture systems.

5. ANALYSIS AND DISCUSSION

According to the rational decision-making model, individuals decide in a mechanistic manner, delimited by a guiding objective which, in commercial and productive organizations, is profit. This objective also serves as a thermometer to signal the vitality of the business. However, in every type of enterprise, especially in the agricultural sector, decisions based solely on this factor do not guarantee the longevity of the natural resources that are necessary inputs to actually promote profit.

Thus, most managers now consider other variables in the decision-making process, such as the ability to intuit as well as to know that their choices "depend" on contingency situations that lead to the expected results. According to Schneider (2003), rural producers are conditioned by social, cultural, economic and spatial factors that put pressure on their production units. Inherited expressions such as fears and care in their choices in the conduct of farming, for example, are present.

With the results of the research carried out in the field, it was possible to perceive the mechanistic way in the behavior of the grape growers, both those who still make use of the conventional system of treatment of their vines and those who opted for a non-conventional system of soil care. The results gathered from the interviews and direct observations made show that the use of biodynamic farming practices is still incipient. It can be said that those who are migrating to this system of cultivation practices are in a process of adjustment in every way. These adjustments can be perceived from the conduction of soil care, as well as in the transformation of the wine growers' behavior in the approach to the philosophy behind biodynamic agriculture, which is anthroposophy.

It is noticeable that, until now, in the vineyards that have migrated to the practice of biodynamic agriculture in the production of *Vitis vinifera Chardonnay*, there has been "an adjustment of agricultural cultivation techniques". This means a concern for the balance of the ecosystem, fertility and good soil quality. It was possible to perceive the concern of the production units' managers to make use of less aggressive techniques and treatments to the environment, mainly in soil treatments.

Table 1 - Tradeoff of winegrowers in weighting the Cost of Production Opportunity

		Correlations					
		QtoP_Ambiental-Recursos_Naturais	QtoP_Econômico-Recursos_Financeiros	QtoP_Social-Recursos_Humanos	QdoP_Ambiental-Recursos_Naturais	QdoP_Econômico-Recursos_Financeiros	QdoP_Social-Recursos_Humanos
OQP_Ambiental-Recursos_Naturais	Pearson Correlation	-,106	-,170	,039	-,067	-,446*	-,077
	Sig. (2-tailed)	,606	,407	,851	,746	,022	,710
	N	26	26	26	26	26	26
OQP_Econômico-Recursos_Financeiros	Pearson Correlation	,223	,352	-,332	,117	,000	,308
	Sig. (2-tailed)	,275	,078	,098	,571	1,000	,125
	N	26	26	26	26	26	26
OQP_Social-Recursos_Humanos	Pearson Correlation	-,234	,084	-,229	-,220	-,506**	,113
	Sig. (2-tailed)	,250	,683	,261	,279	,008	,583
	N	26	26	26	26	26	26
CP_Ambiental-Recursos_Naturais	Pearson Correlation	,437*	,155	-,184	,048	-,147	,295
	Sig. (2-tailed)	,026	,450	,369	,816	,473	,143
	N	26	26	26	26	26	26
CP_Econômico-Recursos_Financeiros	Pearson Correlation	,050	-,028	-,086	,047	,502**	,054
	Sig. (2-tailed)	,809	,890	,675	,820	,009	,793
	N	26	26	26	26	26	26
CP_Social-Recursos_Humanos	Pearson Correlation	,090	-,328	,303	,028	,302	,032
	Sig. (2-tailed)	,663	,102	,132	,891	,134	,875
	N	26	26	26	26	26	26

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Research Data (2020).

As it is observed in the data of Table 1 for the correlation of the Economic variable in the item “financial resources” in relation to "how to produce" for "when to produce", the result was a moderate correlation of $R^2 = 0.502$, positive perfect. This means that the decision maker concentrates on evaluating the economic variables at 50.2%, and reserves 49.8% for the other variables. The other variables are related to Environmental and Social issues. Thus, for a given time and type of farming, the decision maker's concerns are balanced in assessing the opportunities to make the choice of farming system.

As for the equalization of the manager in "how to produce", $R^2 = 0.437$ was found, perfect positive. The variables constituting the Environmental-natural resources issues is 43.7%, correlated with the variable "how much to produce", also the relevance is for the Environmental issue, being one of the important factors to consider when deciding how to reach the amount of kilograms of vinifers.

The opportunity cost variable of "what to produce", Environmental and Social factor, in relation to the variable "when to produce", Economic issues presented a negative correlation with $R^2 = -.446$, and $R^2 = -.506$, variables implying the social issues. Biodynamic vineyards are formed by young vines, because the soil needs to undergo a detoxification process with biodynamic treatments (IBD CERTIFICATIONS, 2019) to receive a crop according to the guidelines of biodynamic agriculture. What has also been noticed is that some winegrowers of conventional systems have migrated to the use of biodynamic treatment. In this system of cultivation, in some cases, a reduction of the planted area may occur, as this system requires greater care and involvement of the human being, which implies more work force as well as an area with fewer vineyards per hectare. As consequence, there was a reduction in production volume in

kilograms of grapes from conventional to biodynamic. On the other hand, the latter may, in theory, achieve greater added value, on the market, as well as better quality in the characteristics of the fruit.

According to the winegrowers of the biodynamic cultivation system, "it is a question of changing the way of thinking and seeking better quality fruit" (statement of the vineyard manager SCBD 004), and for the vineyard manager SCBD 005, "... by producing grapes with biodynamic practices and preserving the soil pattern, biodiversity, and human health is not a unanimous reality yet, but with the intention to improve".

Decision-making, regardless of the cultivation system adopted in the agricultural unit, presents risks and may also arouse uncertainty, due to some shortcomings in the decision-making process, such as the lack of reliable information and adequate tools that allow a correct evaluation of available resources and adequate technical guidance; add to this the limitations of cognitive capacity, inherent to human beings, and what is obtained will be a suboptimal choice for the moment (Limited Rationality). At the same time, intuitive ability can also lead to choices converging on a pessimistic or very optimistic scenario that happens because of past experiences or beliefs or cultural imperatives. In this scenario, the choice is also only satisfactory.

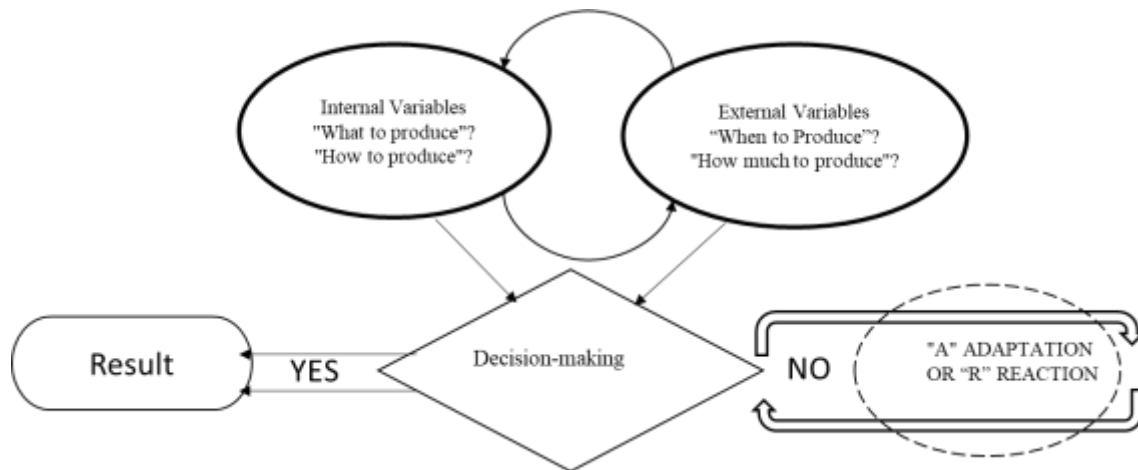
The profile of the decisions shown in the study is related to the characteristics of the vineyard model. Thus, for example, as to the size of the cultivated areas, it is stated that the planting area is on average one hectare, many of which are family-owned, and present a strong appreciation of beliefs, guidance received from their predecessors and sharing of experiences with neighbors, technicians and suppliers, being considered of significant value in establishing the criteria for decision-making.

Deciding, when faced with complex situations in the management of the vineyard unit, requires the winegrower to innovate, including in the way he acts. There must be a detachment from beliefs and habits that do not contribute to the desired results, and focus on process innovation, as well as commitment to issues where it is necessary to follow procedures requiring planning for long-term results and denoting many uncertainties and learning in the face of the new. In this sense, to enable the improvement of the management process, the need for adequate technical tools, information, monitoring, and learning is perceived.

Decision making is at the root of any organizational process. It is important to develop effective skills and strategies that enable problem to be solved, cost-benefit assessment, and an examination of possible choices (WESTER et al., 2008). The decision-making process can be complicated and "overwhelming". As a result, the model that was perceived in the decisions, both daily and long-term, of the sampled winegrowers, has two sets of variables: internal and external.

The internal variables answer the questions: "what to produce" and "how to produce"; the external variables, "when to produce" and "how much to produce". These issues are often interinfluenced and not clearly defined for decision making, as they are strongly influenced by different external actors, or by local culture, or family values. A third process perceived in the interviews was the systematic relationship between what is being called here internal and external variables. Decision-making can be represented by alternatives of producing or not producing, and rethinking the investment (adaptation or reaction).

Figure 6 - Model of decision making of the cultivation system in agricultural production



Source: Prepared by the authors (2020).

The decision-making process can be facilitated by three decision support routines in order to arrive at a satisfactory alternative: a) control routine; b) communication; and c) policies (CHOO, 1998). Corroborating, Daft (2008) includes the subjective variables of the intuitive field such as experience and common sense, because intuition is not despotic or irrational; it is based on years of practice and direct experience, speeding up the decision-making process.

March and Simon (1975) make it clear that most decisions, whether of an individual or organizational nature, involve the discovery and selection of satisfactory alternatives. Choo (1998) explains that, for the most part, these alternatives are motivated by the occurrence of a problem, oriented to the symptoms or to an old solution and conjecture: the training, the experience and the objectives of the decision participants.

Decision makers in the agricultural unit seek to be rational through their individual behaviors; however, because it is a complex process, they are subject to limitations, often of information and training. In this dimension, the farmer needs knowledge and agility in the search for competitiveness and even survival. In agricultural production, the complexity of the processes is accentuated due to the particularities of the activity, such as the influence of climatic variations, soil type, management and care of the crop. It was possible to realize in the interviews that all these elements are present in the decision questions, although with different weights and a little disarticulated.

Finally, the analysis of the results shows that decision making required management of a flow of information that would lead to a result that was not only satisfactory for a certain period of time, but a choice that would lead to the sustainability of the business. It needs to be a choice that generates reliability and allows the farmer to have an adaptation reaction or to react to an internal or external context. Their choices, in parallel, need to be in line with the longevity of the use of natural resources. Their decisions need to be consistent with maintaining the good quality and fertility of the soil in their vineyards.

Choosing a conventional and/or biodynamic farming system goes beyond the capacity of a rational or intuitive choice. It is a choice that "all depends" (in line with the Contingency Theory). In this specific case, knowing the physical and chemical characteristics of the soil allows the use of a technical tool that will assist in decisions on planting vines, the analysis report allows one to know the soil profile and its

nutrients, and thus the type of crop that best fits, such as what, how, how much and when it should be cultivated in a given territory and season, which can greatly assist the decision in the choice of treatment management and vineyard management system as well as indicate regions with soil profile, climate and natural conditions that best adapt to certain agricultural cultivation systems.

With the results found, it was noticeable that the winegrowers do not have a knowledge or do not take into account the compatibility of the characteristics of the soil and the type of culture that will be introduced in the place, but the economic result that has equivalent weight to the sum of all other variables that are part of the complex decision process, and, often, today's decisions can lead to unsatisfactory long-term results and even environmental and human health consequences, due to the choice of soil care and highly intensive fertilizer treatment systems.

6. FINAL CONSIDERATIONS

Information is the limiting factor in decision making. Transparency and speed of data flow contribute to improving the efficiency of all components involved in the process, resulting in better management and consequently efficient use of productive resources. Faced with the challenges of *trade-off*, the decision-maker needs to access and appropriate the tools and techniques that guarantee him/her to achieve or approach the desired results for that moment, given the conditions that present themselves in the context.

The relevance of valuing choice must also be intrinsically linked to the cognitive capacity of the decision-maker. With this, the influences absorbed in a trajectory of activities and coexistence in the environment are present, which may be to equalize the decision making with more or less emotional or intuitive content due to experiences in previous facts.

The time factor and environmental conditions for decision making are part of a dynamic and complex context that is not always considered to assess the ability to choose an optimal or sub-optimal decision. The overall knowledge of the problem and the individual's ability must be related to the objectives of the business and aligned with his/her purposes. It means that his/her capacity for rationality acquires a wider range of perception, which facilitates access to alternatives that guarantee, at a minimum, choices that keep the objectives aligned with the expected results.

Growers who work with *Chardonnay* vinifera mostly decide with restricted information and often do not meet the needs of the business or family. It was verified that the choice for an alternative cultivation system, with management and use of alternative techniques, in most of the properties participating in the research, was, in the first place, due to the economic factor and, in the sequence, come the environmental concerns, represented by the care with the soil. This is due to the sequels the soil in the region shows in technical reports of quality analysis and soil profile, such as the high levels of: a) copper due to treatments with "Bordeaux mixture"; and b) other chemical additives influencing the vegetative process of the vines (MARQUES et al, 2020).

Therefore, Guerra et al. (2003) indicate that soil properties influence mineral elements, organic acids, phenolic compounds, and aromas, which are factors closely linked to the characteristics of the grapes

grown in each soil of a region, leading to changes in the sensory and chemical properties of the wine, interfering in the result of a good "*terroir*".

According to the vineyard manager SBD002, the difficulties encountered and the concerns to adapt in a less conventional cultivation system "are due to the climatic conditions and soil profile of the wine-growing regions in the Serra Gaúcha region, which present many variations that do not always favor the cultivation of *Vitis vinifera*". Even so, the reduction of the use of chemical treatments in the vineyards has been occurring gradually in the properties participating in the study, until it is possible to carry out all the care and treatments of the cultivation with the techniques of biodynamic agriculture. On the other hand, conventional vineyards are still heavily dependent on the use of pest control chemicals and cleaning between grapevine lines.

The pertinent question was to analyze the variables interfering in the choice of the soil cultivation system, using conventional and/or biodynamic agricultural practices for viniferous production. The results showed that decisions are influenced by the economic variables, in this case, demand and value paid by the market or financial profitability. Thus, the valuation of economic issues is the driving force in decision making, rather than environmental or social issues in the management of the vineyard system independently of the system, that is, conventional or biodynamic.

The tendency of some properties is the search for new cultivation practices, in the case of biodynamic agriculture; however, it signals, in a still tenuous way, that environmental issues may gain more weight in the equalization of alternatives for decision making and, mainly, the concern with climatic conditions and the adequate use of the soil.

It should be noted that the study has its limitations in analyzing only some of the variables that imply the *tradeoff* of opportunity costs, making it impossible to analyze more variables that may be interfering in decision-making in vineyard management. Another limiting factor is the lack of a database with the technical information of the properties and treatments and care with the soil, which occurs with the two systems of grapevine cultivation, also including the winegrowers linked to the local cooperative.

Finally, biodynamic agriculture is still a subject that needs to be studied, tested the treatments, even if its use had begun in the 20th century (1924), by Steiner (1861-1925), and, even today, it requires studies and scientific deepening, because its application is based more on facts, accounts and based on beliefs, customs and philosophy than on scientific evidence and techniques recognized and validated, requiring care as well as signaling possibilities for studies and research.

For future work, it is suggested to carry out a comparison of decision making in the cultivation and soil care system in vineyards in the south of the country with the other Brazilian wine-producing states in order to validate the variables that interfere in the manager's choices.

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EVALUATION OF THE EFFECTS OF FLUORIDE AND ASSOCIATED WITH LEAD IN ANIMAL MODEL AND PHYSICAL-CHEMICAL ANALYSIS OF PUBLIC SUPPLY WATER AND OF THE SINOS RIVER IN THE SOUTH OF BRAZIL

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ABSTRACT

Fluoride related to caries prevention is at the center of a scientific controversy. Studies show that fluoride causes damage to health and the environment, as well as reducing IQ in children. The fluoridation of drinking water, mandatory in Brazil, has repercussions over the whole society. One of our objectives was to know the concentrations of fluoride (F) and toxic metals of Sinos River, treated water and final consumers of the cities of Campo Bom (CB), Novo Hamburgo (NH) and São Leopoldo (SL), as well as the groundwater from Ivoti, located in southern Brazil. We also evaluated in rats the effects of F and, in association with lead (Pb), on thyroid hormones and the Total Antioxidant Capacity (TAC). Three groups of rats were exposed to different waters: G1-Control with distilled water (DW); G2-DW with 25ppm (F); G3-DW with 25ppm (F) + 30 ppm (Pb). The Sinos River has an average concentration of 0.0735 mg.L⁻¹ of F. But the F of both the water treated by the ETA of SL as well as in the final consumers of SL had concentrations above 0.9 mg.L⁻¹ (State Ordinance No. 10/1999). In addition, we verified the presence of Pb and Cr (VI) in all types of water. The results with the animals showed a significant difference in T3 (p=0.032) and in T4 (p=0.043) from G3 to G1. In TAC, the difference was significant from G2 to G1 and G3 (p=0.007), showing that F and F with Pb interfere with the endocrine and antioxidant functions of rats. In addition, the fact that there are water fluoridation failures shows that the population is exposed to health risks. We confirm that drinking water fluoridation needs to be demystified and reconsidered as a public health intervention.

Keywords: Fluoride, Water Fluoridation, Lead, Toxic Metals, Thyroid, Antioxidant Capacity.

1. Introduction

The fluoridation of water has been considered essentially positive by society. However, fluoride and other emerging pollutants like toxic metals that are being intensified by human action, are a global concern in conflict with the provision of safe water to the population (UNESCO 2009; WHO 2016) giving rise to a more rational analysis of the benefits and costs of drinking water fluoridation (Mullenix 2014; Peckham and Awofeso 2014; Ko and Thiessen 2015; Hirzy et al. 2016).

Fluoride (F) is an halogen and a highly reactive element (Jasinski 2016). The phosphate industry is the basis for the manufacture of fertilizers, aluminum extraction and phosphorous (Denzinger et al. 1979), which is a process that generates, among other pollutants, an immense amount of toxic fluoride residues (Schmidt et al. 1995; Loureiro et al. 2008) that are converted into by-products for disposal or commercialization for use in water fluoridation (Glasser 1998; Bryson 2004). Environmental tragedies triggered the study of fluoride toxicity (Roholm 1937; 1937a). The recommendation of the World Health Organization (WHO) is a maximum fluoride value of 1.5mg.L^{-1} (ppm) in drinking water (Fawell et al. 2006). The maximum contaminant level (MCL) and its target (MCLG) for fluoride in drinking water is 4mg.L^{-1} (or ppm), but experts suggest that if there is evidence of a chemical causing cancer the MCLG is set at zero as is for lead (Thiessen 2013). According Spittle (2014) the only safe level of fluoride in drinking water is zero.

The impacts of fluoride on health and its interference with the metabolism have been the subject of extensive investigations related to reduced thyroid function, oxidative stress, early aging, osteosarcoma, as well as a higher incidence of bone ruptures, arthritis, mutagenicity and other pathogenic effects (Waldbott 1980; Yiamouyiannis 1983; Shivarajashankara et al. 2002; Bassin et al. 2006; Ozsvath 2008; Kharb et al. 2012; Ravula et al. 2012; Pain 2017; PHE 2018). Dental fluorosis is chronic fluoride toxicity (Denbesten and Li 2012) and is already a public health problem in several countries such as in USA (Lewis and Banting 1994), India (Susheela et al. 2005; Reddy 2009) and in Brazil (Cangussu et al. 2002; Domingos 2009; Komati and Figueiredo 2013).

Fluoride is a neurotoxic element (Grandjean and Landrigan 2014). It is cumulative in the pineal gland (Mullenix et al. 1995; Luke 2001) and causes adverse effects on neurotransmitters, impairs mental functions and reduces children's intelligence (Trivedi et al. 2007; Valdez-Jiménez et al. 2011; Choi et al. 2012; Saxena et al. 2012; Vandenberg et al. 2012; Peckham et al. 2015, Bashash et al. 2018). Studies associating fluoride with IQ reduction in children (Rocha-Amador et al. 2007; Tang et al. 2008; Hirzy et al. 2016; Bashash et al. 2017) show that they are among the minorities most vulnerable to fluoride and lead damage and neurotoxicity, as well as athletes, diabetics, and the kidney deficient (Marcus 1986; White 2004; Wimalawansa 2016; Wasana et al. 2017). These effects are aggravated in the presence of lead which fluoridation may intensify with corrosion in the pipes (Masters et al. 2000; Coplan et al. 2007; Maas et al. 2007; Hirzy et al. 2014).

Fluoride is considered an endocrine disruptor (Waissmann 2002; NRC 2006; Vandenberg et al. 2012; Jaishankar et al. 2014; Pain 2017). Its toxic effects significantly impact antioxidant defense systems (Rzeuski et al. 1998; Ruiz-Payan 2006; Shivarajashankara et al. 2002; Shivarajashankara and Shivashankara 2012). Combined with other metals such as lead, fluoride increases the production of free radicals in the brain (Chinoy and Shah 2004) and its synergistic effects on humans is a critical factor for public health (Stackelberg et al. 2015; Wasana et al. 2017).

The fact is that rates of dental cavities have declined in most of the developed nations in the last 40 years due to the increase of fluoride intake through food and toothpaste (Yiamouyiannis 1990; Colquhoun 1993; Levy et al. 2003; Jones et al. 2004; Fagin 2008) making it difficult to determine the amount consumed (Heller et al. 1997; Jha et al. 2011), thus requiring a review of fluoridation parameters (Levy and Guha-Chowdhury 1999; Levy et al. 2003; Connett et al. 2010; Peckham and Awofeso 2014). Relevant discovery

was that the beneficial effect of fluoride is topic (Warren; Levy 2003; Fagin 2008; Buzalaf et al. 2011; Peckham and Awofeso 2014).

In view of the relevance of this theme to the whole society, we evaluated in animal model the effects of water with fluoride and synergisms of fluoride with lead on thyroid hormones and on total antioxidant capacity (TAC). We also analyzed the physico-chemical parameters, including the fluoride and toxic metals of the Sinos River, of treated water and of end-user water, as well as the groundwater of cities in the Sinos Valley region in southern Brazil.

2. Materials and methods

2.1. Identification of the study area

The Sinos Valley region is located in the state of Rio Grande do Sul, Brazil, which includes the cities of Campo Bom (CB), Novo Hamburgo (NH) and São Leopoldo (SL) that capture the water of the Sinos River for the public supply and Ivoti, which uses groundwater. The Sinos River is the source of raw water for approximately 1.2 million inhabitants, covering 32 municipalities with an area of 3,820 km² in its route about 190 km (FEPAM 2017). The Sinos River is heavily impacted by domestic and industrial sewage, mainly in the region of Novo Hamburgo due to the leather-footwear industries located in the area (Scalon et al. 2010).

2.2. Collection and analysis of water

2.2.1. Raw and treated water from Sinos River

The raw water of the Sinos River is the source for the abstraction of water from the cities of CB, NH and SL for the proper treatment and distribution by the ETAs to the population. The catchment points are shown in Figure 1, at the coordinates 29°41'28.3"S 51°02'35.6"W (CB); 29°43'54.7"S 51°05'01.9"W (NH); 29°45'37.6"S 51°08'08.6"W (SL). The collections of both raw and treated water, ready for distribution, were carried out in the respective ETAs. The three sites were sampled at two distinct time points covering one sampling in the winter and one sampling in the summer, with the first collection being performed on the winter morning on 21/08/2017 (9 a.m. at 9°C) and the second on the summer morning of 10/01/2018 (9 a.m. at 25°C).

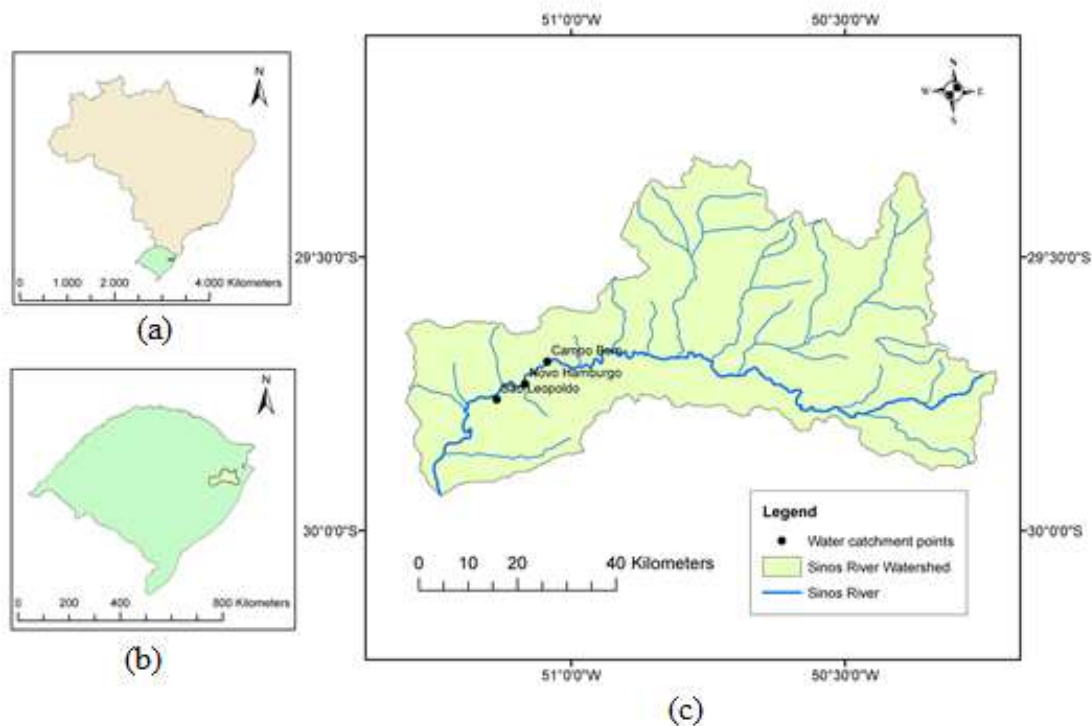


Fig. 1. (a) Map of Brazil with the State of Rio Grande do Sul (RS) in green. (b) Map of the RS state with the region of the Sinos River Basin in yellow. (c) Map of the Sinos River Watershed with the identification of the three water catchment points (Campo Bom, Novo Hamburgo and São Leopoldo).

The three concessionaires that collect water from the Sinos River in the cities of CB, NH and SL follow the Brazilian legislation of the Ministry of Health (BRASIL 2011), Ordinance No. 5/2017, which regulates the drinking water standard for human consumption. Specifically for fluoride ion concentration in the State of Rio Grande do Sul, they follow the Ordinance No. 10/1999 of the Department of Health, which defines levels of fluoride ion concentration in water for human consumption. In the municipality of CB the concessionaire captures the raw water of the Sinos River that supplies the cities of Campo Bom, Estância Velha, Portão and Sapiranga, covering a population of 224,149 inhabitants (COREDE 2015). The treatment of the water carried out in the CB ETA follows the conventional model. It uses aluminum sulfate coagulant, chlorine disinfectant and fluosilicic acid for fluoridation. The municipality of NH has a population of 244,007 inhabitants (COREDE 2015). The NH ETA uses as the main coagulant/flocculant agent a product called aluminum polychloride and as an extra coagulant/flocculant an organic product based on tannin and chlorine-based products as a disinfecting agent. To fluoride the water, it uses flu silicic acid and sodium fluosilicate. The municipality of SL has 226,546 inhabitants (COREDE 2015) and the concessionaire responsible for the distribution of SL drinking water captures the raw water of the Sinos River in the two treatment units, using sodium hypochlorite in the disinfection process and fluosilicic acid for fluoridation.

2.2.2. Ivoti Groundwater

Ivoti groundwater was collected in three artesian wells, from the well SB3 on 21/08/2017, and from SB15 and SB50 on 10/01/2018. Water from the Ivoti wells was collected after treatment with sodium hypochlorite only at the site of collection and before being distributed to the population. For this reason, it

was considered as treated water in the statistical analysis of the results. The municipality responsible for capturing and distributing water to the population of Ivoti follows Brazilian legislation relevant to drinking water (BRASIL 2011), but does not artificially fluorinate the water.

2.2.3. End-user water

Three collections of water samples were made from end-users on 11/05/2017, 08/21/2017 and 10/01/2018, from 2 sites (1 Hospital and 1 School) in each of the cities (CB/NH/SL). There were 18 end-user water samples in total.

2.3. Physical-chemical parameters analyzed

The physico-chemical parameters of the analyzed waters were fluoride, lead, total chromium, hexavalent chromium, iron, manganese, mercury, nickel, nitrates, nitrites, sodium, zinc, pH, total solids and turbidity. All analyzes to determine the physicochemical parameters in the water samples were performed by the Laboratory of the Analytical Center of the Feevale University, according to the Standard Methods for the Examination of Water and Wastewater of the American Public Health Association (APHA) of 2017.

2.4. Animal model

Fifteen (15) male Wistar rats were used from the Feevale University Animal Hospital, with approximately 40 days and mean weight of 163 g. They were exposed to a light/dark cycle of 12 hours, in an air-conditioned environment ($22 \pm 1^\circ\text{C}$ and $50 \pm 10\%$ RH), with standard feed of industrialized ration and water *ad libitum*. All the cages had regular exchanges of the drinkers, being then measured the amount of water ingested by cage. The fifteen rats were randomly divided into three groups of five rats for 45 days of treatment, distributed as follows: Group 1 (G1) Control, composed of 5 rats, supplied with distilled water; Group 2 (G2) Fluoride, composed of 5 rats exposed to water with 25 mg.L⁻¹ of fluoride (fluosilicic acid [H₂SiF₆]), Group 3 (G3) Fluoride + Lead, composed of 5 rats exposed to water with 25 mg.L⁻¹ of fluoride (fluosilicic acid [H₂SiF₆]) added to 30 mg.L⁻¹ of lead acetate [Pb(C₂H₃O₂)₂] (Sawan et al. 2010; Fioresi 2011). The concentration of 25 mg.L⁻¹ of fluoride was adopted by reproducing in rats the same effects as 2 mg.L⁻¹ of fluoride detected in human plasma (Sawan et al. 2010), and it's near the concentration we found in final consumers water. As the distilled water together with the used agents was slightly acidic, the pH of the water was adjusted to around 7. The water ingested in each group was changed and measured at intervals of 2 to 3 days and the weight of the animals was recorded once a week. Minutes before the examination, the rats were anesthetized by the use of inhalant pharmacological agents (Isoflurane) (Paiva et al. 2005). The rats were then decapitated, blood was collected and aliquoted into metal free tubes, stored in the refrigerator until analysis for quantification of serum levels of TSH, T3 and T4 and TAC. The protocol for the use of animals in this experiment was approved by the Animal Use Ethics Committee (CEUA) of the Feevale University under the number 02.17.061.

2.4.1. Biochemical analyzes of serum levels of T3, T4 and TAC

The serum levels of thyroid hormones T3 and T4 total and free in the blood of the rats were determined by the immunoassay test in the chemiluminescent equipment (ECiQ VITROS). The biochemical analyzes were performed by the Biomedicine Laboratory of Feevale.

For the determination of TAC in the blood of the rats, the FRAP (Ferric Reducing Antioxidant Power) method was used according to Benzie and Strain (1996; 1999) characterized by the reduction of

iron (Fe^{3+} in Fe^{2+}) based on the electron transfer reaction of the phenols. The analyzes were carried out at the Pharmacy Laboratory of the University of Feevale.

2.5. Statistical analysis

Statistical analysis of the data was performed using the Statistical Package for Social Sciences v.24.0 (SPSS) software. For the water analysis the values obtained did not present a normal distribution and were analyzed by the Kolmogorov-Smirnov test. The Kruskal-Wallis non-parametric test was used for the analysis of medians, means and standard deviation, and correlations between data for when the p value was significant ($p < 0.05$). The Kruskal-Wallis non-parametric test followed by Dunnett was used for the analysis of the hormones. For the statistical analysis of the weight of the rats ANOVA was used, followed by Tuckey.

3. Results and discussion

3.1. Analysis of raw water from the Sinos River, treated water, groundwater and end-user water

The statistical analysis of the results of the physical-chemical parameters of the water samples does not present normal distribution (Kolmogorov-Smirnov test). The data of all types of water analyzed are shown by type of water: raw water; treated water (including groundwater); end-user water from the three cities (CB, NH, and SL), and are expressed by their medians, means and the standard deviation (Table 1).

Table 1. Physical-chemical parameters of raw, treated and end-user water from Campo Bom, Novo Hamburgo and São Leopoldo.

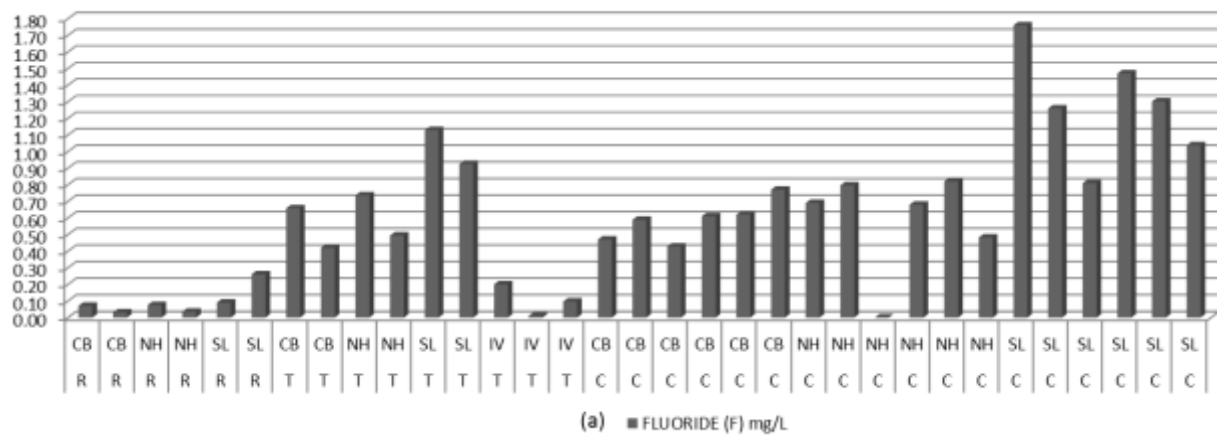
Parameter	Fluoride	Lead	Chromium Total	Chromium VI	Nitrate	Nitrite	Iron	Manganese	Mercury	Nickel	Zinc	Sodium	pH	Total Solids	Turbidity
	mg.L^{-1}	mg.L^{-1}	mg.L^{-1}	mg.L^{-1}	mg.L^{-1} N in NO_3	mg.L^{-1} N in NO_2	mg.L^{-1}	mg.L^{-1}	$\mu\text{g.L}^{-1}$	mg.L^{-1}	mg.L^{-1}	mg.L^{-1}		mg.L^{-1}	NTU
RAW WATER	Median	0.074	0.009	0.015	0.001	0.668	0.050	0.870	0.104	0.020	0.031	0.005	6.100	120.5	27.55
	Mean	0.094	0.014	0.051	0.012	19.315	0.050	2.600	0.287	0.020	0.031	0.028	6.425	153.3	49.20
	S.D.	0.085	0.113	0.065	0.026	45.75	0.025	4.621	0.493	0.000	0.001	0.045	0.814	91.0	64.96
TREATED WATER	Median	0.494	0.005	0.015	0.007	0.961	0.001	0.030	0.022	0.020	0.030	0.005	9.400	115.0	0.20
	Mean	0.519	0.005	0.015	0.005	5.051	0.001	0.037	0.328	0.026	0.031	0.025	18.956	157.2	0.30
	S.D.	0.380	0.001	0.001	0.004	6.742	0.000	0.020	0.028	0.018	0.001	0.030	21.200	78.7	0.28
CONSUMERS WATER	Median	0.730	0.006	0.017	0.004	0.687	0.001	0.030	0.022	0.020	0.032	0.020	9.330	101.0	0.60
	Mean	0.811	0.006	0.090	0.004	0.818	0.002	0.034	0.312	0.032	0.031	0.023	9.470	108.0	0.72
	S.D.	0.421	0.001	0.109	0.003	0.353	0.003	0.013	0.022	0.037	0.001	0.020	2.705	45.3	0.53

The table 1 presents the results of each parameter whose name and unit of measure are described in the title of each column.

The results are expressed by medians, means and standard deviation (S.D.) by water type:

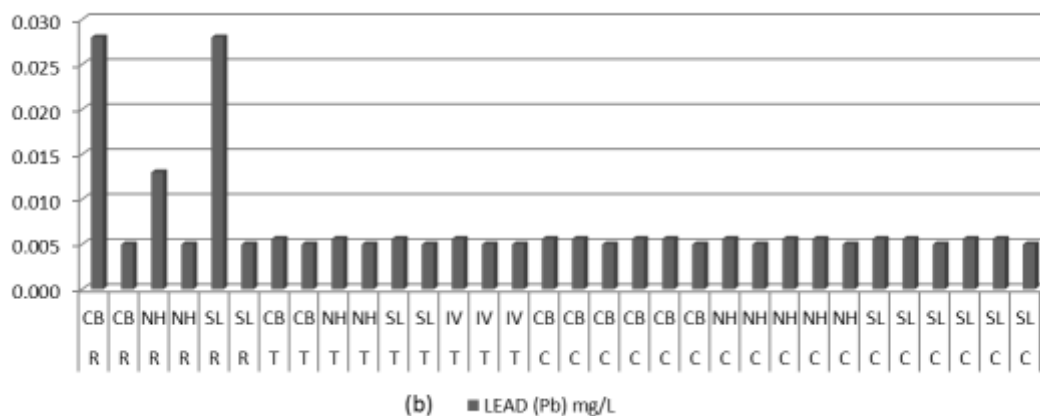
- Raw Water ($n = 6$); - Treated Water ($n = 9$); - Final Consumers Water ($n = 18$).

The present study emphasizes fluoride and its synergistic action with lead, therefore, the results of all analyzes of these two parameters are shown by water type and city and are presented in Figure 2a for fluoride (F) and Figure 2b for lead (Pb).



The results of fluoride (F) concentrations are expressed em mg.L^{-1} (ppm) by water type: Raw Water (R) $n=6$; Treated Water (T) $n=9$; and Final Consumers Water (C) $n=18$, and City (CB, NH, SL). The dates of the respective results are described in the methodology (topic 2.2).

Fig. 2a. Physicochemical analysis of Fluoride of raw, treated and end-user water.



The results of lead (Pb) are expressed em mg.L^{-1} (ppm) by water type: Raw Water (R) $n = 6$; Treated Water (T) $n = 9$; and Final Consumers Water (C) $n = 18$, and City (CB, NH, SL). The dates of the respective results are described in the methodology (topic 2.2).

Fig. 2b. Physicochemical analysis of Lead (b) of raw, treated and end-user water.

According to Brazilian legislation, the amount of fluoride in the water supplied to the population must be at most 1.5 mg.L^{-1} (BRASIL 2011). However, the Maximum Allowed Value (VMP) of the fluoride applied in the state of Rio Grande do Sul, follows the State Ordinance no. 10/1999 which defines the concentration of fluoride between $0.6\text{-}0.9 \text{ mg.L}^{-1}$ in end-user water (Portaria 1999). In fact, in April 2015, the US Department of Health and Human Services lowered the recommended amount of fluoride in drinking water to 0.7 mg.L^{-1} nationwide. This change was the first since 1962, when the federal government suggested an increase to 1.2 mg.L^{-1} in areas with colder climates and 0.7 mg.L^{-1} in warmer areas where people consume more water (HHS 2011).

The water fluoride treated by the ETA from SL presented concentrations of 1.1285 and 0.9245 mg.L^{-1} respectively (Fig. 2) in the two collections, which exceeded the MPV of 0.9 mg.L^{-1} of State

Ordinance 10/99 (Portaria 1999). As the distribution networks are exempt from submitting fluoride analyzes to the community (Portaria 1999), we can assume that the fluoridation carried out in the water treatment process is flawed, apart from the worrying fact that it is not feasible to monitor the excess of fluoride in drinking water by users. The treated water of NH and CB presented all values within the standard of Ordinance 10/99. Another study by Lacerda (2016) found fluoride at a mean of 0.541 mg.L^{-1} in the treated NH water.

The water fluoride of the end-users of SL reflected the result of the treated water of that city (Fig. 2), being above the MPV of 0.9 mg.L^{-1} (Portaria 1999) in 83.3% of the six samples (Hospital-SL: $1.760 / 1.2595 / 0.8102 \text{ mg.L}^{-1}$; School-SL: $1.470 / 1.3014 / 1.0378 \text{ mg.L}^{-1}$).

Ivoti's groundwater presents relatively low fluoride levels, with a mean of 0.102 mg.L^{-1} (Figure 2a). Groundwater is the source of drinking water for many communities in many parts of the world where high concentrations of fluoride are found above the WHO limit of 1.5 mg.L^{-1} (Edmunds and Smedley 2001). In rural areas of South Africa, groundwater is the only source of water and elevated levels of fluoride are causing a preponderance of dental fluorosis and negative impacts on human health and the environment (Odiyo and Makungo 2012). The central depression region of RS/Brazil has a high concentration of fluoride in the groundwater, and the study carried out in the city of Santa Maria, located in that region, fluoride contents in most wells presented high values of fluoride, between 0.5 up to 3.3 mg.L^{-1} (Terra 2015).

In relation to raw water, in Brazil, we can compare the results found and presented in Table 1 with the CONAMA Resolution 357/2005 that establishes maximum values (VM) in water bodies in the national territory for the management of the uses of this resource (CONAMA 2005).

The Sinos River raw water had a mean fluoride concentration of 0.094 mg.L^{-1} (Table 1). Little is known about this parameter because the ETAs perform this analysis after the water fluoridation. One of the few studies that analyzed fluoride from the Sinos River raw water in Novo Hamburgo was conducted by Lacerda (2016) and found lower values at a mean of 0.036 mg.L^{-1} (S.D. 0.033).

The lead in the Rio dos Sinos water presented a mean of 0.0140 mg.L^{-1} (SD 0.113) and was found in all points of the first collection (Fig. 2b) with values close to the MPV of Class 3 of the Brazilian legislation CONAMA 357/2005 (0.033 mg.L^{-1}) (CONAMA, 2005). This fact was determinant for the use of lead in the animal model. Robaina et al. (2002) also found lead in high levels of contamination in the Sinos River. Oliveira (2015) found 0.145 mg.L^{-1} of lead in the lower section of the Sinos River in two collections conducted in 11/2011, and the general mean of 0.039 mg.L^{-1} , presenting the river classification as 50% of the periods classified as Class 3 and 33% as Class 4. Lacerda (2016) found lead in raw water at a mean of 0.014 mg.L^{-1} (SD 0.026) and treated on average 0.010 mg.L^{-1} (SD 0.019), indicating that there were samples with lead above these limits. Costa et al. (2014) found high levels of lead (0.023 mg.L^{-1}) in the Sinos River in Campo Bom, in the summer, and included the source and mouth of the Schmidt Stream, which flows into the Sinos River. Toxic contamination was considered high due to the presence of heavy metals cadmium and lead.

Total chromium presented a mean in the raw water of 0.051 mg.L^{-1} (S.D. 0.065) and in the end-user water of 0.090 mg.L^{-1} (S.D. 0.109). The presence of chromium of 0.04 mg.L^{-1} was also verified in the Sinos River by Scalon et al. (2010). In the first collection, performed only in end-user sites, chromium appeared in all samples between a minimum of 0.187 mg.L^{-1} (NH, Hospital) and a maximum of 0.287 mg.L^{-1} (SL,

School), well above the VMP. The legal maximum limits for chromium are both for raw and potable water, 0.05 mg.L^{-1} (CONAMA 2005; BRASIL 2011). However, Cr VI was included in the subsequent analyzes and was actually detected in all treated water samples with a mean of 0.0053 mg.L^{-1} (SD 0.004) and 0.004 mg.L^{-1} (SD 0.003) in end-user samples. In raw water, Cr (VI) was 0.012 mg.L^{-1} (S.D. 0.026), and the most significant sample in CB in the summer was 0.0660 mg.L^{-1} . Cr VI is a known carcinogen (EWG, 2011) and is responsible for the toxicity observed by the tannin effluents in the Vale do Sinos region (Lacerda 2016). Other studies have shown high levels of Cr VI contamination (Robaina et al. 2002; Costa and Klein 2006; Nascimento and Naime 2009; Nudler et al. 2009). Another study carried out in the Sinos River in 2011 found the presence of Cr (VI) in an average of 0.045 mg.L^{-1} in Novo Hamburgo and 0.065 mg.L^{-1} in São Leopoldo (Oliveira et al. 2012). Studies of rivers contaminated with chromium are important for the evaluation of aquatic ecosystems and the contamination of the environment, considering other synergistic or antagonistic interactions among the chemical products (Lambole et al. 1994; Scalón et al. 2010).

Manganese presented an average of 0.287 mg.L^{-1} (SD 0.493) in Sinos River water, which is within the range of 0.1 mg.L^{-1} for Class 1 and 0.5 mg.L^{-1} for Class 3 permitted by CONAMA Resolution 357/2005 for fresh water (CONAMA 2005). However, in one of the CB samples a concentration of $1,291 \text{ mg.L}^{-1}$ was found, well above these permitted levels. Other studies carried out in the Sinos River also verified the presence of manganese, presenting an average of $0,104 \text{ mg.L}^{-1}$ (SD $0,054$) (Lacerda 2016) and, at the Campo Bom catchment point, the river can be classified as a class 3 in 40% of the manganese analyzes (Nascimento et al. 2015). Manganese oxides are the only inorganic oxidants found in the environment that cause the rapid oxidation of Cr (III) to Cr (VI) (RAI et al. 1989). At least one hypothesis indicates that natural fluoride forms a soluble complex with minerals containing chromium (III) after which the dissolved Cr (III) comes into contact with the manganese dioxide (MnO_2) and material contained in the aquifer, causing oxidation to Cr (VI) (Jacobs and Testa 2004). This indicates the complex synergistic effects that may occur in water among different pollutants, toxic metals and fluoride.

The table 2 shows the medians, means and standard deviation of the parameters that presented a significant difference ($p < 0.05$) in the comparative test between the mean values of the raw and treated water parameters.

Table 2. Comparison of physical-chemical parameters between raw and treated water.

	Parameter	Fluoride	Nitrite	Manganese	Sodium	Turbidity
		mg.L^{-1}	mg.L^{-1} N in NO_2	mg.L^{-1}	mg.L^{-1}	NTU
RAW WATER	Median	0.074	0.050	0.104	6.100	27.55
	Mean	0.094	0.050	0.287	6.425	49.20
	S.D.	0.085	0.025	0.493	0.814	64.96
TREATED WATER	Median	0.494	0.001	0.022	9.400	0.20
	Mean	0.519	0.001	0.328	18.956	0.30
	S.D.	0.380	0.000	0.028	21.200	0.28
	p-Value	0.026	0.008	0.003	0.026	0.0001

The table 2 presents the results of the parameters that obtained p values ($p < 0.05$) using the Mann-Whitney test, whose name and unit of measure are described in the title of each column. Data are expressed as median, mean and standard deviation (S.D.).

We emphasize that the significant difference in the increase of fluoride is the result of the process of intentional addition of fluoride in the drinking water by the concessionaires for compliance with the federal legislation (BRASIL 1974). The other parameters with significant difference, such as nitrite, manganese, and turbidity, which decreased, also result from the water treatment process, denoting its efficacy. However, the presence of these elements in raw water highlights the worrisome conditions of contamination of the water bodies of the studied region, evidencing the need for a better management and monitoring of the water resource in this region. A study by Blume et al. 2010 carried out in four sites in the Sinos River basin in 2007 and 2008, identified that the Sinos River was not suitable for the collection of water for human consumption in accordance with the Brazilian legislation CONAMA (2011). The results of another study in the Sinos River basin, including catchment points in 5 cities (including Campo Bom) suggested that the main pollutant of water was domestic sewage, with no metals and pesticides (Nascimento et al. 2015). On the other hand, Robaina et al. (2002) found lead, chromium and nickel in stream sediments that flow into the Sinos River. The increase of sodium from raw water to treated water raises the idea of treating the “hardness” of the water caused by the presence of calcium and magnesium with the use of sodium. In water treatment and filtration systems, softeners that normally use sodium or potassium ions are used to replace calcium and magnesium ions that create hardness in water (EPA 2005).

The comparison between treated and final consumer water shown in Table 3 showed a significant difference ($p < 0.01$) in total chromium and turbidity.

Table 3. Comparison between treated and end-user water.

	Parameter	Chromium	
		Total mg.L ⁻¹	Turbidity NTU
TREATED WATER	Median	0.015	0.20
	Mean	0.015	0.30
	S.D.	0.001	0.28
CONSUMERS WATER	Median	0.017	0.60
	Mean	0.090	0.72
	S.D.	0.109	0.53
	p-Value	0.000	0.002

The table 3 presents the results of the parameters that obtained p values ($p < 0.01$) using the Mann-Whitney test, whose name and unit of measure are described in the title of each column. Data are expressed as median, mean and standard deviation (S.D.).

The lack of regulation for hexavalent chromium (Cr VI), the most toxic form, assumes that the total chromium measurement is 100% Cr VI in order to ensure that the greatest potential risk is addressed (EPA, 2016). The presence of chromium and especially chromium (VI) in treated and end-user water is

problematic, mainly from raw water (table 1). Although the significant difference ($p=0.000$) in the reduction of chromium from the treated water to the end user is positive, this fact may be due to Cr (VI) reduction processes in this path. Another study carried out in the Sinos River by Oliveira et al. (2012) also found high levels of Cr (VI) in NH and SL. The Environmental Working Group (EWG 2011) released an analysis of more than 60,000 faucet water tests conducted nationwide, finding that hexavalent chromium is in the tap water of 31 of the 35 US cities surveyed, the highest levels being high in Norman, Oklahoma (12.9 ppb); Honolulu, Hawaii (2 ppb); and Riverside, California (1.69 ppb). In groundwater, one of the sources of Cr (VI) comes from the proximity of coal ash ponds, contaminating potable water wells as shown by Vengosh et al. (2016). It is known that the reduction of Cr (VI) to Cr (III) results in the formation of reactive intermediates that contribute to cytotoxicity, genotoxicity and carcinogenicity through cellular events and oxidative damage such as apoptosis, DNA mutations, chromosomal damage and oxidation of proteins and enzymes (Caprara et al. 2016; Taju et al. 2017).

The increased turbidity may be related to contamination processes originating from both the distribution network and the storage and distribution in the end users. The level of turbidity in the delivery systems may vary depending on the source of supply; the type of treatment; the operating conditions (e.g. pressure fluctuations and continuous or intermittent supply); and the characteristics, condition, complexity and integrity of the distribution network (WHO 2017). Disruption of the water supply may also lead to unhealthy material entering the pipelines and, due to back suction through leaks, damage and failure of the supply lines, it can be transported to end users when the supply is resumed (Khadse et al. 2016). In a study conducted in the Sinos River to identify the most relevant parameters contributing to seasonal variations in water quality using integrated statistical techniques, turbidity was one of the most significant parameters in the spring, demonstrating that this parameter can be used as an indicator for water quality assessment (Alves et al. 2018). Turbidity is an important parameter to be included in water safety plans to support water quality management (WHO 2017).

The other physical-chemical parameters analyzed presented values within the standard set by the legislation for raw water (CONAMA 2005) and proper for human consumption (BRASIL 2011).

The observation of some of the parameters analyzed outside the legal standard (e.g. fluoride, lead, chromium, hexavalent chromium and manganese) endorses the need for periodic analysis and studies that allow a monitoring and control of possible distortions of toxic elements, both in water from the Sinos River and in treated water and end-user water.

3.2. Analyzes of the animal model

3.2.1. Evaluation of parameters of water consumption and weight of rats

During the 45-day period of the experiment, the water of the animals was changed three times a week and there were 17 changes in total. The total water consumption in the Control group (G1) was 8.2 liters and the average per animal was 1.63 liters; for the Fluoride Group (G2) the total consumption was 7.9 liters, with a mean of 1.59 liters per animal; and for the Fluoride + Lead group (G3) the total consumption was 7.1 liters, with an average of 1.42 liters per animal. According to the normality test of Kolmogorov-Smirnov, the data do not present normal distribution. The Kruskal-Wallis test did not present a significant difference between the groups ($p=0.15$).

The animals were weighed at the beginning of the experiment and weighed on average 166 grams. The individual evolution of the weight of the animals was accompanied with weekly weighing. The initial and final weight and mean weight gain per group is shown in Table 4.

Table 4. Weight gain per group of rats exposed to Fluoride (G2) and Fluoride + Lead (G3).

Group	Initial Mean Weight (g)	Final Mean Weight (g)	Weight gain (g)	Dif. to G1 (g)	Dif. to G1 (%)
G1: Control	162	333	171	-	-
G2: (F)	170	353	183	12	7
G3: (F) + (Pb)	166	369	203	32	19

The table 4 shows the Initial and Final Weight (Mean) and the Weight gain of each group of rats in the period of 45 days of exposure in the unit of measurement in grams (g). The weight gain of Group 2 and 3 in relation to the control group is represented in the last two columns by weight (g) and percentage (%) respectively.

The statistical analysis of the influence of different exposures of the animal model on the weight of the rats showed a significant difference ($p=0.037$) (ANOVA followed by Tuckey), between G1 (Control) and G3 (Fluoride + Lead). This indicates that lead may have been the cause of the weight difference. The risks of adverse health effects and the toxicity of lead are related to the total body content of lead, an understanding that was possible through lead kinetics and its interference in all metabolisms (Moreira Moreira, 2004). Lead is associated with health problems ranging from mental retardation in children to hypertension and renal insufficiency (Jadhav et al. 1995; Gomaa et al. 2002; Hu et al. 2006), accumulating in the thyroid and other glands interfering with reproductive functions (Moreira and Moreira 2004), passing through breast milk (WHO 2001) through the placenta, increasing the rate of abortions and malformations (Peres et al. 2001; Hu et al. 2006). Lead exposure is also associated with increased risk of delinquency and antisocial behavior (Needleman et al. 1996; Coplan et al. 2007). It is known that heavy metals, including lead, are endocrine disrupters and also confirmed as being associated with obesity, which may indicate, along with environmental factors, the growing prevalence of overweight people (Grun and Blumberg 2006). The study by Sun et al. (2017) demonstrated that chronic exposure to 0.05% lead (Pb) results in weight gain and insulin-specific resistance causing disorders are related to the metabolism.

3.2.2. Evaluation of T3 and T4 parameters and Total Antioxidant Capacity (TAC)

The results of the T3 and T4 hormone and TAC analyzes by group are shown in table 5. The Kruskal-Wallis non-parametric test showed that there is a significant difference between the groups for T3, T4, and TAC.

Table 5. Results of the analysis of the hormones T3 and T4 and TAC.

Group	Parameter	T3 (ng/dL)	T4 (µg/dL)	CAT (µMol/L)
CONTROL (G1)		83.00 (77.00 - 87.00)	3.95 (3.480 - 4.045)	159.00 (155.50 - 167.50)
FLUORIDE (G2)		90.00 (73.00 - 92.50)	4.12 (3.295 - 4.270)	491.00** (463.50 - 640.00)
FLUORIDE + LEAD (G3)		92.00** (90.50 - 95.50)	4.36* (4.125 - 4.615)	130.00 (116.50 - 163.50)
	p-Value	0.032	0.043	0.007

Table 5 shows the results of T3 and T4 hormone and Total Antioxidant Capacity (TAC) analyzes per group. The significant difference between the groups was performed by Dunnett's Post Hoc test, showing that:

* In both T3 and T4 the difference is significant between G1 and G3: T3 (p = 0.032) and T4 (p = 0.043).

** In TAC the difference was significant from G2 to G1 and from G2 to G3.

These results with significant increase in T3 and T4 hormones in both groups, G2 (F) and G3 (F + Pb), in relation to the control group (G1), the difference being for T3 (p = 0.032) and T4 (p = 0.043), are denoting that the association of fluoride with lead interferes more than fluoride alone in T3 and T4 hormones. Most of the studies, contrary to our results, relate fluoride to the reduction of thyroid hormones, causing hypothyroidism, but both, lead and fluoride are identified as being an endocrine disruptor (NRC 2006; Vandenberg et al. 2012; Pain 2017). T3 and T4 levels are regulated by the pituitary gland through TSH, an acronym for the synthesis of thyroid stimulating hormone, whose function is to induce the thyroid to produce the two hormones triiodotironine (T3) and thyroxine (T4) that help control the metabolism of the body (Brownstein 2014).

The study of Nascimento (2010) on the effects of exogenous treatment of T4 on plasma levels of T3 and T4 found levels of T3 (55.60 ± 1.93 ng/dl) in the control group (treated with saline solution for 10 days) and T4 (7.87 ± 0.33 µg / dl). Compared with the control group (Table 5), our result is about 30% higher in T3 and half in T4. In the study by Mota et al. (2004) performed in adult Wistar rats, the analysis of the hormones before a transplantation was performed, finding the pre-surgery T3 values of 46.7 ± 6.6 ng/dL and T4 of 1.9 ± 0.4 µg/dL and comparing with our results, this values are much lower.

Peckham et al. (2015) found that in fully fluoridated area people are almost twice as likely to report high prevalence of hypothyroidism compared to non-fluoridated area. Some studies have found, for example, that subclinical hypothyroidism in pregnant women results in reduced IQ in the offspring (Haddow et al. 1999; Klein et al. 2001) and that adults with subclinical hypothyroidism have a significant increase in coronary heart disease (Rodondi 2010). Dysfunctions on thyroid hormones are associated with patients with panic, anxiety, stress and depression syndrome (Fishman et al. 1985; Nascimento 2010). In Delhi, India, from a group of 90 children with dental fluorosis living in areas with endemic fluoride, not iodine deficient, 54.4% had well-defined hormonal disorders (Susheela et al. 2005). Other studies in China and Russia corroborate the relation fluoride/hypothyroidism with changes in thyroid hormones, including reduced T3 and increased TSH, in populations exposed to high levels of fluoride in the workplace or in water (Bachinskii et al. 1985; Mikhailets et al. 1996). Zhao et al. (1998) found that high fluoride content

produced goiters in rats. Another study by Bobek et al. (1976) found decreases in plasma T3 and T4, as well as a decrease in the free T4 index and an increase in T3 uptake, consistent with the groups treated with Guan et al. (1988), in which a fluoride intake of 30 mg.L⁻¹ (F) in water resulted in significant decreases in thyroid function, weight decrease and effects on the morphology of thyroid. Another study found an overall reduction in thyroid tone in tumor-bearing animals (Walker-256) (Monte et al. 2005).

Lead is associated with various endocrine disturbances causing testicular atrophy and reduced sperm quality and quantity (Moreira and Moreira, 2004) and causing a significant increase in the rate of abortion, stillbirth, prematurity, decreased postnatal growth and increase the rate of malformations (Peres et al. 2001). Contamination with lead caused by corrosion in water pipes has been studied under various fluoridation conditions (Masters et al. 2000; Coplan et al. 2007; Maas et al. 2007; Hirzy et al. 2014) and have also shown that fluoride present in water increases the concentrations of lead in the blood in children (Masters et al. 2000) and in calcified tissues in rats (Sawan et al. 2010). The effects of lead on thyroid hormones were analyzed by Singh et al. (2000), who studied 58 men who were occupationally exposed to lead, concluding that levels of lead in the blood ($\geq 50 \mu\text{g.dL}^{-1}$) may increase the release of thyroid stimulating hormone (TSH) from the pituitary without any significant change in circulating levels of T3 and T4.

The significant change in TAC ($p=0.007$) in the present study from G2 (Fluoride) to G1 (Control) and from G2 (Fluoride) to G3 (Fluoride + Lead) shows that fluoride and lead interfere with the total antioxidant capacity of rats. The factors that influence the reduction of TAC are alcoholism, smoking and exposure to radiation, herbicides, carbon monoxide, carbon tetrachloride, lead, arsenic, mercury, cadmium, aluminum and other toxic elements (Ferrari 2012). Basha et al. (2011) observed that the fluoride-induced increase in lipid peroxidation and decreases in antioxidants were more pronounced with the second and third generations compared to the first generation of rats. Bahrami et al. (2016) found that *Toxoplasma gondii*-infected mice found much higher blood levels of TAC in the control group (uninfected) on the order of 874.1 ± 128.3 (mmol/L). Other studies have shown that exposure of humans to lead compounds results in changes in the activity of antioxidant enzymes and oxidation of lipids in the blood (Kasperczyk et al. 2005; ATSD 2007). Chronic exposure to lead weakens the antioxidant system causing cardiovascular diseases by promoting oxidative stress associated with hypertension, increased activation of the angiotensin converting enzyme, increased levels of lipid peroxidation and lower levels of nitric oxide and total antioxidant capacity (Dursun et al. 2005; Nunes et al. 2015). Varol et al. (2013) demonstrated that TAC plays an important role in patients with endemic fluorosis. Our results showed that fluoride significantly increased the antioxidant defenses of rats, and fluoride in combination with lead also interfered with TAC, but in an inverse way, that is, reducing these defenses to levels below the control group, suggesting that effect of fluoride may be being suppressed by the synergism of fluoride with lead. This agrees with other studies in which the exposure to lead was associated with hypertension, increased activation of the angiotensin-converting enzyme, increased levels of lipid peroxidation and lower levels of nitric oxide and total antioxidant capacity (Chen et al. 2000; Villeda-Hernández et al. 2001; Nehru and Kanwar 2004; Payal et al. 2009; Alghasham et al. 2011).

4. Conclusion

The physicochemical analyzes of water show levels of fluoride above the maximum value allowed in treated water and in end-user water of São Leopoldo when compared to the state legislation. The presence of other metals, including lead, manganese and hexavalent chromium (in all types of water) were also observed, evidencing the need and relevance of the monitoring of the Sinos River water parameters and the public supply system. Results from the animal model showed that lead may have caused weight differences in rats and that there was also a significant increase in T3, T4 and TAC between groups, showing the interference of fluoride with lead in the thyroid and TAC functions. It remains the indication and the urgent need for complementary studies with rats including the analysis of other tissues such as the brain, as well as the repercussion of fluoride on the psychological and behavioral aspect of the animals to evaluate and confirm the data that evidence the reduction in IQ. The fluoridation process is subject to failure and evidence was found on the adverse effects of fluoride and fluoride with lead in the endocrine system exposing part of the population to risks. The need for the practice of artificial water fluoridation needs to be reconsidered as a public intervention in health. In addition, the need for further studies was evidenced, so as to elucidate the effects of fluoride together with the mechanisms of action with other toxic metals in living beings and in the environment.

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Epilepsy Detection Using Artificial Neural Networks

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Abstract

Epilepsy is a neurological disorder, where there is a cluster of brain cells that behave in a hyperexcitable manner, the individual can promote injuries, trauma or, in more severe cases, sudden death. Electroencephalogram (EEG) is the most used way to detect epileptic seizures. Therefore, more simplified methods of analysis of the EEG can help in the diagnosis and treatment of these individuals more quickly. In this study, we extracted pertinent EEG characteristics to assess the epileptic seizure period. We use Perceptron Multilayer artificial neural networks to classify the period of the crisis, obtaining a more efficient diagnosis. The multilayer neural network obtained an accuracy of 98%. Thus, the strategy of extracting characteristics and the architecture of the assigned network were sufficient for a rapid and accurate diagnosis of epilepsy.

Keywords: Epilepsy. Electroencephalogram. Artificial neural networks. Multilayer Perceptron. Seizure detection.

1. Introduction

The figures presented by the World Health Organization (WHO) indicate that epilepsy is one of the most common neurological diseases [1]. The disease is characterized as a chronic neurological disorder, presenting convulsive manifestations, where the individual manifests brief episodes of involuntary movements in a certain region of the body or even throughout its length, usually epileptic episodes cause loss of consciousness or uncontrolled bladder and bowel. Thus, epileptic seizures are temporary dysfunctions of a set of neurons, thus reflecting the excessive and hyper-synchronous activity of neurons in the brain [2].

For a few seconds or minutes, a group of brain cells are attacked by excessive electrical discharges, causing problems that extend from muscle spasms and brief lapses of attention to more serious and longer occurrences, thus depending on the region of the brain affected in the first moment and how fast it spreads. In case the problems are restricted, the crisis will be called partial; if they involve both brain hemispheres, widespread. Approximately 30% of patients with epilepsy continue to present crises without remission, despite the existence of adequate treatments with anticonvulsant medications [3].

Electroencephalogram (EEG) is the method used to measure and record electrical pulses in the brain. For this, electrodes are used, capable of capturing and amplifying these pulses, converting them into analog signals with which the analysis of patients' brain activity is performed. Usually, the doctor uses this method

manually, making a visual scan of EEG recordings, however, the analysis becomes impressive and time-consuming. To solve this problem, studies have proposed several robust and promising methods to detect epileptic activity in EEG signals [4] - [8].

Some works address different methods and mathematical models to automate and improve the detection of epilepsy in EEG. Thus, methods such as the wavelet transform served to observe the dynamics of EEG epileptic signals [9]. Extraction of time and frequency resources has also been used to classify EEG epileptic signals [10], [11].

In addition, other methods, such as multiple wave transformation and approximate entropy, were used as input to artificial neural networks for classification purposes.

Other works have also applied medium grouping networks and artificial neural networks to classify EEG epileptic signals [6], [11] - [14].

Although there are several studies using artificial neural networks, it is still necessary to use more efficient methods of extracting characteristics for better detection. Thus, the aim of this study is to propose a more efficient classification of epileptic seizures using artificial neural networks.

2. Materials and Methods

2.1 Data base

The EEG samples were extracted from the database of Children's Hospital Boston (www.childrenshospital.org) from pediatric patients with attacks of intractable epilepsy, developed from the monitoring of these individuals without the use of anticonvulsants in order to present in epileptic crises, with each sample referring to a session lasting approximately 1 hour. Brain signals from three patients were used, with only one EEG session from each patient being used.

2.2 Processing of data

The EEG data was extracted in a compressed form in '.edf' files, which consists of a 23x921600 matrix, that is, 23 EEG channels x 921600 signal points. The selected '.edf' files were converted to ASCII format so that it was then possible to save them in the '.csv' extension, thus seeking greater ease of manipulation, since the '.edf' files are more complex to work with. Subsequently, a selection and conversion of the files was established, requiring treatment for each file. The duration of each EEG session was 1 hour, so they were converted to 3600 seconds. The signal characteristics were extracted by the second order statistic, the Variance (σ^2). The variance of a random variable X is defined as the second-order central moment, such as:

$$\text{Var}(X) = \sigma^2 = E[(X - \mu)^2] \quad (1)$$

In this way, a new database with the Variances of the signal was assembled with a total of 3600 points, equivalent to a total of 256 points that corresponded to an interval of 1 second. The data of the three patients were recorded and the periods of the epileptic seizure were classified, according to the indication available at the Children's Hospital Boston. Later, a last line responsible for representing the expected outputs was added to the matrix. Figure 1 shows the flowchart of EEG processing to detect epileptic

seizures.

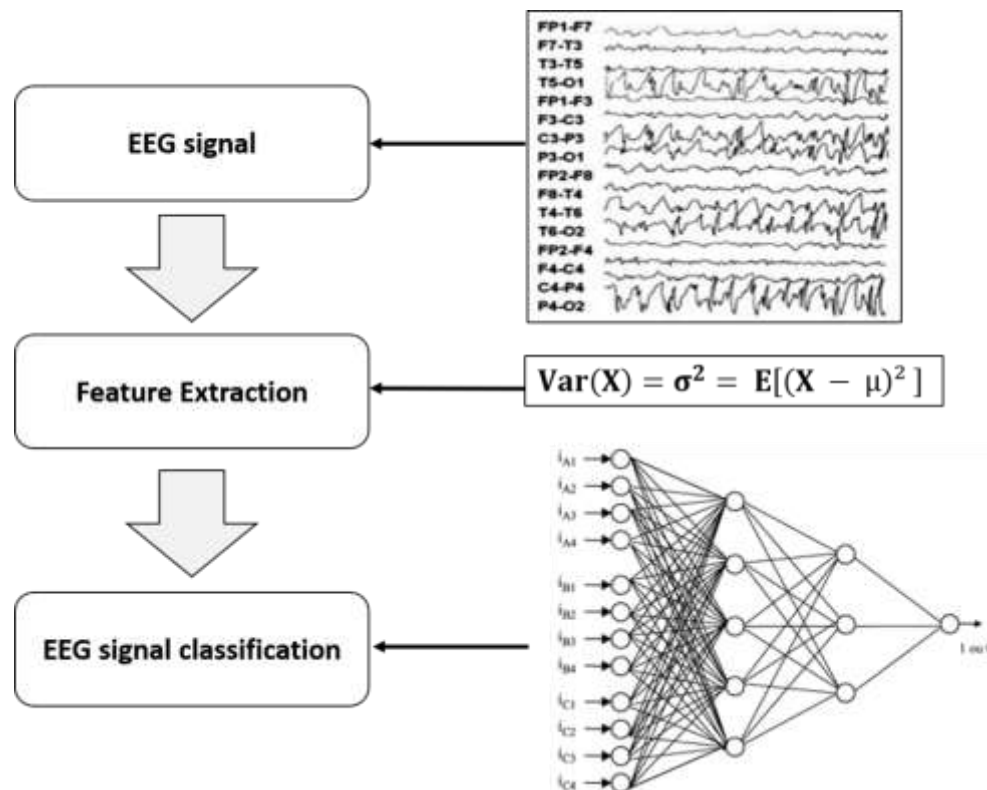


Figure 1 - Flowchart of the EEG classification process.

2.3 Multilayer Neural Network

Artificial Neural Networks were inspired by the functioning of biological neurons in the nervous system of animals. The artificial neuron reproduces the functions, shape and performance of a biological neuron. Thus, the components are changed as follows: dendrites through the inputs, the connections with the cell body are made through weights (similar to the synapses), the stimuli identified by the dendrites (inputs), are processed by the sum function and the axon is replaced by the activation function. In addition, the computational model of a neuron can be combined with more neurons and multiple layers, thus managing to solve complex, non-linearly separable tasks. Figure 2 shows the representation of an artificial neuron [15].

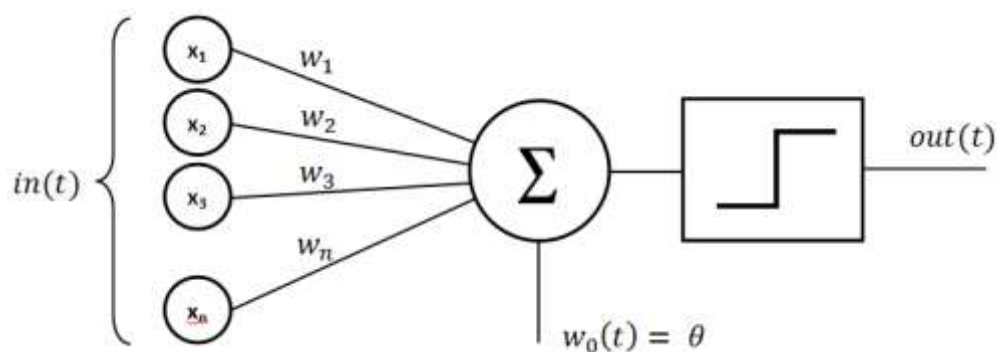


Figure 2 - Artificial neuron [15]

The neural network topology used is the standard feedforward network, known as Multilayer

Perceptron, containing an input layer with 23 neurons, 4 hidden or intermediate layers with 100 neurons each and an output layer with 1 neuron. It is important that the neural network has intermediate layers, as a network with few hidden nodes would be unable to differentiate between complex patterns. In addition, the network uses the sigmoid activation function to filter the output between the intermediate layers and the output layer, as shown in figure 3, in addition, 500 times were established to obtain the network learning.

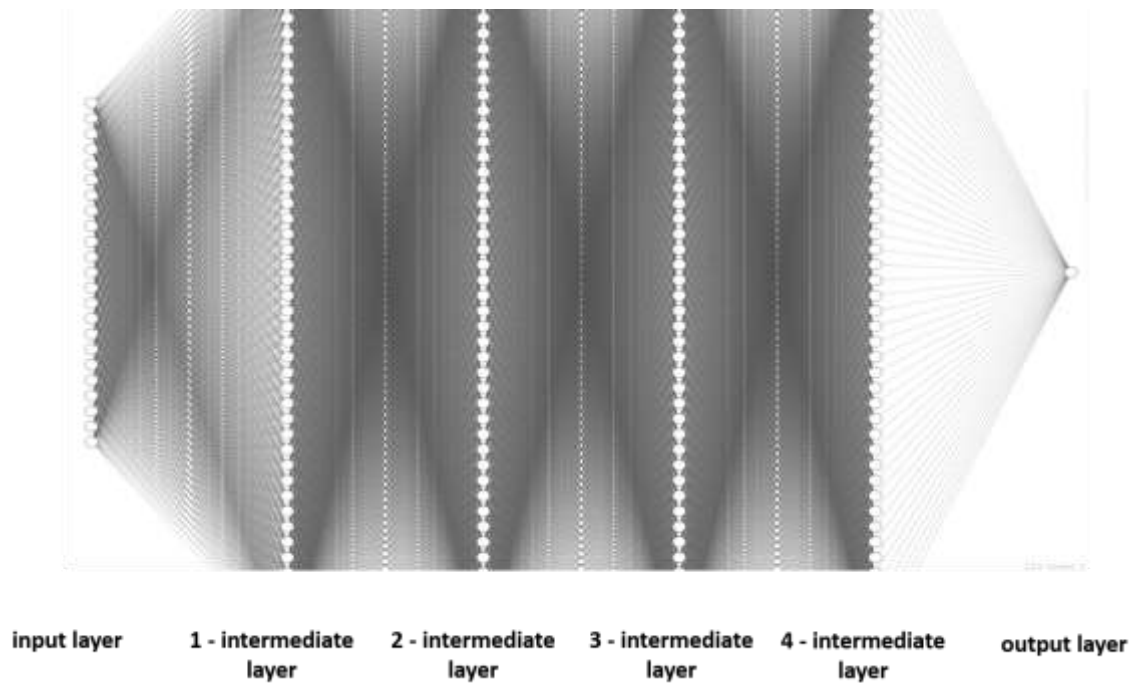


Figure 3 - Neural Network Model Developed.

The network was developed using the Keras library (<https://keras.io/>), for Python, and the Pandas library (<https://pandas.pydata.org/>) for manipulating the database in '.csv'. The input data in the artificial neural network were normalized, thus, it was reduced to the limits [0.1] or [-1.1]. The database was divided into 80% for training and 20% for testing. The “rmsprop” function was used as an optimizer and the “binary_crossentropy” function as a loss function. Both aim to minimize network errors, improving their accuracy, and the first (optimizer) performs the downward gradient for this.

3. Results and Discussion.

In this study, the input parameter of the neural network for training was the EEG signal variance. After training the neural network using 80% of the database for 500 periods, the network showed an accuracy of about 99% and in specific cases reaching 100%. During the tests, certain characteristics were noted in the database that allowed the network to achieve such high accuracy. The database has 10,800 samples, each of which represents 1 second, totaling 3 hours of examination, however in the epileptic seizures noted in the EEG signal available in the database used, it presented only a few minutes. At random, the selection of 80% of the database for training was made, and in some moments of execution the network reached an accuracy of 100%, since the data are always chosen at random so that the network is not with data addicted to your training.

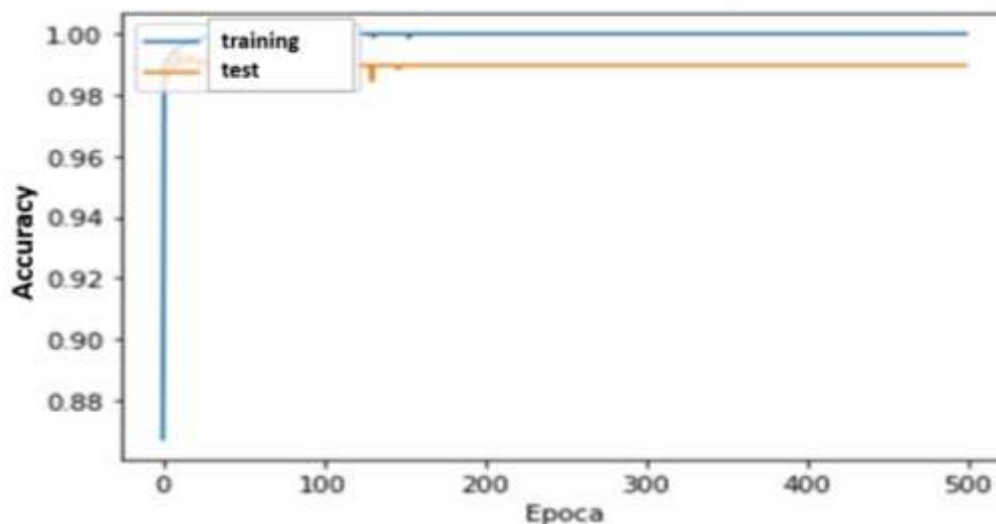


Figure 3 - Model accuracy.

The results for the best performance of the backpropagation neural network baseline were for accuracy and sensitivity. Thus, we achieved an accuracy rate of 98% classification using the proposed architecture, accuracy refers to the proportion of the total cases that were correctly predicted, whether negative or positive. Sensitivity is the percentage of correct predictions for patients who have not had epileptic seizures, with 99%; and specificity is the percentage of correct predictions for patients who had epileptic seizures during the EEG was 77%.

As it could be noted, such metrics resulted in quite satisfactory values, it was possible to reach a number equivalent to 1068 of true positive in an example of execution of the artificial neural network in question, that is, during the execution of the test performed by the neural network, the which corresponds to the execution of 10% of the base, where the whole includes training, testing and validation, 1068 of the positive cases were correctly predicted, while only 2 of them were classified incorrectly. Regarding the classification of negatives, we have a total of 7 cases classified correctly and 3 classified incorrectly.

In a recent study, Variance, Asymmetry and Kurtosis were used together to extract characteristics of EEG signals with epilepsy, machine learning classifiers were used, such as the Steam Support Machine, K-Neighbors and Discriminating Linear Analysis, obtaining an accuracy of 97%, slightly lower than the results obtained in that article [16].

Thus, our results show that only the use of Variance was able to be a good parameter for extracting characteristics and detecting Epilepsy, thus being a more consistent vector of characteristic.

Finally, it is clear the need for studies in this area, not only using statistics, but using other statistical parameters to measure the efficiency of the neural network, in order to obtain better results and advances in studies of patients with epilepsy.

4. Conclusion.

In this study, a multilayer neural network architecture was used to classify epileptic seizures, using Variance as an input parameter. The results of the simulation showed that the proposed network could present

satisfactory results with an accuracy of 98% in the detection of seizures. The proposed model can be an alternative to create software to assist health professionals for a quick and accurate diagnosis in hospitals and medical centers.

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EVALUATION OF MENTORING STRATEGIES AMONG ACADEMICS: A SURE WAY TO QUALITY RESEARCH REPORTS

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Abstract

Qualities of research outputs by young academics in recent times in this country are less than expected. This could be as a result of extent to which young academics are mentored by the more experienced or exposed academics. This study therefore sought to evaluate/ascertain the status and strategies of mentoring young academics for research. This will expose whether there is need for policy decision making toward improvements. This evaluation study is aimed at ascertaining the current status and strategies involved in mentoring amongst academics. A sample of 160 participants (mentors and mentees) were drawn from 372 academics from 6 (six) out of 11 (eleven) faculties of Imo State University, Owerri using proportionate random sampling techniques. They were given a set of strategies to rate under a 4-point scale. The rating scale has 27 items clustered under four subheadings: general mentoring, research teaching, research supervision and research networking. The reliability of the instrument was determined using Cronbach alpha and found to be 0.694. The instrument was administered face to face and this enabled the researcher to augment the scale with oral interview in which the respondents were asked to express their personal views about mentoring in the university. Mean and standard deviation scores, z-test and ANOVA F-test were the methods of data analyses. Results show that the mentoring strategies were largely informal where the mentors and mentees are allowed to freely establish relationships which have inherent loopholes. It was recommended that there is need to strengthen mentoring through institutionalization.

Introduction

No one knows it all. Experience has shown that brilliant academic qualifications do not always equate directly to excellent practical performance on job. This is the reason employees are said to grow on the job over time. The growth entails increase in practical knowledge, skills and depositions (kds) which gradually accumulate over time. The rate at which the kds increase depend on the employee's environment, exposure and experience. Nevertheless, hardly can an employee's KSD improve without the assistance of people who were there before him/her, that is, the older (not in terms of age) and more experienced/exposed colleagues. This fact holds true amongst members of academia in universities in Nigeria. They are familiar with mentoring and are known for mentoring their younger and less experienced/exposed colleagues to foster and perpetuate excellence in research reports and general service delivery. Research reports are very crucial in individual and national development. They guide policies of government that impact positively

on the lives of the people. As a result of this, “no student is awarded a degree without having carried out research investigation and submitted reports” (Ijaiya 2013, p. 6). It has been observed that younger lecturers are now left to learn on the job whether good or bad (Ijaiya 2013). This raised a concern and informed this study which is meant to ascertain whether the poor quality of research reports submitted by the students are traceable to mentoring problems. Do academics in universities still insist on mentoring their younger ones who in turn supervise students’ research works? What strategies do they use, the researcher is intrigued to ask?

It is apt at this point to undertake clarification of the major concepts as they relate to the study. Academics are teachers teaching in the universities. They are generally referred to as lecturers or teaching staff to distinguish them from non-teaching, administrative staff. Lecturers carry out three basic categories of functions which include teaching, research and community services (Nwana, 2008). Academics have culture that subsists in quality services. They teach people to acquire university education, advance knowledge through research findings and cause inevitable changes, improvements and modernity to occur in the society. Okpala (2012) had said that through evaluation research, lecturers get involved in the process of keeping the components (inputs, process and outputs) under the watchful care of the people who have stakes in education. Lecturers are insatiable with knowledge and quite sensitive to events in their environments leading to their usefulness in diverse community services. Mentoring is one of the ways academics achieve and maintain character of excellence in service delivery.

Literature is replete with expressed ideas about mentoring. Each writer saw mentoring as the process of stamping cordial relationships between different individuals/employees where one functions as mentor, godfather, godmother or rabbi while the other is the mentee, protégé (protégée for female) or apprentice. Mentoring is a professional relationship in which an experienced person (mentor) assists another (mentee) in developing specific skills and knowledge that will enhance the less experienced person’s professional and personal growth (<http://www.management-mentors.com>). Uzonwun (2014) listed mentoring as one of the staff development programmes that promotes awareness and refinement for the individuals professional development by providing and recommending structured opportunities for reflection and observation. Kram was cited by Isiozor (2014) as describing mentor as a coach, counselor and sponsor who actively intervene, provides support and facilitates the development of the less skill/experienced/exposed staff. Ubulon (2008) opined that for the young faculty members to cope with the responsibilities, they require guidance from senior colleagues who can serve as their mentors and role models. Thus, mentoring creates environment that is supportive, non-competitive and non-judgmental. On the other hand, it fosters trust, facilitates sharing and mutual respect (Sodiye and Madukama 2013). Ogomaka (2013) posited that a mentor should be knowledgeable, skillful and of positive dispositions. He/she should be creative, flexible and fluent in ideas because the mentee can have other sources of information. The mentor should be patient, pathetic, empathic, approachable, outgoing and observant because he/she will not expect the mentee to always come to discuss his/her deficiencies with the mentor. Thus relationship between mentor and mentee should be that of mutual respect because they learn from each other. Isiozor (2014) observed that mentoring can be formal or informal. In the formal mentorship programme, the less experienced staff is paired with more experienced staff who have standing record of professional competence. This implies that the formal mentoring is institutionalized while the informal mentorship focus more on the ability of the younger staff

to initiate cordial relationships with the most senior colleagues and vice versa. That means that in informal mentoring both mentor and mentee found themselves. Activities of mentoring are structured around the following concepts;

- (i) **Teaching:** A mentor takes the mentee to class to observe the mentor teach. He/she is also free to observe the mentee teach with the view of giving professional advice (Ihekwaba and Nosike 2016).
- (ii) **Research:** Giving mentee research topic to develop and a research reports to critique.
- (iii) **Networking:** Linking the mentee to sites in the web for relevant professional association guidelines on research investigation and reports as well as attending conferences to enrich knowledge.
- (iv) **Supervision of students' research works:** The mentee is added as the second supervisor who will read the work first and transfer to the mentor for ratification among other assignments. Mentoring relationship whether formal or informal are neither time or space bound. This is the reason academics can jointly carry out research works across disciplines, faculties and universities. This study will help to ascertain the type of mentoring that strives in the university and the benefits and challenges of each type. However, mentoring helps to avert the initial mistakes of the young staff in trying to cope with the full range of instructional and paper work responsibilities (Ihekwaba and Nosike 2016).

Perhaps, it may be better to be a bit elaborate in this concept of mentoring since it is not taught as a course in school and human persons differ in their pattern of relating with others. It is good to mention guidelines as reference point in order to cushion the effect of human differences in mentoring. Ogomaka (2013) provided some approaches which he called **logical working styles**. He believed that mentors can apply any of the approaches depending on the personality characteristic of the mentee.

1. **Thinking style:** This is based on changing the thought processes in line with the demands of the job. The focus is to instill self-confidence, self-control and to deal with the feelings of inadequacy and doubt.
2. **Try hard style:** This is to encourage the mentee to be thorough, search for more information and not to always settle for the convention. Such phrases as you can do better than this, look at this a second time, you are strong, go ahead, 'look for more information' are used. The mentee moves with renewed strength to do the needful and in the end achieves that which was seemingly impossible.
3. **Hurry up style/approach:** This is used mainly on mentees that are slow in getting things done. He/she can be the procrastinating type. Give him/her regimented assignments with time frame to complete it. Phrases such as 'you have the ability to do this in a short period, you can achieve, move on' etc. The mentee gets challenged and works to impress the mentor and match up with mentors' description of him/her.
4. **Stamped approach:** This exposes the mentee to the nature of the job. Lecturers are busy people and their functions require speed and accuracy and the mentee should learn this. Mental alertness is also essential to cope with accompanying challenges. The mentee is guided to work within and outside the official hours to complete assigned tasks as expected.

5. **Perfect style/approach:** As the period of mentorship advances the mentee becomes more like the mentor. He/she can carry out higher tasks with less monitoring. The mentor expects perfection in the discharge of duties. The mentee can successfully represent the mentor outside the domain and render credible reports.

The ideas raised in the literature about mentoring can be articulated as follows;

- Mentoring is a staff development programme
- It consists of establishing cordial interpersonal relationships among staff of any organization. Such relationship can be horizontal, involving staff of the same level or status or vertical involving staff of different status.
- Mentoring provides a level playground for staff to learn from each other irrespective of seniority.
- Mentoring can be formal ie where it is entrenched and enforced as a policy or informal where mentoring is left to chance and individual decision.

The writer went this far in explaining mentoring because of the importance in maintaining quality in research. Given that other professional growth programmes may not come up as regularly as expected, academics resorted to mentoring which occurs on daily basis. To this end, mentoring programmes of the universities need to be evaluated at regular intervals to ascertain whether there is room for strengthening. Evaluation has to do with the determination of worth or worthlessness of something (Ogomaka 2016). It is the process of taking decision in the light of evidence. Its origin dates back to creation period when God created all things and looked back and assessed them and passed judgment that they are all good (Gen. 1:31), since then, humans learned to, at some points, assess their activities in order to determine the need for continuation, remediation or outright dropping of such activities for another. In the same way this study is meant to assess the current status of mentoring among academic staff to guide policy-making regarding mentoring as a tool for improving research.

It may not be necessary to go into full discussion of evaluation models because this is not intended. However, a brief mention of a few of them is possible. Robert Stake's model of evaluation seeks to establish whether there is congruency between what exists and what suppose to exist about a given programme. The Stufflebeam model recommends that the evaluation should examine the presage variables (inputs), context variables (operating environments), process variables (implementation) and product variables (nature of the output). Information obtained from each of the stages gives impetus to adequate decision-making about a given programme. This implies that if any of the preceding variables (inputs, context and process) is faulty, it automatically reflects on the final outcomes/products. In the similar manner, the plausible question would be, to what extent can poor research reports be attributed to weak mentoring. To find answer to the question intrigued this writer into carrying out this study with the aim of ascertaining the strategies of mentoring among academic staff.

Research Questions

1. What are the mentoring strategies among academics as shown by the mean and standard deviation scores of their responses per section of the instrument?

2. What are the mean rating scores of academics according to their status (mentor or mentee)?

Hypotheses

- H₀₁: There is no significant difference between the mean rating scores of strategies by mentors and mentees ($p < 0.05$).
- H₀₂: The mean rating scores of mentoring strategies by the academics do not differ facultywise.

Method

This is evaluation survey because surveys ascertain current status of things about a given population by obtaining information from either the entire members of the population or by using a representative sample of the population. This was done without any form of manipulation/alteration of the natural setting of the population. It is evaluation because result will guide policy decisions toward improvement. This study is also a case study because it involves a single social unit (Imo State University) among other social units (other universities). This is to enable in-depth study for which case studies are known. A sample of one hundred and sixty (160) academic staff (mentors and mentees) was drawn from a population of 372 academic staff of six (6) out of eleven faculties for the study. A mini survey was carried out to ascertain the total number of academics and their ranks in each of the six randomly sampled faculties. The academics fall into categories in this work viz; Professors, Readers and Senior lecturers are designated as mentors while lecturer I, lecturer II, Assistant lecturers and graduate assistants belong to mentees. Proportionate cluster random sampling techniques were used to constitute the sample. The clusters are the faculties and the status of lecturers (mentor or mentee) which they indicated on answering the research instrument which is a 4-point rating scale. The instrument has the length of 27 items clustered under four sub-headings – general mentoring, teaching research, research supervision and research networking/synergy. Two academics who are experts in research vetted the instrument and their concerns were taken into consideration in the final draft. The instrument was trial tested using 50 (mentors and mentees) academics from Abia State University. Using Cronbach alpha, the reliability index of the instrument was found to be 0.694.

The instrument was administered face to face. The researcher supplemented the rating scale with oral interview in which the respondents were asked to express their general view of mentoring in the university. Since in evaluation studies there should be a standard based on which the result would be compared and the researcher can provide such reference standards where none exists, this writer used the expected mean scores as the reference point. This is based on the facts that if a given item is generally acclaimed as mentoring strategy practiced in the institution that item will have the maximum mean score of four (4) in a 4-point scale. When this is multiplied by the total number of items in the instrument cluster it gives the cluster mean score as the standard by which the observed mean score is interpreted. Mean scores and standard deviation scores were used to answer research questions. Since randomization was used in constituting the sample size, it is expected that the data would be normally distributed; therefore the expected or criterion mean score of $2.50N$ was used, where N is the number of items which attained mean

score of 2.50 or above. Hypothesis one was tested using z-test of significant difference between two sample mean scores while ANOVA F-test was used to test hypothesis two.

Results

Results are presented in tables in line with research questions and hypotheses.

Table 1: Results regarding mentoring strategies among academics according to sections of the instrument **Section A: General Mentoring**

Table 1a: Mean and Standard deviation scores of responses concerning general mentoring

	Item Statement	\bar{x}	Sd	Remark
1.	Young academics are mentored by their senior colleagues	2.55	0.87	Adopted
2.	Mentees are officially assigned to their mentors	1.52	0.79	Not adopted
3.	Mentors and mentees are left to find themselves	3.16	1.01	Adopted
4.	Mentors cross-check the works of their mentees for quality compliance	2.25	0.91	Not adopted
5.	Mentors encourage their mentees to feel free to consult them	2.84	0.89	Adopted
6.	Mentors give guidelines on best practices with or without consultation by the mentees	2.51	1.45	Adopted
	Cluster mean score and sd	14.83 (61.8%)	2.87	

Four strategies were adopted out of six since they met the criterion mean score of 2.50 and above. In this segment the cluster mean score performance of academics regarding general mentoring is 14.83 out of 24 or 61.8%. The small magnitude of sd scores in each of the items and the cluster sd (2.87) indicate that the academics did not differ so much in their responses.

Section B: Teaching research

Table 1b: Mean and standard deviation scores of mentoring strategies regarding the teaching of research

	Item Statement	\bar{x}	Sd	Remarks
1.	There is team teaching involving mentors and mentees	2.92	0.96	Adopted
2.	Mentors go to class with their mentees to teach	2.14	0.99	Not adopted
3.	Young academics are mentored/guided to teach research at undergraduate level	1.88	1.02	Not adopted
4.	Mentees are guided to teach research at Masters level	2.70	0.87	Adopted

5.	Mentees are mentored before allowed to teach research at Ph.D level	3.20	0.79	Adopted
6.	Mentors give their mentees course to teach and observe them teach for quality maintenance	2.31	1.13	Not adopted
7.	Mentees are required to participate in the post graduate proposal/internal defence	2.66	0.95	Adopted
8.	Mentees are allowed to clerk research defence for more knowledge	2.86	0.97	Adopted
9.	My faculty organizes workshops/seminars based on research skills where the mentors deliver talks for mentees development	1.85	1.34	Not adopted
Cluster mean score and sd		22.52 (62.6%)	3.04	

The data in table 1b show that five strategies out of nine are adopted as mentoring strategies by the academics. The cluster mean score which is 22.52 amounted to 62.6%, the cluster standard deviation (3.04) is noteworthy when compared with that of section A (general mentoring). The magnitude of sd score for section B (teaching research) is higher than that of general mentoring (2.87) indicating that the respondents differ more in the area of research teaching than in general mentoring. Can this connote lack of uniformity in mentoring regarding research teaching?

Section C: Research Supervision

Table 1c: Means and standard deviation scores of respondents on research supervision

Item Statement	\bar{x}	Sd	Remarks
1. Young lecturers are mentored in research supervision before they are assigned undergraduate students to supervise	2.15	1.05	Not adopted
2. It is assumed that young academic can supervise undergraduate students without mentoring	2.90	0.91	Adopted
3. Mentors give their mentees research topic to develop and co-author research articles with their mentees	2.60	1.24	Adopted
4. Mentors give mentees research reports to critique and submit for scrutiny	2.35	0.89	Not adopted
5. Mentors monitor the mentees' supervision of students' research efforts	2.10	0.96	Not adopted
6. Mentees are guided through mentoring before they are assigned post graduate students to supervise	3.10	0.98	Adopted

Cluster mean score and sd	15.20	2.27
	(63.3%)	

In the area of research supervision, three strategies are identified out of six. The cluster mean rating score is 15.20 out of 24 giving a percentage score of 63.3. Again the responses were somewhat similar resulting in a small standard deviation (sd) score of 2.27.

Section D: Research Networking

Table 1d: Results concerning mentoring in the area of research networking

Item Statement	\bar{x}	Sd	Remarks
1. Mentors encourage their mentees to register and become members of relevant network of professional research associations	2.58	0.90	Adopted
2. Mentors urged their mentees to attend academic conferences with them	2.75	0.95	Adopted
3. Mentees are encouraged by mentors to write papers and read at conferences	3.25	1.01	Adopted
4. Mentors expose their mentees to research linkages across institutions	2.55	1.04	Adopted
5. Mentors delegate mentees to represent them in sessions requiring paper presentations	2.36	0.98	Not adopted
6. Mentors expose their mentees to things required for research reports to be qualitative	2.60	0.89	Adopted
Cluster mean score and sd	16.09	2.36	
	(67%)		

Five out of six strategies were adopted in table 1d. The mean score in this segment is 16.09 or 67.0%. The respondents scored the highest percentage in this cluster and the disparity in their responses is also small (2.36). For the whole length of the instrument with 27 items, seventeen (17) were adopted as mentoring strategies amongst the academic staff of Imo State University and their total mentoring performance stands at 63.6%. Thus, research question one was answered by the data 1a, b, c, and d.

Table 1a to d: Summary of results according to sections of the instrument. Figures in bracket are percentages

Clusters	No. of items	Observed mean score	Sd	Expected mean score
General mentoring	6	14.83 (61.8)	2.87	24.0 (100)
Teaching research	9	22.52 (62.6)	3.04	236.0 (100)
Research supervision	6	15.20 (63.3)	2.27	24.0 (100)
Research networking/synergy	6	16.09 (67)	2.36	24 (100)
Total	27	68.64 (63.6)		108 (100)

Results of test of hypothesis one**Table 2: Results of test of no significant difference between mean score responses according to status**

	\bar{x}	Sd	N	z_{cal}	$z_{crit.}$
Mentors	46.8	11.99	82		
Mentees	45.6	9.9	78	0.71	1.96

Since the $z_{cal} < z_{crit.}$, the null hypothesis one is accepted, that there is no significant difference between the two mean scores. This answered also the research question two which seeks to ascertain the mean score responses of the two categories of staff. This means that the respondents do not differ in terms of status.

Test of hypothesis two**Table 3: ANOVA test results of responses according to faculties**

No. of Faculties	N	\bar{x}	Sd	Sources of variation	Sum of Squares	Df	Mean Squares	F	Sig.
1	50	46.58	10.11	Between groups	1594.758	5	318.952	3.011	.013
2	20	48.05	7.39	Within groups	16314.842	154	105.941		
3	16	47.63	9.26	Total	17909.600	159			
4	26	40.35	8.44						
5	30	41.03	12.51						
6	18	47.78	12.51						
Total	160	44.95	10.61						

Since 0.013 is less than 0.05 the null hypothesis of no significant difference is not accepted, showing that responses differ according to faculty of the participants.

Discussion

According to the analyses' results, mentoring amongst academic staff in the university stood at 63.6%. This could be described as encouraging but there are areas of blemishes that require improvement. It was found out that the methods of mentoring were largely informal where the mentor and mentee are left to initiate the mentoring relationships. This pattern of mentoring has inherent problems of promoting apathy in the sense that it will be difficult to hold any staff responsible should mentoring fails to exist. It also means one is free to be or not to be involved in it. Moreover when people are not happy due to poor condition of service they may become disinterested in mentoring especially when it is not mandatory. Results of interview with respondent lend credence to this idea. While mentees complained of selective mentoring by the senior colleagues, that is, they favour some young staff who are connected to them in some way leaving the others, the senior colleagues (mentors) complain that the younger staff behave as having known it all and therefore do not need mentoring. These accusations and counter accusations will not arise if mentoring is institutionalized. The situations at present projects the idea already put forward by Ijaiya (2013) that young academics are left to learn on the job anyhow. Interview results also reveal that there were inadequate number of very senior academics (mentors) to mentor the younger ones in some disciplines, making mentoring almost on-existent in such areas.

A cursory look at the identified mentoring strategies indicates the patterns of mentoring amongst the staff. Mentoring focus more on two major areas;

(i) The urge to write and read papers at conferences (ii) getting the young staff ready to function at post graduate level. This is the reason the respondents scored more points in the area of research networking than in teaching and supervision of research of the undergraduate students. This results in the poor quality of research reports submitted by the undergraduate students. If the quality of research reports are taken to be a representation of the supervisors' level of research knowledge one would appreciate the need to begin mentoring as soon as employment is given to a young academic. Undergraduate stage is a foundation level which makes it imperative that the research skills of students should be taken seriously because poor research foundation has multiplier effects in the entire educative process. Mentees are sufficiently informed to write and attend conferences because their promotion depends on their outputs but if they are left unaided they begin to make researches that are not novel, researching about the problems that the solutions are already found. Perhaps, this is the reason plagiarism is often traced to young academics. As a result of weak mentoring relationships, the mentor do not send their mentees to represent them in session requiring paper presentation because they are not sure of quality representation by the mentees. Sodipe and Madukama (2013) had advised that formal (institutionalized) mentoring removes individual considerations and creates environment that is supportive, non-competitive, non-judgmental and facilitates trust and mutual respect between both parties.

Organizing workshop/seminars based on research at faculty level which could have been a veritable avenue for mentoring young faculty members did not pass as a mentoring strategy among the staff. The assumption that a newly employed academic with masters or Ph.D degree can satisfactorily handle research programmes of the undergraduate students without mentoring should be made with some reservations. This is because there is always gap between theory and practice as well as individual differences in actual

performance. As a professional development programme (Isiozor 2014 and Uzonwun 2014) mentoring should be made to be inclusive of all aspects of the institutions' functionality to ensure uniform and quality delivery. Ubulon (2008) corroborated by adding that the young faculty members should be mentored by their role models who should provide necessary guidance. For this to happen, staff should be made to be responsible for the accomplishment. The small magnitude of the standard deviation (sd) scores in each of the item is an indication that the respondents did not differ much in their responses. The overall standard deviation score for the entire instrument is 10.61, still portraying little distance/disparity amongst the participants. In the same way, the participants' responses did not differ according to their status (mentor or mentee) but their responses differ according to faculty as indicated by the results of tests of hypotheses one and two. Lecturers are not the people to fake information on what exists. This is the reason both mentors and mentees responded in a similar way to the instrument. The disparity in responses according to faculties can be explained from the fact that mentoring is predominantly informal, each faculty handles it the way she deems fit leading to variations in strategies across faculties. Indeed, every faculty is at liberty to organize faculty-wide seminar/workshops for staff and students to acquaint them with uniform procedures of research. This is done especially when the faculty is not satisfied about the quality of research reports submitted by the students. This writer has participated in such seminar in her faculty.

Being present in research defence to learn from the corrections given by the most senior colleagues is one of the strategies but mentees who do not possess Ph.D degree are not allowed to benefit from Ph.D research defence. Since this method does not cut across all levels of mentees it is important that they are assigned individual mentors. Encouraging young academic to attend conferences is one thing, sponsorship is another thing. Poor/lack of sponsorship poses a serious limitation. Interview highlighted the fact that there is team teaching in some faculties but it only entails that both mentors and mentees teach same courses but go to class at separate periods. Since they do not go to class at the same time mentoring is not clearly discernible in this method.

The mentees are suppose to consult their mentors. This is normal but Ogomaka (2013) advised that mentors should also be observant to see where the mentees needed helps. This is because the mentee may not to always find it comfortable to appear before the mentor presenting his/her deficiencies.

Summary and Conclusion

Mentoring is one professional growth programme that does not necessarily require extra charge/expenditure. It is an in-house management outfit which workers in an organization use to perpetuate their character and relevance to the outside world. It has human interpersonal relationship as its major attribute. Mentoring programme appears to differ according to institution. Mentoring programmes of the institution in this study is stronger at the postgraduate than at the undergraduate levels. Much as mentoring is fairly adequate in the area of research network, linkages and synergy, it is below expectation in areas of research teaching and supervision. This is traceable to the fact the mentors and mentees are freely left to locate themselves. This finding was further attested to by the results of test of hypothesis two (2) which shows that mentoring is faculty variant. However, both the mentor and the mentees agree to this results as in test of hypothesis one (1). Mentoring in the institution is largely informal. Research is very technical, it

tasks individual to think ‘outside the box’, achieve creative solution to problems, avoid wastes, proffer useful policies and advance development of human persons and nation. These are possible if research results are not misleading. Academics whose duty it is to advance the course of research should not toy with mentoring because compromising research quality means to compromise national development. Supervision of undergraduate students’ research should be given more impetus. Informal mentoring has obvious limitations of lack of commitment on both parties (mentor and mentee). If care is not taken, mentoring will gradually become extinct with passage of time with no individual to be held responsible.

Recommendations

The following recommendations are made based on the findings

1. Mentoring should be institutionalized for quality assurance in research reports.
2. There should be policies that will enable faculties to assign young staff to the most senior members of the faculty for purposes of mentoring.
3. The mentor should scrutinize the mentees supervision of students’ research efforts.
4. Highly exposed staff should be employed in areas where mentors are lacking. Any employment of staff should have a good mix of mentors and mentees.
5. There is need to strengthen mentoring through institutionalization to remove it from optional to mandatory lists of functions.

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The incorporation of Radio Frequency Identification Technology in health institutions and the determining aspects of adoption

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Abstract

The process of traceability by radio frequency identification system (RFID) is considered one of the biggest contributions of the last years in the health sector. This article aims to study the academic contributions that this technology has brought to the segment in question and the consequent difficulties resulting from the implementation of this technology in the ambit of hospital and outpatient facilities. To carry out this work, we proceeded to survey and literature review in order to select the research related to the topic of RFID in the context of traceability. The data obtained clearly show that the benefits of this tool are numerous, ranging from drug screening to the correct availability of patient data. Although it is imbued with all these advantages, RFID still represents a visible difficulty of insertion in the hospital environment due to economic and security problems in terms of information privacy. However, this new reality is undeniable and its implementation is increasingly present in the medical environment, being a necessity rather than a technological advance.

Keywords: RFID; management; traceability; technologies; services; health;

1. Introduction

In the middle of the information age, it can be said that the technology involved in this process has made effective contributions to society. It is also worth noting that it is in this direction that the traceability process is moving through Radio Frequency Identification Technology (RFID), which brings a series of advantages that contribute increasingly to the social advance in the instant identification of objects,

properties, animals and people. In this sense, this tool has been configured as an important instrument for control, localization, tracking and identification of various utensils and objects, giving them an identity capable of effectively collaborating in the control and monitoring of services in the field of health. Building intelligent hospitals with streamlined processes and fluid workflows is the goal of all institutions that claim to be modern and advance in line with aspects of modernity. However, for this to happen, it is necessary to use means that provide conditions to explore this objective. Since RFID has been increasingly incorporated into medical institutions, it is of fundamental interest to seek to report and acquire more information on this technology, to provide a greater science of medical advances through it.

According to Fuhner and Guinardi (2006), an alarming statistic in health care organizations in America reveals that 195,000 people died in the US in hospitals from 2000 to 2002, victims of potentially preventable medical errors. The numbers also show that the problem is not that non expert people take care of other people, but work in bad systems that needs to be safer (Fuhrer & Guinard, 2006). The default of a system that provides greater integrity and security to health institutions seems to be primarily responsible for this situation.

With RFID, such problems could be avoided, as this system not only gives greater accuracy about the information reaching health professionals, but also gives greater control over all actions taken by the medical team regarding patient. According to Linda et al., this inhibits errors, because it gives the team access to more concise data, as well as the accountability for actions taken by the team more clearly, inhibiting medical error (Castro et al., 2013).

With regard to health care, society has been demanding greater efficiency and quality of care, which has led to increased complexity, placing hospitals under great pressure to reduce costs and ensure exceptional service to the general public. It is in this context that information and technology communication, especially RFID, are emerging as a tool to assist hospitals in their most efficient goals (Caldas, 2012).

Within the hospital setting, although the technology is being implemented, it is possible to list a number of medical healthcare applications that make the difference, such as human RFID tag implants, which contain all the information about a patient who enters the hospital, as well as monitoring the production of medicines along the production chain and improving the production of quality management of these medicines (Kalagiakos & Ria, 2006).

These are some of the reasons that make health care the next use of RFID, and how the presence of information technology (IT) in hospitals and healthcare systems is increasingly pressing as a competitive differential, as it provides better patient care. Both the healthcare system and the medical team and the patient have to gain from RFID, which is a tool of undeniable strategic, tactical and operational value (Pedroso et al., 2009). Other applications also point to RFID as the replacement of patient surveillance devices, blood center control, newborn security, supply chain management, and greater control of counterfeit and drug theft, among other things. The value of RFID lies in the fact that it is intelligent administration equipment that serves to assist the hospital in its management and operation of its daily processes (Castro et al., 2013; Rizzotto et al., [s.d.]; Wang et al., 2016). This procedure differs from the others by the careful attention to the observation of all hospital activities through an effective and constantly updated computer system.

Building smart hospitals with improved processes and fluid workflow is the goal of all institutions that

claim to be modern and advanced aligned with aspects of modernity. However, for this to happen, it is necessary to use means that provide conditions to explore this objective. It is believed that, since RFID has been increasingly incorporated into medical institutions, it is of fundamental interest to seek, to report and acquire more information on this technology, in order to provide a greater science of medical advances through it. In addition, several circumstances hinder and prevent the true incorporation of this technology in order to provide a greater science of medical advances through RFID. Thus, it is intended throughout this article, to find out what are the contributions that RFID technology and the traceability process have brought to the health area, as well as to evaluate how these tools are contributing to patient care and the evolution of the health system as a whole. It is also worth highlighting the multiple advantages of using these instruments in the health sector, as well as the main factors that hinder their effective implementation. The health industry is considered one of the largest sectors of the economy and is an important space for innovation and capital accumulation, generating investment, income and employment opportunities, this is, it is an essential locus of economic development. Wamba et al. conducted studies on the quality of care in hospitals, revealing that this sector already faces several challenges, including the increase in operating costs and high numbers of medical errors, as well as a gradual aging population that has been intensifying, in the last decades. Also, according to Infante, the health organization is defined as a productive health care system, where the supply sector is integrated as a subsystem to meet the needs of inputs and equipment (Wamba et al., 2013).

Besides, it is worth mentioning the selection of materials and inventory management that defines the materials used in the hospital and the ways to monitor consumption levels that allow them to be the program for their acquisition and distribution. They are critical processes of the organization, highlighting the interface between clinical professionals and the supply sector as critical to the organization of supply. Already in Farouk's view, the hospital environment is a complex system with the large physical flow (medicines, materials, patients and documents), large flow of information (medical prescription, patient records, medical records) and large financial flow (patient accounts, receiving and paying financial transactions). Traceability can be defined as an identification system that allows us to retrieve the origin and history of the product at all stages of the supply chain, from raw material production to end-consumer use. Several technologies can be introduced to ensure product traceability in conjunction with quality processes such as barcodes, QR codes, Quick Response, and radiofrequency recognition (RFID, Radio Frequency Identification) (Metzner & Cugnasca, 2015).

RFID is essentially an electronic radio frequency technology that enables automatic identification and location of objects, people and animals in a wide variety of jobs. A brief description of the operation of the RFID system involves the detection and identification of a tag using the data it transmits. This requires a tag (also known as a transponder), a reader (also known as an interrogator), and antennas (also known as a coupling device) located at each end of the system. The reader is connected to a central computer or other equipment that has the intelligence needed to further process the tag data and take action. The computer is usually part of a larger computer network and, in some cases, is connected to the internet (Bhuptani & Moradpour, 2005).

There are three types of RFID tags: passive, active and semi-active. A passive RFD tag receives power through the radio frequency signals from the reader. An active one has a battery attached to each label, so

it enables a larger memory and more features. A semi-active tag communicates with the reader as if it were a passive tag, but additional modules can be supported by a small internal battery. From this, software is responsible for converting data into meaningful information. It is a wireless Automatic Identification and Data Capture (AIDC) technology that uses radio signals to remotely identify an object, store or retrieve information about it, stored in the tag that is attached to it, placed on the object. Within logistics, traceability directly affects the quality of patient care.

The error reduction made possible by an intelligent system directly reflects user safety as it is possible to reduce human interference significantly in the checking and information capture processes.

The literature on RFID technology is rich and diverse, and much has been written about its use that is becoming increasingly used worldwide. In this context, the objective of this research is to perform an integrative literature review, and through it systematizes what are the advantages and disadvantages in the use of RFID and what has been produced about it in the hospital environment.

Based on the premise that RFID implementation and adoption are barriers and advantages, the study aims to examine through an integrative literature review the factors that inhibit or stimulate the use of RFID in the hospital area.

2. Materials and Methods

In this inquiry the adopted method was the integrative literature review. Initially, we proceeded with a database search that revealed a large number of articles on the research theme. In the case of this research, the keywords RFID and health, and RFID and healthcare in both English and Portuguese languages were used.

The integrative literature review is a method that provides the synthesis of knowledge and the incorporation of the applicability of results of significant studies in practice (Souza et al., 2010). For Mendes et al, the integrative literature review aimed to gather and summarize the scientific knowledge already done on the investigated theme, IE, it enables the search, evaluation and synthesis of available evidence so that it can help in the construction of knowledge on the theme in the area (Mendes et al., 2008).

Regarding the study inclusion criterion, all articles that reported investigations on the subject were included, including descriptive, observational, quantitative and qualitative studies. The criteria used for the selection of the material were: all articles on the subject in question that were directly related to health, that were not exclusively of a technical nature, that were not related to animals, that made available the full texts, which preferably related to hospital health, which were exclusively addressed by authors seeking to reflect on the positive and negative data on the use of RFID. Articles that contained technical reports, that worked with animals, that did not provide the full texts and that only sought to describe systems implementation were excluded.

The survey period was from January 2010 to December 2019. The motivation for the initial period of 2010 was due to the fact that in Brazil the date of the first implementation of RFID technology in a hospital environment was made at Albert Einstein Hospital, located in São Paulo, the capital, which was thought to be a good starting point to exhaust the contributions and shortcomings of such a tool.

Capes, LILACS, MEDLINE, Pubmed and SciELO were used as databases.

The study was divided into three moments. The first one searched and selected articles that contained the intended theme and all articles were selected. In the second moment, the abstracts of articles that apparently in their titles were related to the area of interest were read. In the third, the full reading was done to verify the inclusion or exclusion of articles in the review e, ending with its categorization and analysis.

Initial search in several databases reported about 600 different studies. Based on their titles and abstracts, the number was 120, and after reading the respective texts, 48 articles were selected to compose the work, according to the degree of importance and the diversity of the approach used. It should be noted that the research was conducted in isolated databases and that many titles were repeated. For the approximate number of 600 articles, account was taken of their duplication, since the same article could be in two databases. In addition, the number of articles with the terms RFID and health and RFID healthcare was added.

3. Results

As a result of this study on hospital RFID traceability, a brief summary of the survey's quantitative data was initially obtained. Then, we analyzed the chronological distribution of the articles of great impact to subsequently survey the most relevant authors, articles, scientific journals and institutions. Thus, for the analyzed data, all factors related to the quantity, articles, authors, journals, countries and institutions were taken into account during the analyzed period. In Figure 1 we can see the process of job selection:

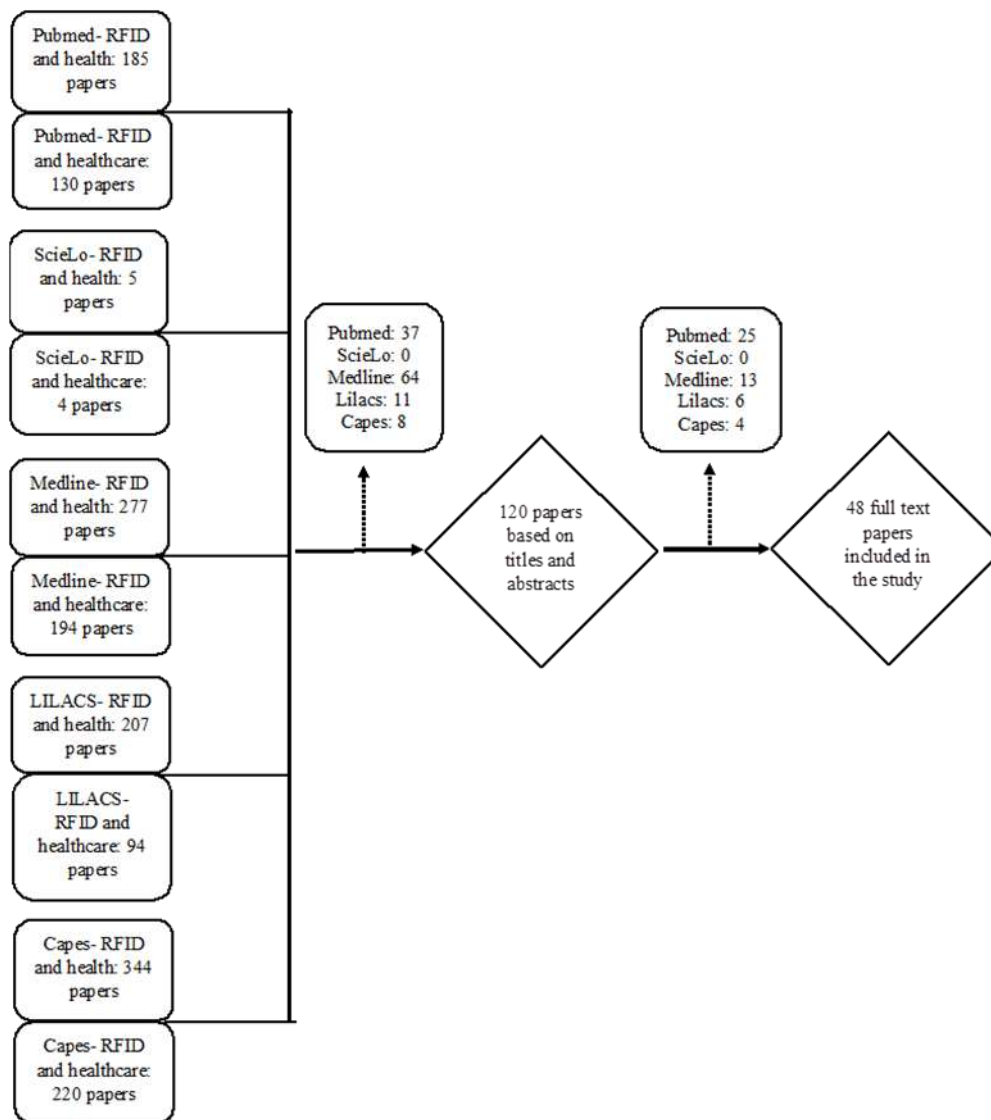


Figure 1. Job Selection Process Board.

Prepared by the authors (2019).

To continue the proposal of the article, about 600 studies have found in different databases, of which 48 were being used for this work. To analyze the source of the studies, the conclusion shows that most of them, 52% (25) came from Pubmed (Table 1). Secondly, 27% (13) articles were been found in Medline and the remaining 21% (10) in the Capes and LILACS Journal portal. No articles related to the topic were been found in the SciELO search (Table 1).

Table 1. Distribution of selected publications based on 2019 query sources

DATABASE AND SOURCE OF CONSULTATION	TEXTS RELATED TO THEMATIC	Selected publications	
		(n)	(%)
MEDLINE	471	13	27%
SciELO	9	0	0
PUBMED	315	25	52%
PERÍODICOS CAPES	564	4	8%
LILACS	301	6	13%

Source: Prepared by the authors.

The most used source was the Journal of Medical Systems and the Journal Sensors, with 15% of the total papers, with the remainder distributed with the other journals (Table 2).

Table 2. Distribution of articles according to bibliographic

Bibliographical Sources	Selected Articles	
	(n)	(%)
Am. J. Infect. Control.	1	2%
American Journal Health System Pharm	1	2%
American Journal of Pharmaceutical Education	1	2%
AMIA Annual Symposium Proceedings Archive	1	2%
Ann. Biomed. Eng.	1	2%
Aorn Journal	1	2%
Asian Pacific J. Cancer Prevention	1	2%
Enegep	1	2%
Facilities	1	2%
Heath Care Management Science	1	2%
IEEEExplore	2	4%
International J. Health Geographics	1	2%
International Journal of Information Management	1	2%
International Journal of Health Care Quality	1	2%
International Journal of Medical Informatics	1	2%
International Journal of Pervasive Computing and Communications	2	4%
International Medical Informatics Association	1	2%
Journal American Geriatrics Society	1	2%
Journal Med. Toxicol.	1	2%
Journal of Biomedical informatics	1	2%
Journal of Thoracic Disease	1	2%
Journal of Medical Systems	6	13%

Journal of Research in Medical Sciences	1	2%
Journal PLOs One	4	8%
Pakistan Journal Medical Sciences	1	2%
Perspective in Health Information Management	3	6%
Sensors	7	15%
Surg. Endosc.	1	2%
Technology and Health care	1	2%
Telecommun System	1	2%
Total	48	100%

Source: Prepared by the authors.

The publications chosen were mostly from 2015 and 2018 with 23% (11) and 21% (10) respectively. Following are 2016 with 17% (8) of publications and 2013 with 15% (7) each; 2017, 2014 and 2012 with a total of 6% (3) each and finally 2019, 2011 and 2010 to 2% (1) of the articles selected respectively (Table 3).

Table 3. Publications used by year and author and by magazine

Author	Year	Newspaper
Aboelmaged & Hashem	2018	International Journal of Medical Informatics
Ajami & Carter	2013	Pakistan Journal Medical Sciences
Ajami & Rajabzadeh	2013	Journal of research in medical Science
Alharbe & Atkins	2014	International Journal of Pervasive Computing
Alharbe & Atkins	2016	International Journal of Pervasive Computing and
Álvares López <i>et al</i>	2018	Sensors
Asamoah <i>et al</i>	2018	Health Care Management Science
Asgharzadeh-	2017	Technology and Health care
Barry <i>et al</i>	2018	Journal American Geriatrics Society
Castro, Lefebvre	2013	Journal of Medical Systems
Chai <i>et al</i>	2015	Journal Medical Toxicology.
Coustasse <i>et al</i>	2013	Perspective in Health Information Management
Coustasse <i>et al</i>	2015	Perspective in Health Information Management
Coustasse <i>et al</i>	2016	Perspective in Health Information Management
Decker <i>et al</i>	2015	American Journal of Pharmaceutical Education
Hamm <i>et al</i>	2018	American Journal Health System Pharm
Hazarika <i>et al</i>	2019	International Medical Informatics Association
Hu <i>et al</i>	2014	Telecommun System
Huang <i>et al</i>	2016	Surg. Endosc.
Isella <i>et al</i>	2011	PLOs One
Kusuda <i>et al</i>	2015	International Journal of Health Care Quality
Lakshmi Dhevi <i>et al</i>	2018	Journal Medical System
Lucet <i>et al</i>	2012	PLOs One
Marchand-Maillet <i>et al</i>	2015	Journal of Medical Systems

Martinez-Pérez <i>et al</i>	2012	Sensors
Martinez-Pérez <i>et al</i>	2016	Sensors
Martinez-Pérez <i>et al</i>	2016	Sensors
Martinez-Pérez <i>et al</i>	2018	Sensors
Metzner e Cugnasca	2015	Enegep
Ozella <i>et al</i>	2018	PLOs One
Péres, Gonzáles e Dafonte	2017	Sensors
Pineles <i>et al</i>	2013	Am. J. Infect. Control.
Radhakrishna <i>et al</i>	2015	Journal of Medical Systems
Roper, Sedehi e Ashuri	2015	Facilities
Safdari, Maserat e Maserat	2012	Asian Pacific J. Cancer Prevention
Sejdic <i>et al</i>	2013	Ann. Biomed. Eng.
Sipes e Baker	2015	Aorn Journal
Torres <i>et al</i>	2017	PLOs One
Trcek	2016	Sensors
Uy, Kury e Fontelo	2015	AMIA Annual Symposium Proceedings Archive
Vakili <i>et al</i>	2015	International J. Health Geographics
Vankipuram, Traub e Patel	2018	Journal of Biomedical informatics
Wamba, Anand e Carter	2013	International Journal of Information Management
Wang, Hung e Yen	2016	Journal of Medical Systems
Wang e Zheng	2018	IEEEExplore
Yao, Chu and Li	2010	IEEEExplore
Yoo, Hwang e Jheon	2016	J. of Thoracic Disease
Zailani <i>et al</i>	2014	Journal of Medical Systems

Prepared by the authors.

The most used approach was applied research, with 28% of the total articles, and analytical studies with 19% of the total. Third is the literature review work with 17%. In fourth place we have interview studies and pilot studies with 10% and last fifth we have prototypes for study with 8%. (Table 4).

Table 4. Classification of Articles by Most Used Approach

Approaches	Number of Newspapers	Percentage
Literature review	8	17%
Case Studies	4	8%
Interview Studies	5	10%
Analytical Studies	9	19%
Prototype for Study	4	8%
Pilot Study	5	10%
Applied Research	13	28%
Total	48	100%

Source: Prepared by the authors.

All of these articles classified this technology as an important tool in the daily practice of the hospital context. In the article by Uy et al, the author notes that the safety standard of medication practices requires the observance of five factors: drug, time, dose, routine and right patient. In this context, the use of tools that automate administration corresponds to a decrease in the number of errors, precisely because it minimizes human factors in the process (Uy et al., 2015). The author also reveals that tools such as bar code, RFID and biometrics suggest effectiveness in the course of processes, but that RFID, in particular, has as a determining factor in its use that it removes the signal line required by scanners from the code bar and the ability to be programmable. All of this leads both patients and medical staff to gain efficiency and safety by having this technology, as medication errors are prevented once the right patient is informed that they are taking the right drug, due to the infrastructure adopted by the hospital. In addition to making it easier for nurses, clinicians and pharmacists to work, RFID also saves time reading handwritten recipes and makes it possible to find errors faster when they occur.

Ajami and Carter, when performing a bibliographic research, bring data about RFID in the emergency rooms of hospital centers. They show through multiple sources of study (libraries, databases, Google searches, and conferences held) how this technology can contribute to overcoming errors in patient care, workflow optimization, and reducing emergency room costs. For these authors, it is evident that RFID leads to excellence and improved quality of care in the health sectors. They also point out some disadvantages that prevent the formalization of this technology in hospitals. These are: insufficient hospital budget, the complexity of technology and systems, still very high costs for hospital procurement, and technological and privacy limitations. Among these disadvantages, which most seem to limit the adoption and expansion of RFID use, is security, as there is a concern with the data that will be captured by the system (Ajami & Carter, 2013).

The authors are betting on the quality of health care through this technology, as some of Singapore's largest hospitals, such as Alexandra Hospital and National University Hospital, implemented RFID technology to track equipment during the Severe Acute Respiratory Syndrome epidemic (SARS), a respiratory disease of Asian origin, which hit the city. Other countries like China, Philippines, South Korea, Japan, among others, are massively implementing this technology. In one of the largest surveys ever conducted on the benefit of RFID in the United States, it was found that 70% cited patient safety as the key deciding factor in the implementation (Ajami & Carter, 2013). In a similar study, Isella et al., used RFID to study and measure nosocomial context between different people and functions within the hospital as a way to verify the precise parameterization of the spread of infections in contact between patients and health professionals. This allowed the development of preventive measures for nosocomial respiratory infections, as well as outlining strategies to control the target of the disease and the affected community, inhibiting its spread (Isella et al., 2011).

Authors such as Asamoah et al. assert that RFID provides a decrease in waiting times and hospital queues, improving health resource utilization (Asamoah et al., 2018). Some also point to such technology as an important tool for capturing real-time data and information, which impacts possible interventions and changes (Vankipuram et al., 2018). And in evaluating clinical geriatric health is an important instrument, as it lends itself to determining the health conditions of the most varied forms of older people (Barry et al., 2018).

Radhajrisha et al. understood that RFID can help contain health care-associated infection, which is projected on the world stage as a serious problem to be contained, with an index of 10-20 patients subject to nosocomial infection in the United States. According to the author, the installation of an RFID system in the intensive care center provided a significant increase in hand sanitation and, consequently, an increase in the hygiene of doctors and medical staff, as well as leaving its registered whenever someone was exempt of this practice (Radhakrishna et al., 2015). However, some authors in similar studies found significant differences in the number of hand hygiene by employees in everyday situations, and RFID is not as effective as in the previous study. This was partly justified due to the workload of the period the professionals were facing, also due to the location of the sanitizing dispenser or due to signal inability when the sensor is between the sanitizing water and the badge, which makes proper communication difficult (Decker et al., 2016; Pineles et al., 2013). However, Martinez Peres, Gonzales and Dafonte in a similar situation state that problems with reading through liquids, glass and plastics can be solved 100% thanks to the flag-mode RFID passive tag location strategy that prevents interference with certain materials. Providing a significant increase in the quality of care received by patients during treatment (Martínez Pérez et al., 2016b).

One of the main goals of hospitals is to increase the quality of patient care, as each task is vital for patient protection. In this particular article, the authors are concerned with the drugs that are used for treatment and which result in high levels of poisoning that can result in the patient's death (Pérez et al., 2017). To avoid this type of occurrence, Peres, Gonzáles and Dafonte use an RFID system for intravenous mix administration and propose a scheme that allows for patient/intravenous mixing and tracking. According to the authors, the evaluation of this work was very positive, since the system has been working well for years and is continuously involving more patients and treatments considered high risk and high value. With RFID, it is possible to evaluate the patient's pharmacotherapeutic profile, as well as the weight, height and evolution of the pathology, ensuring that another patient will not take the preparation that would surely cause his death. In addition, compared to other technologies, RFID makes a decisive contribution to these tasks, improving safety and efficiency in its ability to unambiguously identify patients, intravenous mixtures and their components (name, lot number, expiration date) (Pérez et al., 2017). In this case, a medical alert allows the recording of data to be known on time and in real time, for the patient to whom a specific batch of medicine was administered. This whole process undoubtedly contributes to a greater efficiency of the procedure. In this case, a medical alert allows the recording of data to know on time and in real-time for the patient to whom a specific batch of medicine was administered. This whole process undoubtedly contributes to greater efficiency of the procedure (Pérez et al., 2017).

With RFID, it is possible to update in real time whether the equipment is available or not, where it is, and if there is a problem that should be passed on to the maintenance department. In addition, workflow becomes easier and permanently dynamic. With the RFID system, knowledge and experience can be gained, which demonstrates that the emergence of intelligence processes associated with air pump storage, use, and maintenance activities improves the administration of mobile equipment, while at the same time focus on patient care. The author also points out as a barrier to the use of RFID the necessary costs, as well as the bureaucracy that constitutes a limiting scenario so that it can expand fully (Castro et al., 2013). Hamm, states that an emergency medication tracking and administration system enables a 74% decrease in task performance compared to traditional systems (Hamm et al., [s.d.]).

Another important use of RFID is the administration of surgical instruments that can be forgotten inside the patients' bodies, causing extensive harm, or getting lost in the hospital, causing difficulty in finding the instrumentation at the right time. Compared to other existing methods such as barcoding, attaching RFID tags to surgical instruments has several benefits. Barcoding has limitations, such as the fact that bloodstains require frequent and new prints because it makes labels unable to be read. In addition, because of its nature, barcoding allows only one instrument to be read at a time, unlike the RFID system, where there may be multiple readings of the surgical instrument at a time, effectively supporting the central supply department of sterilisables. RFID also decreases the number of surgical items retained in various hospital wards, ensuring the traceability of any instruments purchased and available. This technology still manages the system where infection was possible, reducing this occurrence, since in equipment that requires more accurate sterilization, RFID is not only able to locate but also gather information for individual administration procedures (Kusuda et al., 2016).

In a study of the positive and negative effects of the implementation and use of RFID in medical transfusion systems, it highlights that among the benefits is the fact that the patient is given an identification in the form of a bracelet, which allows its tracking and any information throughout the transfusion process. With RFID, it is still possible, through mobile equipment, to verify the patient's identification and the entire treatment procedure to be applied to him. In this way, medical teams can scan the patient and blood bag during the process, sending data to the system and thus informing that the process is complete (Coustasse et al., 2015).

Benefits related to using RFID include not only improving the supply chain, but also saving lives and improving patient conditions. Barriers to the implementation of this technology include risks involving the privacy and security of patient information. It is noteworthy that the use of low quality labels may increase the probability that patient information will be accessed by unauthorized persons. Besides, of course, the cost, which represents a major obstacle to the implementation of this tracking technology. In this regard, it can be stated that among the technical issues we have: the fact that RFID interferes with the hospital environment and medical devices; not always reliable, depending on factors such as object label, place of labeling, angle of rotation and actual distance. Another technical issue concerns the lack of commonly acceptable standards that allow for industry standardization and ultimately prohibit the use of large-scale RFID, including standard data structure, air interface and local interface. Economic issues include the cost factor that includes an initial investment in hardware and software, training, as well as the constant high capital investment in infrastructure, maintenance, and upgrades that are required throughout the operation (Coustasse et al., 2015).

There is a constant concern about the confidentiality of data transmitted via the RFID method, because when labeling a person with the RFID tag, virtually a range of personal information is available such as patient name, gender, home address and medical history. This information is highly mobile and sensitive and should be ensured that this information is strictly personal or confidential, so it is believed that some information should be restricted to RFID technology. However, restricting information would be a barrier to the full development of the system. In turn, it is fully believed that they should be stored on secure servers and that people with high ethical commitment should be assigned to the control of information.

As you can see, there are some obstacles that stand between RFID and its full implementation, so we must

make it clear that the adoption of this system should overcome these barriers that are irrelevant when compared to its benefits. Research into the use of RFID to predict patient turnover in a university outpatient surgical center found that the technology was able to match the length of stay of patients in the outpatient surgical unit by seventy-five percent operation. This made it possible to control patient flow by improving the utilization of resources that have been converted into financial benefits for the hospital. In addition, this form of tracking also allows for faster procedures between patients, avoiding overcrowding and traffic, which not only improves processes, but also results in patient satisfaction that does not have to wait for unnecessary delays. According to the author, one of the factors that contribute to making RFID less usable is the cost of its implementation, which should be evaluated by hospital administrators, since this technological tool improves and facilitates institutional procedures (Marchand-Maillet et al., 2015).

In seeking to understand the determinant factors for the use of RFID in healthcare in Malaysia, Zailani et al undertook an investigation with hospital managers and members directly linked to this area and the support team, through determinant tests in the area adoption of this technology. The results showed that perceived ease of use (the degree to which a person realizes that the use of this technology will be effortless), perceived utility (which refers to one's perception of how the new technology will help them performing their tasks) and the social influence of the implementer has a positive effect on the intention to adopt RFID in Malaysian hospitals (Zailani et al., 2014). Other authors are betting on the robustness of the system and the ability to monitor in real time and the immediate and retrospective collection of available data, which makes RFID a unique device (Huang et al., 2016).

Variables such as security and privacy concerns have had negative effects on the possibility of using this technology, directly affecting managers' intention to adopt it (Zailani et al., 2014). According to Zailani et al, if managers are able to reinforce the perceived ease of use and usefulness of new health care technologies, RFID could be more easily implemented by the team. The author also notes that information security and privacy issues should be targeted by government policies that should dictate how these rights should be protected. These policies should demonstrate how the data will be obtained by the system and clarify who will handle it, and show how the security of this personal data will be protected by those responsible for obtaining it. Only by informing the purpose of data collection and the importance of this procedure for care in hospital institutions, it will be possible to spread the adoption of this technology more widely.

There are many uses in which RFID can be used as we are seeing. For Ozella et al, quantifying and monitoring the contact rate between people with infectious diseases such as pertussis and healthy people is one of the uses that is becoming essential since through this technology it is possible to study and combat the spread of diseases (Ozella et al., 2018).

In the view of some, RFID today is an essential resource for supporting a broad spectrum of patient care activities. When approaching this technology to monitor infusion pumps, it became clear that the efficiency and productivity gain is so wide that it is difficult to measure. In fact, in addition to the gains in control and savings that come from avoiding losses and thefts, the speedy monitoring process and the availability of so-called essential hospital medical instruments outweighs the investments required to implement this traceability technology (Castro et al., 2013). It is noteworthy that, within the hospital system, the beneficiaries are:

- Clinic doctors who can be found almost immediately, as well as the possibility of monitoring and

optimizing your hospital round;

- Patients in which RFID can be attached to wrist straps, allowing patients to be monitored in real time, as well as preventing access to prohibited areas for them;
- Medical staff, patients and visitors. The source of contact with an infected patient can be determined, as well as the people who contacted him or her in the event of an outbreak.

Ajami and Rajabzadeh, say that RFID technology is used for three purposes (Ajami & Rajabzadeh, 2013):

- 1) Tracking, because it allows the identification of a product quickly for patients and medical staff, reducing the time required for localization, making this process less problematic;
- 2) Inventory management, an important aspect of the organization, as it enables administrators to monitor inventory by making the right equipment available at the right time and when needed;
- 3) Validation, as it ensures that an action taken or a desired item is available, i.e. the ability to validate procedures through RFID technology can reduce medical errors, check productivity and help build the documentation needed for administrative purposes audit.

It should be emphasized that the most important function of validation is to verify that the treated patient is, in fact, who he / she really should be, with the proper treatment. The authors also concluded that with regard to the healthcare industry, there are numerous advantages to using RFID, such as reducing process costs, time, human resources, preventing theft, increasing job accuracy, the reduction of human errors, improving safety and patient satisfaction. For them, there is no doubt that in the coming years, RFID will be a highly required health equipment. If integrated with the hospital information system, electronic health recordings, and clinical decision support system, this tracking technology will make processes easier by reducing the number of doctors, misdiagnosis, and wrong drug introductions (Ajami & Rajabzadeh, 2013). The use of RFID technology stands out for facilitating the tracking of the movement of cargo units, regardless of the type of packaging or form of distribution. According to Capozoli, in 2011 alone, 850,000 units of counterfeit drugs were seized by the National Surveillance Agency (ANVISA) in Brazil (Capozoli, 2013). This number represented a twelvefold increase over the previous three years. Martinez-Peres et al., by integrating multi-sensor RFID in an intelligent environment to monitor patients and the elderly, found that despite increasing costs, it significantly helps improve quality of life (Martínez-Pérez et al., 2012). Alharbe and Atkins state that monitoring and tracking objects and people transmitting in real time to the internet network is one of the institution's goals, which is only possible through the integration of RFID with ZigBee technology, which ensures benefits such as patient safety and identification of important medical equipment and devices, all simultaneously (Alharbe & Atkins, 2014).

Another use of RFID is in the incorporation and integration with medicine pills for various diseases. This type of use, in addition to greater adherence to treatment, enables the doctor to monitor treatment more precisely, especially those diseases considered chronic and in the end the RFID device is eliminated along with the stool without major complications (Chai et al., 2015). RFID is more accessible than some technologies such as infrared, and is easier to acquire and manipulate. For this RFID allows an effective supply of information flow, although it is no more reliable than infrared (Vakili et al., 2015).

Wang, Hung and Yen bet that the use of new information technologies in clinical diagnostics and training has significantly improved the effectiveness of rehabilitation. For them a patient care and monitoring system such as RFID can be attractive as it supports the hospital and the patient in rehabilitation. In addition,

each patient can be individually controlled and tracked, which reduces staff workload and gives full knowledge of the patient's treatment (C.-S. Wang et al., 2016).

In the health field in general, RFID has helped to reduce drug costs in pharmacies, increasing effectiveness in administration, supply chain security and patient dispensing (Coustasse et al., 2016). For the author, the implementation of RFID alone is not enough, it needs to be integrated with other information technologies. Sejdic et al (Sejdić et al., 2013) argues that the next step in dealing with RFID is to consider the idea of internet of things (IoT), enabling a much broader and more effective scenario for the patient. The engineering of the future will involve IoT and RFID and will enable greater acuity in patient care and hospital problem solving for accuracy and efficiency.

In line with these studies Trcek (Trček, 2016) states that numerous areas of our lives are becoming dependent on IoT structures, which include NFCs, RFIDs, RFIDs with sensors, and single sensors. For this author, the issue under discussion is about privacy, although he believes that it is an illusion according to history. In cancer treatment, RFID enables better care by ensuring that hospitals and clinics have greater availability of chemotherapy drugs, less treatment replication, and equipment loss, which saves inventory costs. In addition, it manages people, identifying in an excellent way, producing a new level of service (Safdari et al., 2012; Sipes & Baker, 2015). Sipes e Becker stated in a study about the perioperative scenario implications that RFID facilitates workflow, reduces costs and improves process management and efficiency. The monitoring of labels inserted on the garments enables the regulation of access to hospital wards, the cleaning of clothes and the authorization of people to access the most diverse sectors (Sipes & Baker, 2015).

RFID has become a key technology for logistics and institutional administration, so it has a lot to contribute to industry 4.0 and e-Health in healthcare applications (Álvarez López et al., 2018). RFID deployment has been quite slow due to some shortcomings, including (Aboelmaged & Hashem, 2018):

- Technical complexity: Lack of a global standard, multiple tag frequencies of different architectures and system operations. In addition to compatibility with various vendors and customers, which require multiple specifications (such as long or short frequencies, antenna models and readers among others)
- Organizational resistance: It is generated due to anxiety and resistance among employees, as a new way of doing work emerges.
- Environmental uncertainty: Failure to predict positive or negative trends tend to cause uncertainty, which in the case of RFID concerns the prospects for risks and debates about privacy disputes, and how it may interfere with successful implementation. In addition, lack of government support induces negatively, generating a lack of enthusiasm.

Moving in this direction, Aboelmaged and Hashem, list the facilitators of the adoption of RFID technology, they are (Aboelmaged & Hashem, 2018):

- Technical advantages: reflect the benefits of new technology that outweigh existing ones, or other existing innovations. RFID technology enhances both strategy and operational effectiveness of the healthcare service, providing safety and visibility to processes.
- Organizational capacity: It is a multidimensional concept related to the resources, facilities and attributes of an organization. The implementation of new technologies could be facilitated through the appropriate acquisition of organizational capacity in terms of adaptability to change, secure infrastructure

and resources, making use of beneficial knowledge and experience of the new system. Thus, organizations with inappropriate capabilities are more likely to invest in new innovations, acquire or maintain high employee skills, ensure cost and foresee the benefits associated with innovation.

- Environmental competitiveness: It is an essential skill for assimilating innovation. Health services can therefore be regarded as a dynamic industry that is vulnerable to changes in health management methods as a result of pressures from patients, new rival hospital institutions, government pressures and regulatory authorities along the supply chain, that can influence services for better quality and lower cost.

Wang and Zheng propose a prototype for multi-user breathing monitoring, which according to them is possible and allows non-intrusive monitoring (Y. Wang & Zheng, 2018). Dhevi et al., from this angle, consider RFID a powerful tool that can monitor body glucose levels and heart rate (Lakshmi Dhevi et al., 2018).

According to work done (Ajami & Carter, 2013), RFID not only enables advantages, but also brings with it some barriers that make implementation somewhat difficult. These include insufficient budget availability, complexity of technology and system, very high cost of acquisition, technological limitations by the hospital, and concern for patient privacy. Yao, Chu and Li also point to privacy as one of the central issues that hamper the popularization of RFID broadly within society (Yao et al., 2010). Concern about the reception of information by malicious people has been one of the main reasons for concern among those who bet on the adoption and widespread use of society as a whole (Ajami & Carter, 2013).

The implementation of the traceability process through RFID requires some investment and the issue of privacy is widely discussed in the literature. However, some authors disagree that this technology may be easily accessible to third parties. It is worth noting that bureaucracy is another strong obstacle that hinders the spread of RFID through professional rigidity, institutional inertia, complexity and inflexibility, which are not good conductors for large hospital changes (Castro et al., 2013). In addition, cultural barriers are also imposed on the adoption of new technologies, such as reluctance and discomfort with entirely new computers and devices. This feeling of reluctance and distrust of new technological frameworks is one of the limiting factors for the expansion of its use to become massified and widespread in the hospital spectrum. Among the negative aspects of RFID is the possible interference with the operation of cardiac pacemakers. Thus, laboratory tests describe that RFID systems can have an effect on those implanted with cardiac management devices, especially those that emit low frequency bands (LH and HL) (Sejdić et al., 2013). The center of the University of Pitsburg has been working on a solution to this problem. While the cost may turn out to be high, it is justified in context precisely when it comes to hazardous treatment and expensive medication. In addition, reducing human errors, improving service efficiency, and waiting time lead services to a higher level of quality. In this case, the application of intravenous RFID mixtures substantially removes the error in the application of expired or exchanged drugs, contributing to the sustainability of the system (Martínez Pérez et al., 2016b).

Yoo, Hwang and Jheon give RFID significant value in patient care and satisfaction. In the adoption of RFID in the Bundang Hospital at Seoul National University, they said such technology reduces the workload on nursing staff, increases accuracy in checking patient documentation and information, prevents medical errors, and promotes the efficiency of resources for emphasizing accountability (Yoo et al., 2016). In addition to the advantages already described, RFID promotes increased motivation to improve the

organization and updating of the institution, favoring increased visibility of institutional excellence, and over time reducing budget redundancies (Roper et al., 2015). Coustasse also mentions cost reduction as one of the main benefits, which results in better financial performance, producing an efficient and productive institution (Coustasse et al., 2013).

For Hu et al, the RFID system can operate throughout the patient's life cycle in medical institutions, improving health care in surgical procedures and operations. Currently, in most hospitals, follow-up is still done on paper. The patient lifecycle that encompasses admission, examination, patient care, recovery, release and payment through RFID is recorded in a system that includes everything from complete patient identification to every step taken in. This cycle should always inform and update the diagnosis and treatment data, as well as the dosage and the recovery process. From the patient's entry into the institution, it will be possible to obtain data on the ability to apply the treatment (Hu et al., 2015).

In this sense, the current situation of RFID in the health sector is in full growth, as the health system urgently needs apparatus that can reduce the errors that happen so regularly. Hu et al (Hu et al., 2015) state that the increase in health care costs is practically the same in all cities of the world, and that governments are looking for ways to reduce these costs and, at the same time, improve health conditions for the patient. For this reason, RFID is configured as an outlet that can, if properly employed, reduce costs while providing support for more accurate and faster patient care. In any case, the growth in the use of this technology in terms of traceability has been booming, allowing health processes and flows to be improved and allocated efficiently within the chain. Compared to other similar technologies such as bar code, RFID stands out due to the following factors: 1) the data are rewritable; 2) the data are easier to transmit; 3) the large capacity of data storage; 4) the possibility of being reusable; 5) the wide read range; 6) security since it does not allow the forgery due to the unique nature.

The construction of intelligent information systems for hospital administration is an ethical issue that discusses not only financial gain, but a whole process based on the structuring and the foundation of health. Alharbe and Atkins discussed issues like these when developing such a controlled environment RFID technology, and came to the conclusion that technology cheapening could be done by integrating with ZigBee technology, which would support a knowledge processing and decision support system (KRDS). This in turn would uniquely support all hospital processes, being a powerful tool for automation, equipment tracking, staff and patients (Alharbe & Atkins, 2016). Among the benefits highlighted by Alharbe and Atkins are real-time data access, which includes information coverage of all tagged objects, which can be retrieved and accessed at any time; improved quality of care due to better management of medical staff and equipment, as well as rapid localization of these and medical equipment, which improves coordination in response to various situations; improves risk management by enabling frequent and rapid device auditing across wards, reducing the potential risk of faulty and poorly maintained equipment; acquire critical data knowledge to continuously monitoring the status and quality of medical and patient equipment, real-time production of historical data that gains informations that enables routine tasks, and consequently reduces costs more efficiently by saving time due

to automatic data management; increased security to prevent loss of mobile and unauthorized access to hospital wards; allows monitoring of all hospital services (Alharbe & Atkins, 2016).

When it comes to RFID technology, you should look to the future that is being outlined, so that if the

healthcare institution wishes to have a reality-transforming potential and operate on innovative foundations in order to increase gain in strategy and innovation, thus improving your business model, the investment can offset the accomplishment. Therefore, enabling an RFID implementation requires a project that is well built, financially supported and managed. Based on the results of their research by Wamba, Anand and Carter they concluded that RFID technology is mainly used for the purpose of institutional administration, and secondly for the purpose of patient administration. These results reveal that the potential for tracking medical products and devices, as well as laboratory specimens and real-time surgical instrumentation is a use that yields many economic benefits to the hospital (Wamba et al., 2013).

Regarding patient acceptability, which for some authors is one of the biggest barriers to RFID adoption, Torres et al. states that this is a matter of experience with the technology, and that its use would promote demystification that could be formed around her. Studies on the use of RFID to prevent falls of debilitated and elderly patients in hospitals show that, in addition to being a crucial tool in preventing patient falls, it also prevents patients with dementia or delirium from circulating without proper assistance. In this study, it was found that the acceptability of the tool increases with the use of the patient, who sees in it an essential addendum in their treatment, and the anxiety that is configured at the beginning, becomes confidence after contact with technology (Torres et al., 2017) .

4. Discussion

With this integrative literature review, we realize that the use of RFID technology brings in its essence a series of factors that make its use complex and surrounded by nuances that invest it with elements that surpass the merely visible. The 48 selected papers addressed the context of the application of the RFID traceability system in hospitals and medical institutions. In view of a greater diversity of opinions, a dialogue was opened between the researcher and the literature from various parts of the world.

Regarding what operates the use of RFID in healthcare organizations, we have as determinants the efficiency gain, i.e., there is a clear reduction in the costs of the operation, savings in the work performed, increased control and administration of the patient and a clear reduction inventory cost (Coustasse et al., 2016; Roper et al., 2015).

In addition, there is still a gain in quality where patient care is improved by eliminating errors that are made against the patient, such as incorrect drug administration and procedures. Coordination between health professionals and staff is improved and patient satisfaction is increased. Infection control is more efficient. The preventive/corrective control and maintenance capacity of the equipment is optimized (Ajami & Carter, 2013).

RFID also provides management gains by covering all benefits related to healthcare professionals, such as regulation of performance and reduction of insurance payments and indemnities, allowing for greater and better auditing when necessary, diagnosing and predicting possible errors (Chai et al., 2015). Other benefits include minimal research time with staff location, increased equipment availability, increased equipment utilization, increased staff productivity, improved preventive maintenance, increased patient turnover, improved ease of access and safety, improved patient billing, improved reimbursement management, reduced emergency equipment purchase and rental, reduced inventory depletion, improved equipment

return, better inventory lead times, reduced inventory shrinkage, fewer defective equipment used, decreased personnel charges, reduced poor service quality, decreased delays (Roper et al., 2015).

In this sense, RFID has several positive aspects in terms of patient care and the use of efficiency. This tool has enabled health care organizations to gain accurate and timely access to information to effectively treat patients (Vakili et al., 2015). In addition, RFID is becoming for some an emerging technology that plays a crucial role in the hospital system as a whole (Alharbe & Atkins, 2014). The ability to attach an electronic identity to a concrete object effectively extends the Internet to the physical world, transforming real objects into an "Internet of Things." Rather than requiring human interaction to register assets, equipment, or even services, applications may "see" items on the network due to their electronic IDs and wireless RF (radio frequency) connections. For businesses, this can mean faster automation, greater control over processes and continuous and accurate inventory. For the health area, it will mean more safety and comfort to the patient, as it will streamline hospital processes. Users of this technology will finally be able to share asset information from the beginning to the end of the supply chain and, just as important, instantly identify the current location of the items. In this way, pharmacists and laboratories will be able to record how long perishable materials have been without proper refrigeration (Trček, 2016).

In turn the physical safety and comfort of patients and system users often raise concerns for hospitals. Even though doctors, nurses and other staff take primary responsibility for physical safety, RFID traceability technology enables an even more efficient and complete care process to be created. This is because this instrument increases user satisfaction and, at the same time, decreases the possibility of errors that can be caused by the "separation" of a patient's information. In addition to the already foreseeable security and accuracy benefits of searching for individual case data in the system, reducing patient / data error rates can help reduce occupational malpractice claims as well as hospital insurance rates, which can generate resources to improve overall care (Coustasse et al., 2013, 2016).

Privacy is the main problem that may eventually complicate the use of RFID. Many believe that by using the tool, both patients and healthcare professionals will lose much of their privacy. And that's making it available will be a precedent for making the information available on the network, enabling it to be seized by anyone who has the technical means to do so. Although it may be pointed by some as a remarkable solution for the most diverse applications, there are those who disagree and point out flaws in its use. Describing the system as needing further research and improvement (Pineles et al., 2013). Still others attribute the lack of integration with other devices as the cause of their deficiencies (Decker et al., 2016). Other issues that make it difficult to use is related to interoperability as the systems that the hospital has, a health organization often has at its disposal a series of equipment that need to work together and that need such devices to work in harmony. Often as it is an emerging technology, systems either interoperate weakly or do not interoperate, which emerges as one of the intervening factors. Lack of standardization is a strong barrier to RFID acquisition (Coustasse et al., 2016).

Studies such as those by Kamaludin, Mahdin and Abawaly point out that while RFID is more efficient than bar code, the problem of cloning, counterfeiting and security attacks is a problem that must be solved. To address this, they suggest an approach to detecting RFID tag clones in the system that according to research has shown good performance.

The limited budget of hospitals makes it a deterrent to participation by some hospitals that believe the cost

of technology is expensive, making it prohibitive for providers (Ajami & Carter, 2013). The lack of preparedness to deal with RFID-sized technology also makes it inaccessible, so for some it is a highly complex tool to use, which hampers the spread for its use (Ajami & Carter, 2013; Wamba et al., 2013).

Competition with other similar technologies that, although inferior in quality, can rival in value with RFID is another constituent factor. In fact, the expressive use of this technology often demands that it can be valued as a technology that is significantly determinant in the daily performance of hospital operational and technical achievements. On the financial side, we can say that this is the most influential aspect that stands between the widespread use of RFID. Many consider the initial investment in hardware and software to be high and not worth it for the institution despite the advantages it offers, even when they seem to be superior to what other appliances of the same size seem to offer. So, thinking in the short term the investment may not be really attractive anymore in the long run, it has an almost certain higher return, saving large sums of money. Thus, the initial invested capital, although high, becomes smaller over time, which contributes to an almost certain return (Coustasse et al., 2013).

Thus, some hospital institutions are not inclined to adopt RFID because there is not enough capital, staff or return on investment (ROI) defined. However, although not cheap, the value of RFID technology has been declining in recent years, enabling a greater number of supporters of this instrument. There is some skepticism about RFID and this is reflected in the restricted implementation in some hospitals, in part because the initial cost and return is only reached in the long term. Although it is known of all the benefits and advantages over similar tools, and the satisfaction rate achieved because it is used, most managers are still unmotivated about investing in this tool (Roper et al., 2015).

This is why for some the use of RFID is fully justified in cases where the high cost of services and the high risk to the patient accompany the hospital routine (Martínez Pérez et al., 2018). This is how its use becomes for these authors of essential relevance (Martínez Pérez et al., 2016a). By allowing the institution to make use of this equipment, it is stocking up on successful medical practices that increase productivity and save time for the medical staff (Coustasse et al., 2015). In addition to enabling the construction of a smart hospital (Alharbe & Atkins, 2016). Others see in RFID the future of hospital processes, even intending to expand their use (Huang et al., 2016). The use of communicable diseases in epidemics has proven to be of fundamental use for health institutions (Ajami & Carter, 2013; Isella et al., 2011; Lucet et al., 2012). The scenario for using RFID is wide, ranging from the newborn, being identified and ensuring pairing with the mother, to the care of the elderly who want some independence accompanied by safety (Alharbe & Atkins, 2016; Martínez-Pérez et al., 2012; Torres et al., 2017). In hospital wards of the aged and immobilized sick patients, it can act to prevent falls from happening (Torres et al., 2017).

In our present society, the Internet of Things has increasingly occupied space. There are numerous applications regarding health, and RFID comes to occupy a privileged space in this field, where process automation is a global trend (Lakshmi Dhevi et al., 2018).

RFID can modernize the most diverse hospital sectors, leading institutions that use it to a standard of excellence in their service. There are many applications, such as supply management, patient management, medicines, newborns, hand cleaning adherence, surgical instrumentation, blood bags, collective and sectoral equipment, and so on. In all of these, RFID allows customization of both attendance and administration. It can potentially change the way health services have been delivered over the years. As is

The contributions of RFID tracking technology to the healthcare field are unlimited in locating and tracking products, objects and people. More than a locating mechanism, it is a control device that enables its users to better assess the situation of a range of processes and flows. When RFID is used, contributions are diverse, such as locating and verifying adulteration and counterfeiting of drugs, proper administration of blood bags, and drug interaction with patients, obtaining patient information faster, as well as locating and restricting certain hospital departments, including the location of medical staff, improved hospital rounding, smart operating rooms, smart medicine cabinets, the location of equipment, and their best distribution, according to hospital needs. The main advantage is in monitoring the patient through smart wristbands that provide information such as blood type, allergies and other relevant data about him or her.

Regarding the numerous factors that hinder the mass access of this technology, the main one concerns the economic order, security and technicians, as well as the cultural, human and bureaucratic barriers that tend to hinder the implementation of a traceability system. These range from budget limitation aspects, including possible interference with electromagnetic equipment. The issue of patient privacy is another much cited obstacle, as it is believed that patient data can be intercepted by unethical individuals. Regarding the fact that full and ubiquitous screening of medical staff, there may also be a nuisance and a negative reaction because of the feeling of constant vigilance, including the time off from health professionals.

To prevent this happening, nor is there a surveillance similar to George Orwell's 1984 fiction, in which the big brother was the ubiquitous figure of the moment, RFID-free areas can be established. Thus, it is possible to preserve the privacy of those who are not strictly related to the hospital context. Despite having to face this challenge, the fact is that traceability through RFID can be considered the next step in the future medical hospital, which should soon be a reality for many professionals and healthcare institutions. Despite the niches that may still reject it, the health area is optimistic and prone to its use with a view to improving safety both in the case of patients and in the presence of greater control and the verification of errors that will be minimized by this technological apparatus.

In this context, it is intended for academic studies to explore and investigate the structural change that is being implemented, in order to spread the importance of RFID. Exploratory, descriptive, explanatory studies, i.e., all studies that may help to broaden the knowledge of the subject. In Brazil, this tool is even more important since technological development occurs slowly and unevenly. RFID demonstrates through this article that despite all the barriers to its spread, RFID is a technology that makes a difference in the hospital environment. Especially when you think that processes are an inherent and important part of healthcare professionals and their patients. This “academic look” focuses on the implementation of this new technology, in view of all the benefits it is already bringing to providing more effective care, thanks to the agility and faster access to information that can make the difference between life and the death of patients who are treated daily in hundreds of clinical and outpatient hospitals. For this reason, studies related to this new setting for data consultation should be encouraged so that researchers realize the need to draw the attention of hospital managers to a process of irreversible technological advancement that is becoming essential in health.

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Colloquiality analysis on social networks: a case from Twitter

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Abstract

Social network sites are present in a constant way in society. The manner people write in social network sites has their dynamism because of the speed information are replicated, the reach publications may have, network sites' peculiarities and the seek for fame. This generates linguistic constructions that are not in accord with the standard norm of the Portuguese language. This quantitative work aims to relate the use of colloquial constructions on Twitter with user's popularity, posts popularity and other specific factors of this social network. This analysis was made using regular expressions, dictionaries, and frequency distribution to identify colloquial constructions. A support system was developed to perform analysis, management, and mining.

Keywords: social network sites, Twitter, natural language, linguistics.

1. Introduction

Social networks have become an important element in modern society, with 2.65 billion active users in 2018 and a growth prospect to 3.1 billion by 2021 (Statista, 2020). Considering that the world population was 7.8 billion people in the same year (UNFPA, 2019) we have almost half of the entire globe using social networks.

Among these networks, Twitter registered 330 million active users in the first four months of 2019 (Statista, 2020). A tweet is a text message from a user containing no more than 280 characters that can contain other media such as images and videos (Twitter, 2020), where 500 million tweets are sent per day (Internet Live Stats, 2020).

In this work, we verify in a general way the incidence of colloquial structures in tweets and the relationship between colloquiality and popularity. Among the specific objectives of this study we can quote: (a) To identify occurrences of colloquiality in a tweet. (b) To verify if there is disparity in the colloquial level between tweets considering the number of followers. (c) To verify if there is a relationship between replication and popularity of tweets with occurrence of colloquialities. (d) Check for disparity in colloquial level between verified users, who have been authenticated by Twitter as legitimate, assigned to accounts that Twitter considers of public interest (Twitter, 2020), and unverified users. (e) Check for disparity in the colloquial level between tweets responses, which are targeted at one person and not all followers, and normal tweets. (f) Check for disparity in colloquial level between users with a large difference in total published tweets.

2. Theoretical foundation

Social networking features such as limitations and functionality create language conventions for its users. Twitter, for example, has a more severe character limitation per post than other social networks, so users use structures like contractions constantly to express themselves as Gouws, Metzler, Cai and Hovy (2011) show. The use of these structures in social networks in general, besides Twitter, is justified by users as a necessity for speed (YAGUI, 2018).

Perception and familiarity with the language is another relevant element in the use of colloquiality. Posts made by users in a language that is not their native language tend to use less these constructions as shown by Perez-Sabater (2012).

A concern with the popularity of social networks in the educational environment is the use of colloquial structures by these users outside the Internet. Souza and Depz (2012) showed that students who use social networks do not tend to use more informal constructions than non-users when in situations that require formality but end up using more in informal situations. Popularity and reach are relevant factors in social networks and internet in general.

Hagen, Uzener, Harrison and Katragadda (2016) showed a correlation between language and the popularity of online petitions. Their study uses computational tools to explore e-petitions, viewing them as persuasive texts with linguistic and semantic features that may be related to the popularity of petitions, as indexed by the number of signatures they attract. Hagen, Uzener, Harrison and Katragadda (2016) made use of a website data, to analyse linguistic features, such as extremity and repetition, and semantic features, such as named entities and topics, to determine whether and to what extent they are related to petition popularity. There are several studies involving social networks, where various are an analysis of the network itself, such as Boyd, Golder & Lotan (2009), which examined the practice of retweeting, action of replicating to their followers a tweet from someone else. Other studies include linguistics in their analysis such as Liu, Li & Guo (2012) and Go, Bhayani & Huang (2009), who work with models for user mood identification. Nguyen, Gravel, Trieschnigg & Meder (2013) did a study linking language and user age on Twitter, using machine learning. Still, there is a lack of studies dealing with the language itself.

3. Methodological path

3.1 Data Collection

The data collection stage in which the tweets sample was collected for analysis on users' colloquiality utilization.

For data collection, Twitter Search was used, which allows many tweets to be obtained. Twitter Search requires an API key which is obtained by creating an application on Twitter Developers (Twitter, 2020).

To use Twitter Search you must provide at least one keyword to search. More frequent nouns in the Portuguese language were used according to the Frequency Dictionary of Portuguese (Davies & Preto-Bay, 2008). Only nouns that did not include accents, tilde and cedilla were selected in order to have a less arbitrary data search. At each search cycle, interspersed by a minute of waiting so that the collection was not blocked by the Twitter API request limit, an average of 400 tweets were returned and then the current

search noun was changed so that the number of distinct tweets remained high.

The tweets were then received, treated and persisted on the server. A returned tweet contains several metadata: from data about the tweet itself, such as ID number, retweets and favorites, to information about the user himself, such as followers' number and geolocation data.

The following data, extracted at the time of the search, for each tweet was persisted on the server:

- Tweet ID number: Unique number that identifies the tweet. Useful for a possible manual check of information.
- Text: Tweet text, 140 characters maximum.
- Username: Unique username that identifies the tweet author.
- Followers: Number of followers of the tweet author. The number of followers is directly linked to the user's popularity.
- Number of tweets: number of tweets performed by the author during their account lifetime.
- Favorites: Number of favorites or likes a tweet received. It is directly linked to the popularity of the tweet and, but not necessarily, the author.
- Verified Flag: Informs whether the user, author of the tweet, has been authenticated by Twitter or not. The verified flag is assigned to accounts that Twitter considers of public interest (Twitter, 2020).
- Flag Response: Informs if the tweet is a direct response to another tweet that is usually seen only by people following the tweet user who received the response and the user who answered simultaneously.

3.2 Text standardization

A treated version of the tweet text is also persisted in which the at sign, hashtags and link are replaced by a single structure indicating such occurrences.

This substitution occurs because an at sign is a quote to another user (Twitter, 2020) and can be treated as a proper name. Therefore it is valid to replace all at signs by a single structure that will always be treated as a proper name since the specific name is not relevant.

The hashtag is used as keywords to facilitate searching for specific topics (Twitter, 2020). A hashtag is often replicated and cannot be analyzed since it does not reflect the use of colloquiality of the tweet author since he is hardly the author of the hashtag. Similarly a link can be replaced since the link itself does not provide any information about the use of colloquiality by the tweet author.

For example, the text of a tweet in its original form:

E a @REDCanids fecha o primeiro jogo e garante o 1x0! GG! #CBLol <https://t.co/VgVFUK1J5N>

This tweet is in Portuguese and its translation into English means: "The @REDCanids finish the first game ensuring the 1x0! GG! #CBLol <https://t.co/VgVFUK1J5N>". In the example we have an at sign "@REDCanids" that refers to a user, then we have the hashtag "#CBLol" that refers to the event that the tweet is contextualized and finally we have the link "<https://t.co/VgVFUK1J5N>".

When receiving the tweet with the metadata, the links, at signs and hashtags are provided and detailed so

the replacement could be done directly without having to identify when they occur. The treated example tweet text follows this:

E a <USER> fecha o primeiro jogo e garante o 1x0! GG! <HASHTAG> <LINK>

The structures for replacement were defined so that they were simple to view and so that they avoided false positives with original text.

There were 92727 distinct tweets collected between March and November 2017. All tweets were only persisted if they were informed by their metadata as belonging to the Portuguese language to avoid the inclusion of tweets with cognates with other languages, mainly Spanish.

3.3 Tokens production

For textual analysis of tweets the text is first transformed into tokens. A token is a sequence of characters that can be a word, a numeral or even a combination of letters, numbers or special characters.

NLTK provides a specific tokenization function for Twitter, the TweetTokenizer that adapts and deals better with casual texts that include emoticons and other peculiarities like hashtags and at signs.

The following is an example of a tweet:

E a <USER> fecha o primeiro jogo e garante o 1x0! GG! <HASHTAG> <LINK>

After the tokenization we have a list of tokens that can be analyzed:

Table 1. List of tokens that can be analyzed

E	o	garante	GG
a	primeiro	o	!
<USER>	jogo	1x0	<HASHTAG>
fecha	e	!	<LINK>

It is worth noting that punctuations adjacent to words such as commas, interrogations and exclamations become a single token dissociating itself from the accompanying word. This facilitates analysis since we have the words and punctuations in their raw forms.

3.4 Tokens identification

The identification of a token is done as shown in Figure 1. The token when entering the flowchart to be identified is first separated into its category. Category 1 includes tokens that contain only alphabetic character sequence. Category 2 includes tokens containing at least one special character such as punctuation and emoticon, category 3 must include digits from 0 to 9 and optionally alphabetic characters.

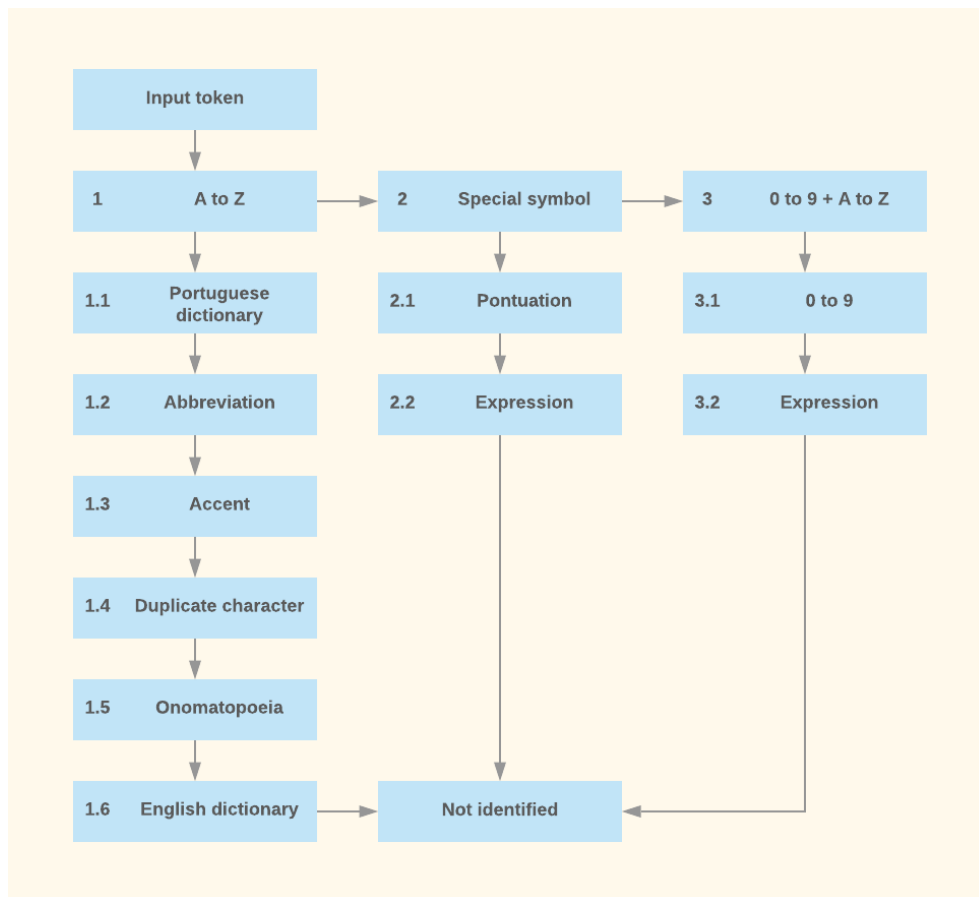


Figure 1: Flowchart of token identification.

Once in its category the token scrolls through the subcategories to be identified. When the token is identified the flowchart is interrupted and the subcategory of the token is defined. The order of the categories in the flowchart was defined in view of the frequency of distribution of their tokens from all the collected tweets. The distribution frequency tells you how often a distinct token appears in a text.

Thus, tokens that include only alphabetic characters, category 1, is the token category with the highest distribution rate. Tokens that include some special character, category 2, comes right after as the second most frequent category, finally category 3 comes last since their tokens are the least frequent among the three categories.

The arrangement of subcategories follows the same criterion. For example, subcategory 1.1 is the most frequent within category 1, according to the frequency of distribution of its tokens. The only exception is subcategory 1.6, which even though it has a higher distribution frequency rate than some subcategories in its category was placed last in order to reduce false positives with the English dictionary.

Once the token falls into its category and is not identified by any of its subcategories the token is then categorized as unidentified. The implemented preliminary version of this flowchart was able to identify 95.8% of all collected tweets tokens.

The tokens "<USER>", "<HASHTAG>" and "<LINK>" are categorized before entering the flowchart since they are peculiarities of the social network itself.

The description for each subcategory according to its category:

- **Category 1, A to Z:** Tokens containing alphabetic characters only.
 - **Subcategory 1.1, Portuguese Dictionary:** With the help of HunSpell the subcategory checks whether the token is valid in the Portuguese dictionary.
 - **Subcategory 1.2, Abbreviation:** A distribution frequency was made where tokens considered valid by the dictionary were removed keeping only the invalid ones. Checking the remaining tokens with higher distribution frequency it was possible to select 158 abbreviations of most common use on Twitter, these abbreviations were then persisted in the database. This subcategory checks whether the token belongs to this abbreviation list.
 - **Subcategory 1.3, Accent:** Generates variations of the token with accent, tilde and cedilla and checks whether these variations are valid in the dictionary. The "icon" token will not be identified in subcategories 1.1 and 1.2, here its variation "icon" will be tested and recognized as valid by the dictionary which will indicate an accent error in the tweet.
 - **Subcategory 1.4, Duplicate letter:** Remove duplicate letters from a token and check if it has become valid in the dictionary. For example the token "VERYYY" will be ignored in the previous subcategories, removing the duplicate letters will have the token "VERY" that will be recognized as valid by the dictionary and that will indicate a colloquial occurrence.
 - **Subcategory 1.5, Onomatopoeia:** Using regular expression it was possible to identify the most common onomatopoeia, according to the frequency of distribution. For example, the token "hahaha" will be identified in this category as an onomatopoeia that indicates laughter, thus indicating a colloquial occurrence in the tweet.
 - **Subcategory 1.6, English Dictionary:** Checks whether the character is valid in the English dictionary. This category is valid only for tokens that are at least five characters long to minimize the number of false positives.
- **Category 2, Special Symbol:** Tokens containing at least one special character.
 - **Subcategory 2.1, Score:** Recognizes punctuation and signs such as commas, quotation marks, question marks, exclamations, etc.
 - **Subcategory 2.2, Expressions:** Recognizes by means of regular expressions tokens that include special symbols such as dates ("01/01/2010"), ordinal values ("1st") and emoticons that have been listed as the most frequent by distribution rate.
- **Category 3, 0 to 9 and A to Z:** Tokens containing digits 0 to 9 accompanied by non-alphabetic characters.
 - **Subcategory 3.1, 0 to 9:** Tokens that include only numbers. Examples: "44", "152" etc.
 - **Subcategory 3.2, Expressions:** Recognizes through regular expressions structures with high distribution frequency containing letters and numbers only. Among these structures we have values with specific units like "10V", "100mm", "500GB" and other structures like scoreboards ("1a2", "2x2", "1vs1" etc.).

3.5 Colloquiality identification in Tweets

Once the tokens are identified, there is colloquiality in the tweet according to the identification of its tokens. The colloquial points observed in a tweet are:

- No capital letters at the beginning of the tweet.
- Absence of tweet punctuation.
- Presence of onomatopes.
- Presence of non-accented words.
- Presence of words with duplicate letters.
- Presence of foreign terms.
- Presence of emoticons.

With the identified colloquial tweets the calculations will be made to obtain the results according to the criteria described in the specific objectives.

3.6 Database Modeling

Modelling the database where Tweets are persisted together with data used by the support system is shown in Figure 2.

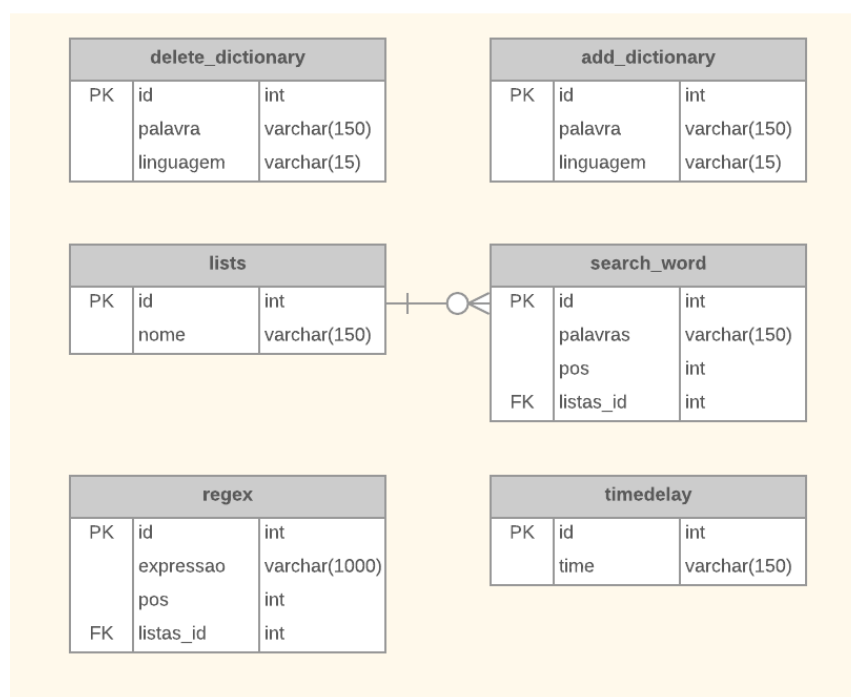


Figure 2: Database modeling.

3.7 Support System

A support system was developed to assist in colloquiality analysis. The Tweetllect system was developed in Portuguese and therefore the screens shown here are in this idiom. The main information on some screens is translated into English (inside a white textbox like next picture) but other, less relevant information remains in Portuguese. The system allows you to perform the analysis with the desired parameters, list

tweets, view graphs to observe how the tweets are distributed according to their metadata, perform tweets mining and manage regular expressions, search lists, dictionaries, colloquial words, and unknown terms. Figure 3 shows the main system screen with the main system functions.



Figure 3: Support system main menu.

In the parameter setting screen for both tweets analysis and tweets listing, the parameters are, in relation to the user: number of followers, number of tweets and if it is a verified profile; in relation to the tweet: number of favorites, number of retweets and if it is a tweet reply. Any combination of parameters can be defined or a tweets analysis or search without parameters can be made for a result involving all tweets.

In Figure 4 the screen shows the result of an analysis. You can see the parameters set, the percentage of tweets with some colloquiality found, and the percentage of tokens identified.

In Figure 5 you can see the list of tweets. For each tweet the name and number of followers of the author, the text of the tweet and a button for more details are displayed.

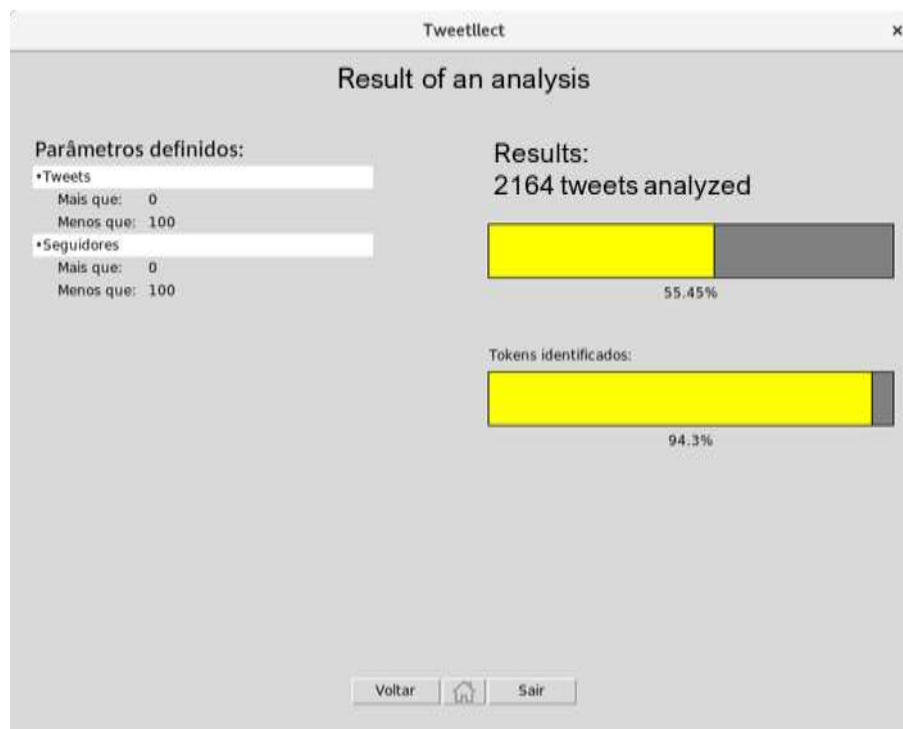


Figure 4: Analysis result screen.

The tweets list screen shows the total tweets found given the input parameters and displays ten per page.

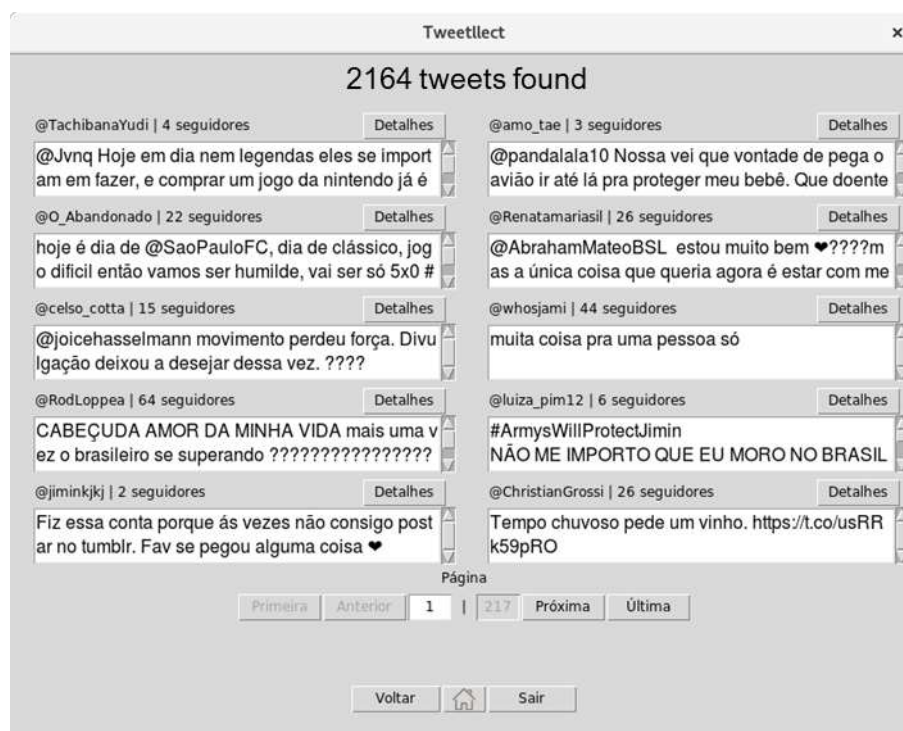


Figure 5: Tweets listing screen.

The screen with a detailed tweet is shown in Figure 6. It lists all the parameters in relation to the tweet and the author. The tokens in this tweet are categorized. Tokens identified as colloquial can be added to the Portuguese or English dictionary while unidentified tokens can be defined as a colloquial term or can be

entered in one of the dictionaries.

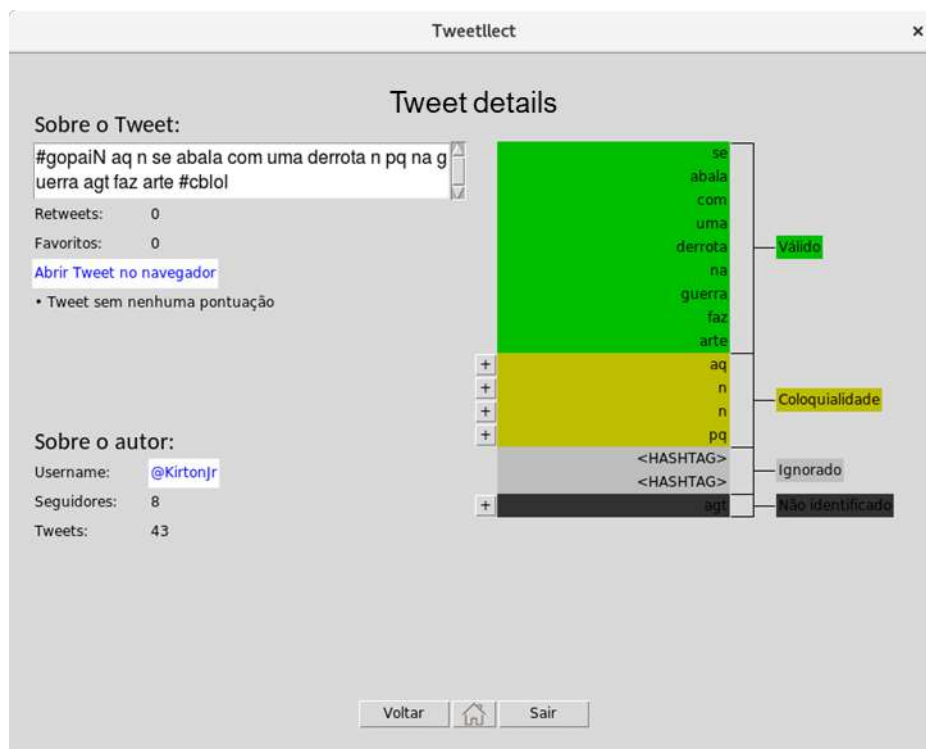


Figure 6: Tweet detail screen.

In Figure 6, valid tokens are grouped in green, tokens considered colloquial are grouped in yellow, ignored tokens are separated in gray, and unidentified tokens are colored in black. In the distribution screen (Figure 7) it is possible to check the tweets distribution, in relation to the author: by followers, by quantity of tweets and by verified or not profiles; already in relation to the tweet: by favorites, retweets, regular or reply tweet.

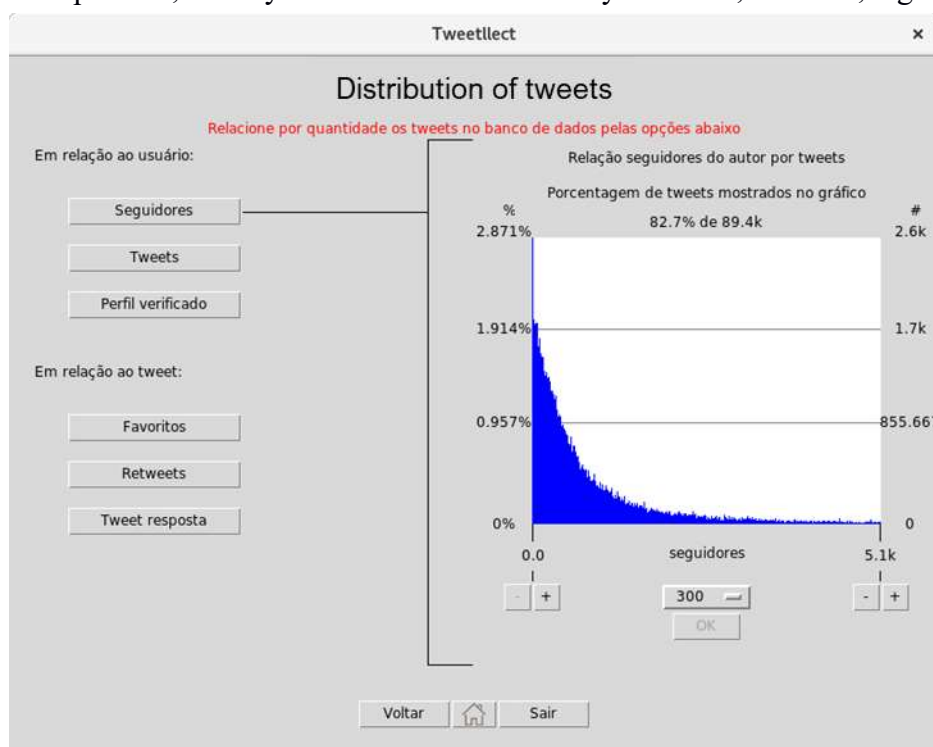


Figure 7: Screen showing the distribution of tweets by followers.

You can adjust the start and end point of the graph. In the example figure the range goes from zero to 5100 followers showing a total of 82.7% of all tweets stored in the graph, so 17.3% of tweets are out of the defined range of followers and it is necessary to expand the limits to show the totality of tweets.

Figure 8 shows the distribution of tweets as to whether it is a tweet reply or regular tweet. As it is a binary parameter the graph shows only two bars. The use of the bar graph is repeated in the parameter of verified or not verified profiles. For the other parameters the distribution is shown in the same way as in Figure 7.

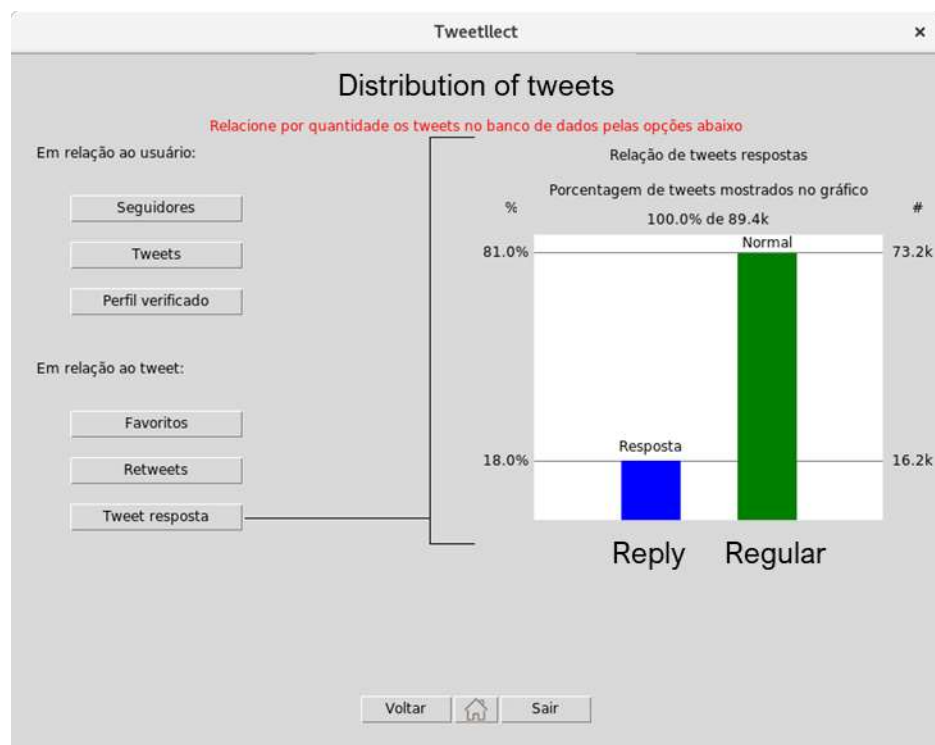


Figure 8: Screen showing the distribution by reply tweets or regular tweets.

Unknown terms, i.e., which are not identified by the algorithm, can be added in the Portuguese or English dictionary or defined as a colloquial term as seen in Figure 9. You can select several terms at once to speed up management. The terms are sorted according to distribution frequency, so the most frequent unknown terms are displayed first. There are ways to see tweets in which these terms are found for a better understanding of the context of their use



Figure 9: Unknown terms management screen.

You can manage the dictionaries by adding, removing or checking if the word already exists (Figure 10).



Figure 10: Dictionary management screen.

Figure 11 shows the regular expression management screen where you can add, remove, test, or edit the expressions. Tokens identified by these expressions can be defined as colloquial or valid.

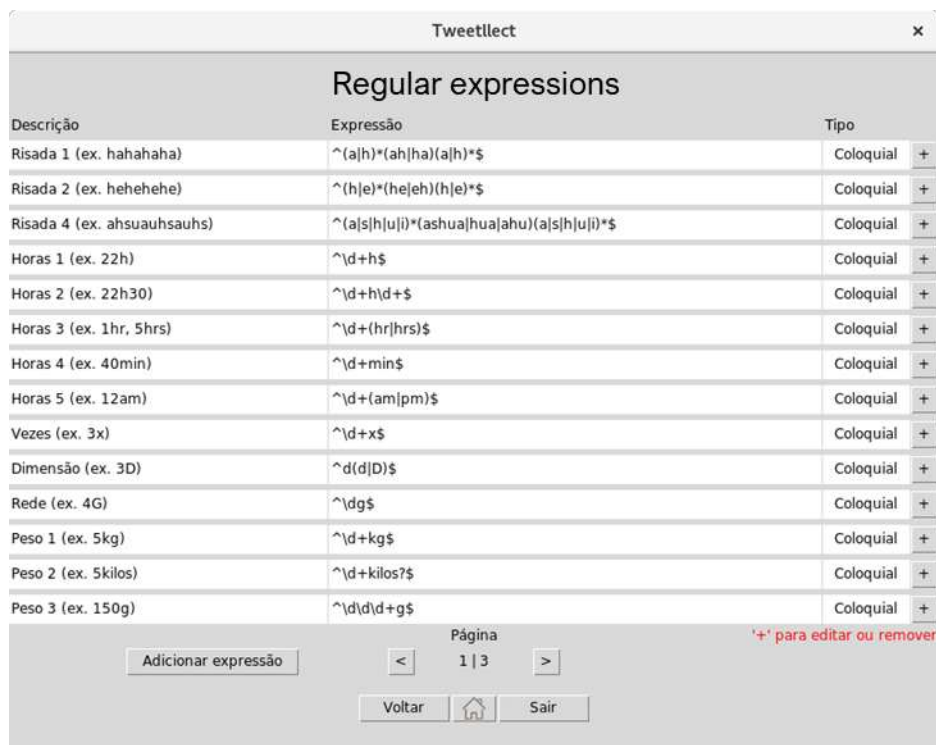


Figure 11: Regular expression management screen.

A mining list contains a few words that are used to mine tweets. These words can be specifically sorted if necessary. Figure 12 shows the management screen for these lists. The lists can be created, removed or edited.

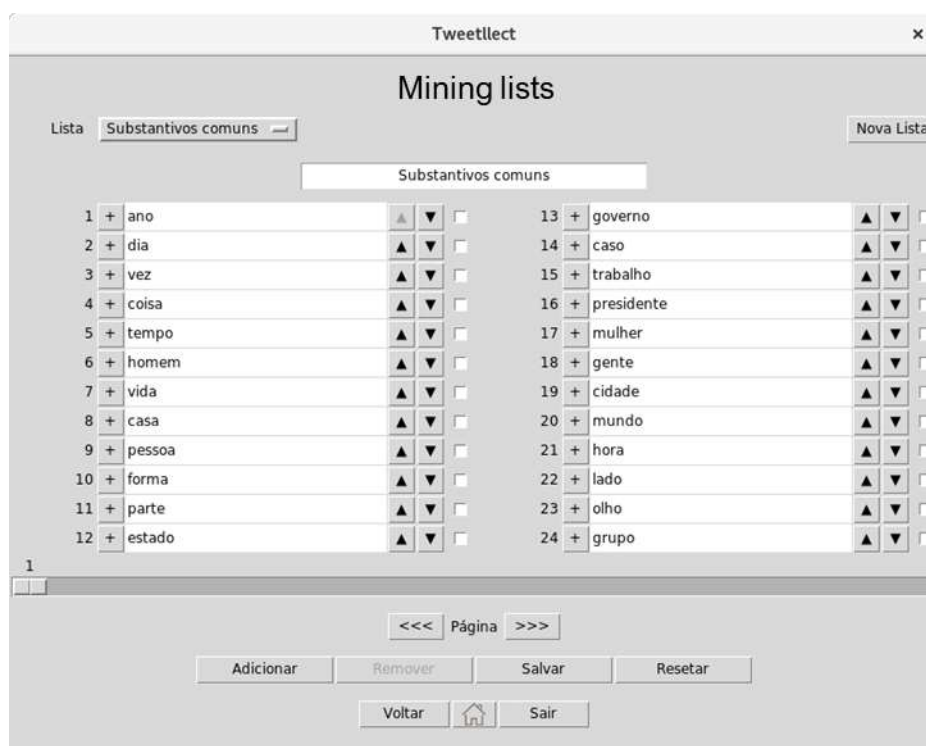


Figure 12: Mining List Management Screen.

Figure 13 shows the colloquial term management screen, terms can be added, removed, or inserted into a dictionary.

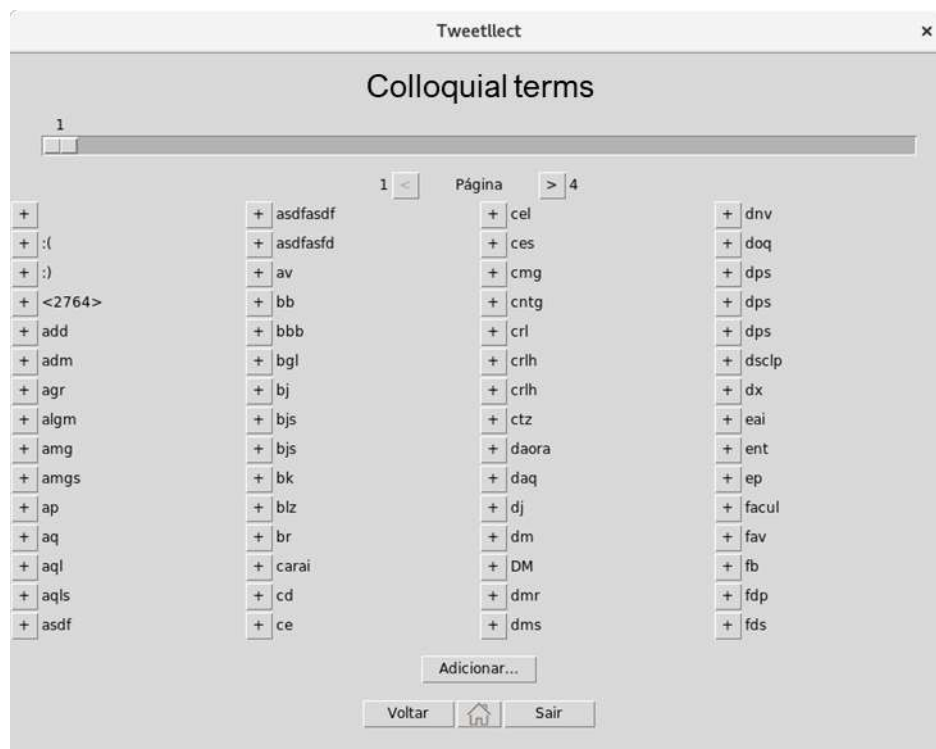


Figure 13: Colloquial term management screen.

The mining screen can be seen in Figure 14. When started mining the words in the list are used as keywords for tweets. Number of tweets obtained, which caused an error due to incompatibility of their content with the database or system coding, or which already exist in the database can be monitored on the side of the screen. You can see more details where all tweets are displayed individually and can be accessed.

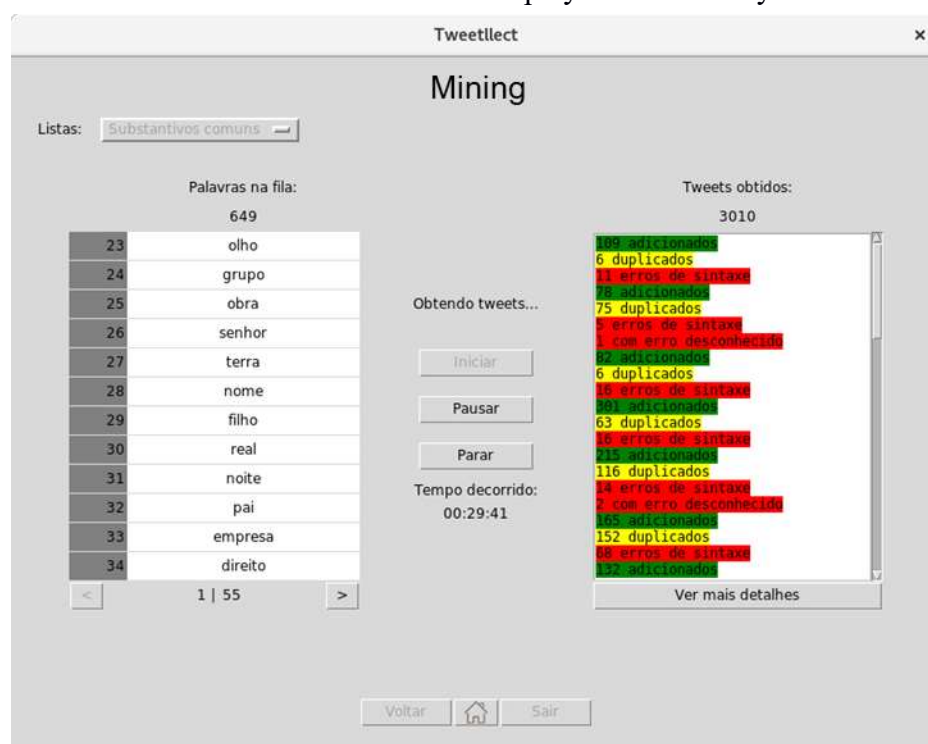


Figure 14: Tweets mining screen

4. Results Analysis

The results were obtained using the Tweetllect support system and using a total sample of 92727 tweets obtained between March and November 2017. According to the specific objectives the results will be discussed in this section.

4.1 Overall results

We analyzed 92727 tweets, 64.19% of which have some colloquiality as seen in Figure 15. The identified token rate was close to 95%. This identification rate was constant ranging from 94% to 96% in all analyses.

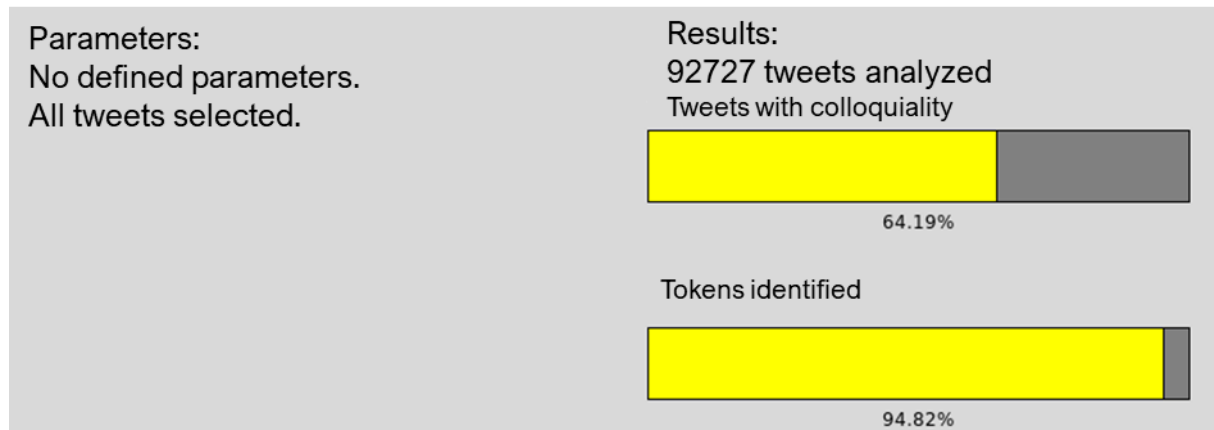
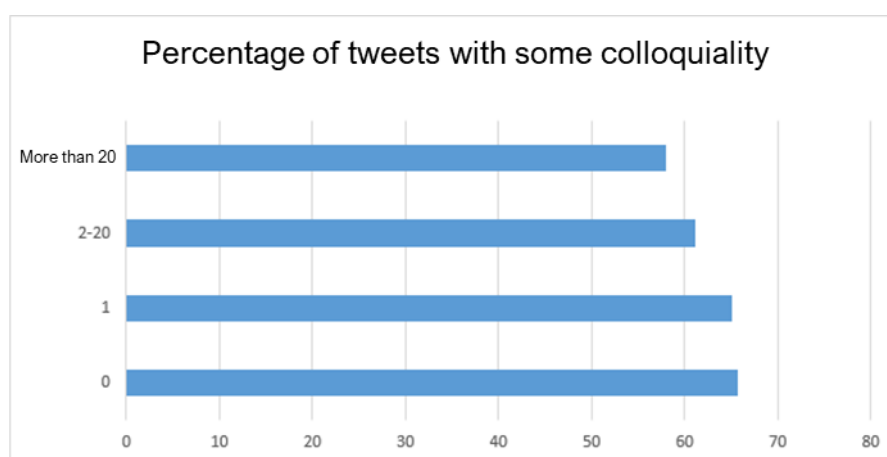


Figure 15: Overall results.

4.2 Popularity and tweet replication

How replication and popularity of a tweet considers its retweets and favorites. In Graph 1 we have the percentage of tweets with some colloquiality that have none, one, between 2 and 20 and finally more than 20 favorites.



Graph 1: List of favorites and colloquiality.

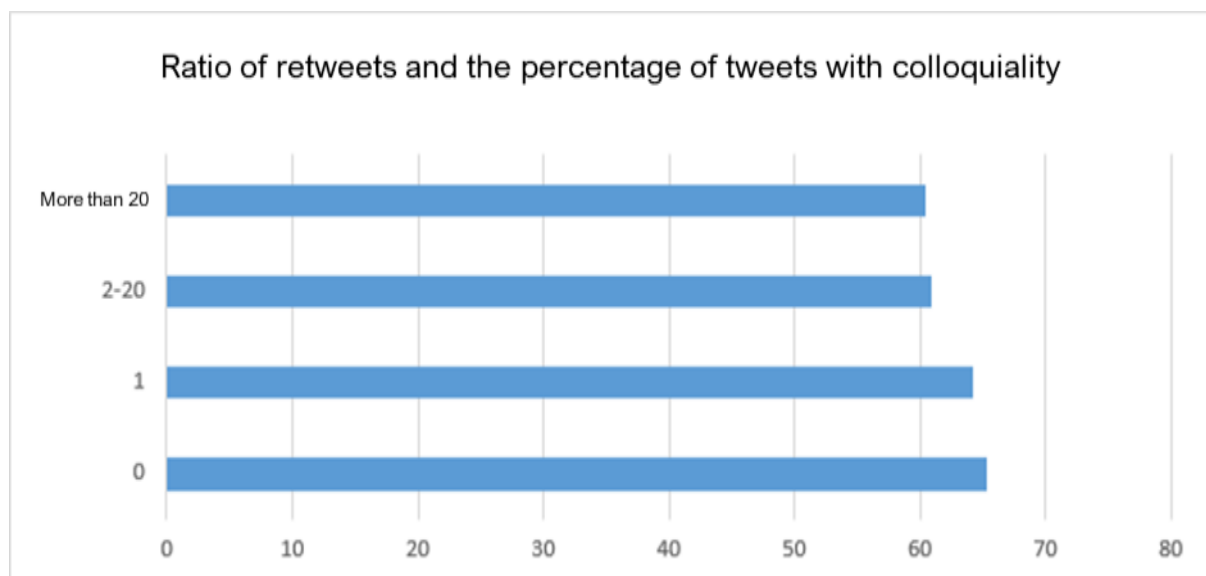
Tweets with fewer colloquial terms have a slight tendency to receive more favorites. About 65% of tweets with zero favorites have had some colloquiality already identified for tweets with 21 or more favorites this number drops to 58%.

Table 2 shows the results of Graph 1 along with information from the samples used. It is worth noting that the sample size for tweets with zero favorites is almost six times larger than the sample for tweets with more than 20 favorites but if we look at tweets with one favorite we have a close sample and a difference in the identification of tweets with colloquiality of 7.09%.

Table 2: List of favorites and colloquiality.

Favorites	Sample size	Sample percentage (%)	Percentage of tweets with colloquiality (%)
0	60.392	65,13	65,73
1	10.171	10,97	65,13
2-20	10.875	11,73	61,11
More than 20	11.289	12,17	58,04
Total	92.727	100	64,19

Graph 2 shows the ratio of retweets and the percentage of tweets with some colloquiality. Similarly to the ratio of favorites and colloquiality (Graph 1), tweets with fewer colloquial errors receive more retweets.



Graph 2: Relationship of retweets and colloquiality.

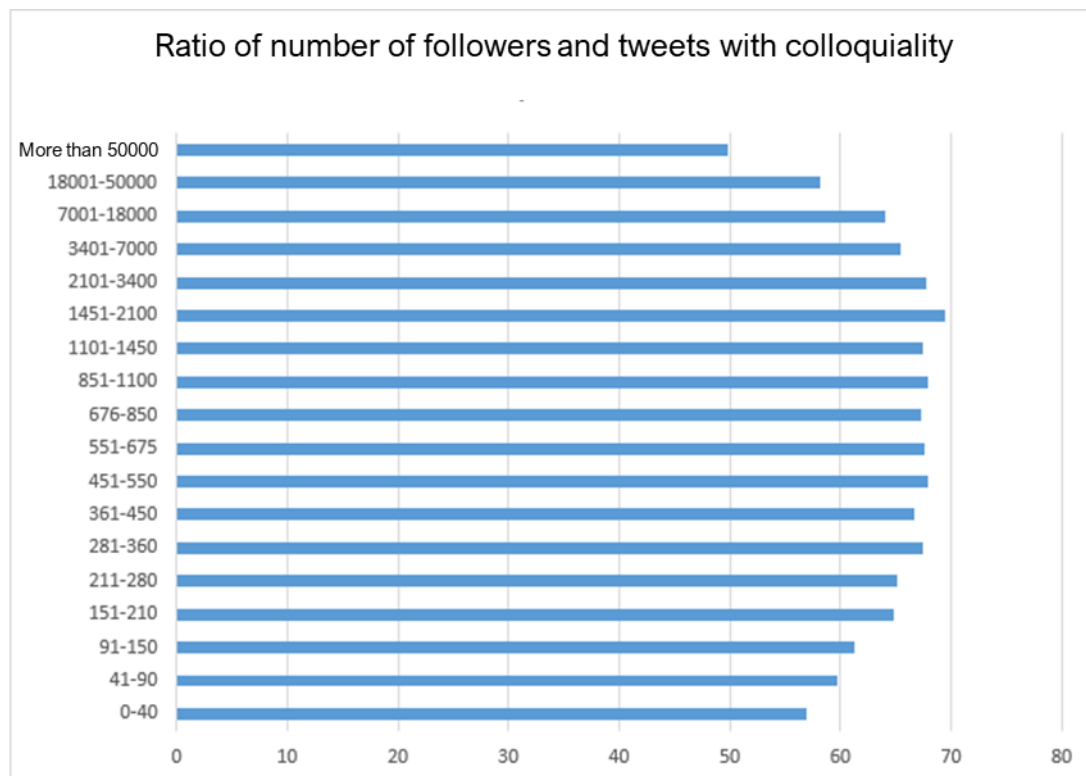
Tweets with zero retweets have an identified colloquiality rate of 65.37%, while tweets with more than 20 retweets 60.49%, or a difference of 4.88%. Again, the discrepancy between these two samples is high as can be seen in Table 3. Considering tweets with a retweet we only have a sample of near size and a difference of 3.67% in the identification of colloquiality when compared to tweets with more than 20 retweets.

Table 3: Relationship of retweets and colloquiality.

Favorites	Sample size	Sample percentage (%)	Percentage of tweets with colloquiality (%)
0	63.435	68,41	65,37
1	7.824	8,44	64,16
2-20	10.702	11,54	60,91
More than 20	10.766	11,61	60,49
Total	92.727	100	64,19

4.3 User's Popularity

As a user's popularity we consider the number of followers he has. Graph 3 shows several ranges of followers starting from zero to 40 followers and ending up with more than 50000 followers. The colloquiality rate starts low, 56.98%, for users who have 40 followers or less and grows up to the range of 281 to 360 followers. From there the rate remains constant, at about 67%, until it reaches the range of 7001 to 18000 followers where it begins to drop to a minimum of 49.79% for users with more than 50000 followers. What is noticeable is that accounts with few followers tend to have fewer colloquial errors, while users with followers ranging from hundreds to a few thousand lose this tendency but it returns to accounts with tens to hundreds of thousands of followers.



Graph 3: Ratio of number of followers and colloquiality.

The following ranges were defined considering the sample size. Each interval averages 5000 tweets as shown in Table 4. This was done so that discrepancies in sample size would not influence the result.

Table 4: Relationship between the author's followers and colloquiality.

Followers	Sample size	Sample percentage (%)	Tweet with colloquiality percentage (%)
0-40	5135	5,54	56,98
41-90	5324	5,74	59,74
91-150	5599	6,04	61,21
151-210	5036	5,43	64,87
211-280	5396	5,82	65,14
281-360	5533	5,97	67,47
361-450	5154	5,56	66,63
451-550	4896	5,28	67,83
551-675	5049	5,45	67,64
676-850	5233	5,64	67,21
851-1100	5409	5,83	67,92
1101-1450	5158	5,56	67,45
1451-2100	5254	5,67	69,41
2101-3400	5183	5,59	67,76
3401-7000	5127	5,53	65,50
7001-18000	5132	5,53	64,11
18001-50000	3447	3,72	58,14
More than 50000	5662	6,11	49,79
Total	92727	100,0	64,19

4.4 Verified accounts

Profiles verified by Twitter are provided to users that it considers of public interest and mainly artists and celebrities, politicians, media and companies get this verification. The colloquiality rate for verified profiles is only 41.38% as seen in Figure 15. Even considering the discrepancy in sample size the difference of an additional 20% between verified and unverified profiles (Figure 16) shows a remarkable trend for verified profiles to avoid colloquiality.

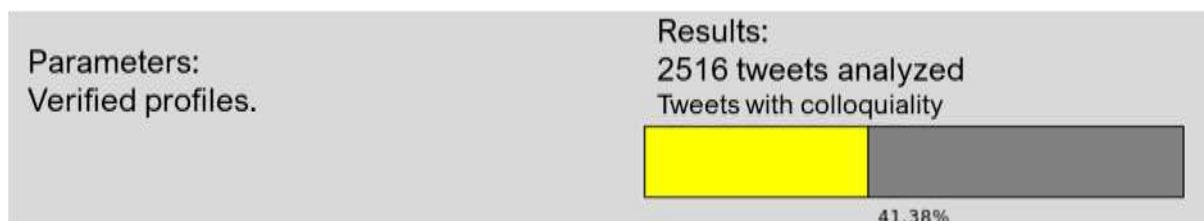


Figure 16: Verified profiles and colloquiality ratio.

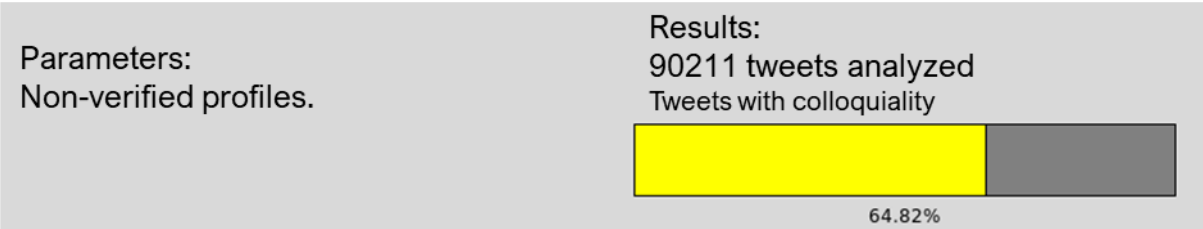


Figure 17: Not verified profiles and colloquiality ratio.

4.5 Tweets replies

Tweets replies are tweets that respond directly to another tweet and are not directed to the author's followers. The rate of colloquiality is slightly higher, only 1.28%, for tweets replies when compared to tweets that do not respond. Showing a tendency to use colloquiality when one is not addressing all followers but only one person.

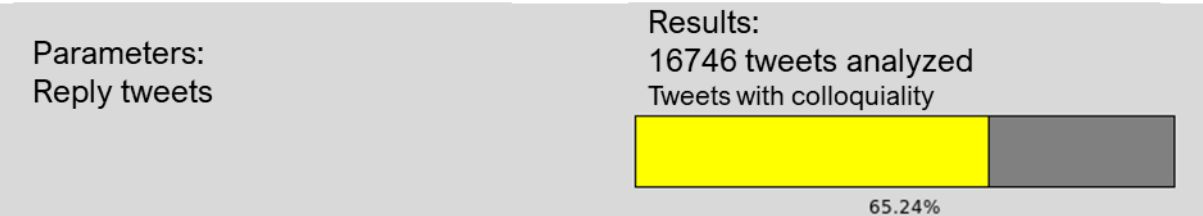


Figure 18: Tweet reply and colloquiality ratio.

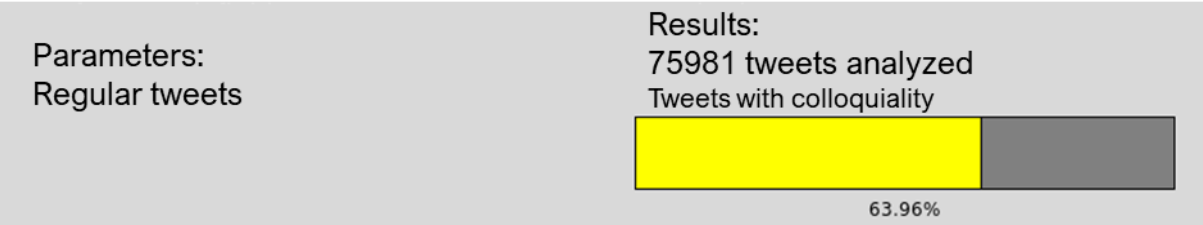
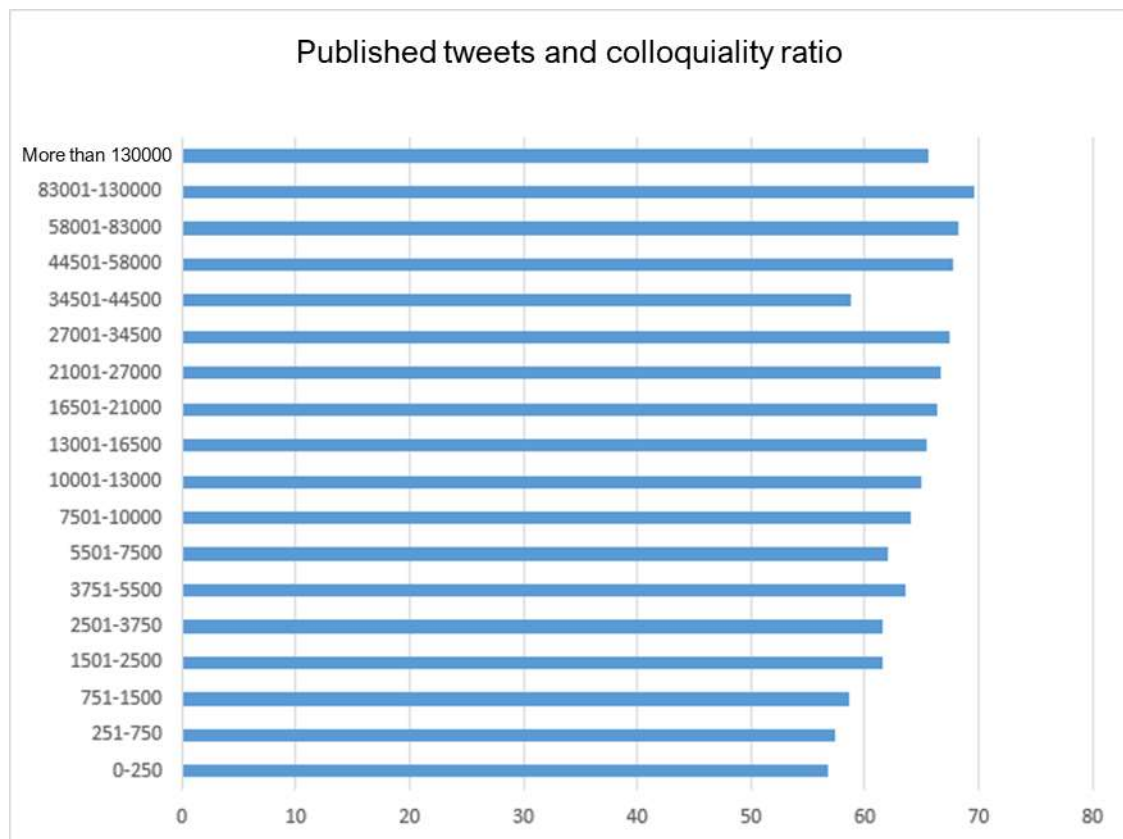


Figure 19: Regular tweets and colloquiality.

4.6 Number of tweets published

Graph 4 shows the relationship between the number of published tweets and the rate of tweets with colloquiality.



Graph 4: Published tweets and colloquiality ratio.

It can be noted that the more tweets the user publishes the greater his tendency to use colloquial terms. The range of published tweets was made so that each sample had approximately 5000 tweets as shown in Table 5 so that discrepancies in sample size would not interfere with the results.

Table 5: Published tweets and colloquiality ratio.

Tweets	Sample size	Sample percentage (%)	Tweets with colloquiality percentage (%)
0-250	5084	5,48	56,83
251-750	5008	5,40	57,39
751-1500	5382	5,80	58,58
1501-2500	5371	5,79	61,57
2501-3750	5172	5,58	61,48
3751-5500	5620	6,06	63,54
5501-7500	5221	5,63	62,02
7501-10000	5242	5,65	64,02
10001-13000	5042	5,44	64,99
13001-16500	5065	5,46	65,37
16501-21000	5024	5,42	66,38
21001-27000	5260	5,67	66,65

Tweets	Sample size	Sample percentage (%)	Tweets with colloquiality percentage (%)
27001-34500	5130	5,53	67,50
34501-44500	5174	5,58	58,82
44501-58000	4960	5,35	67,74
58001-83000	5291	5,71	68,13
83001-130000	4674	5,04	69,62
More than 130000	5007	5,40	65,51
Total	92727	100,00	64,19

5. Conclusion

The analyzes carried out show that there is a relationship between the use of colloquialities in tweets and several factors inherent to the social network Twitter. For example colloquialities versus popularity, colloquialities versus verified accounts, colloquialities versus number of followers, colloquialities versus number of published tweets.

Regarding the relationship between popularity and replication of a tweet considering the occurrence of colloquialities, we can point out that we observed that tweets without colloquialities have a positive trend towards greater popularity. Meanwhile, tweets with colloquialities tend to be less popular. Tweets with few colloquial terms have a slight positive tendency to be marked as a favorite.

Regarding verified accounts, we can see that verified users (artists, sportsmen, politicians, and companies), publish fewer tweets with colloquiality (about 41%) than unverified users (about 65%). Showing that personalities, or companies, that have a public image to care for, are concerned with the correct spelling of their published tweets, avoiding the abundant use of colloquialities.

The more followers a user has, the more he tends to use colloquialities in his tweets. This trend occurs up to a range of 0 to 2000 followers. From 2000 followers onwards, the greater the number of followers of a user, users tend to use a few colloquial terms.

Regarding the number of tweets published per user, we can see that the greater the number of tweets published, the more the user tends to use colloquial structures. This shows us a lack of concern with formalities with the social network over time.

In summary, we realize that the use of colloquial terms in tweets is common. However, its use is more frequent in accounts with few followers, and from unverified users. Other studies can be derived from this paper, for example, the verification of colloquialities versus gender of the user; colloquialities versus specific hashtags (considering specific facts and events); colloquialities versus sentimental analyses; and studies dealing with colloquialities and languages (considering other languages besides Portuguese).

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Students' Internal Efficiency in Public Day Schools in Ngoma Sector, Huye District of Rwanda

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Abstract

This study aimed to estimate students' internal efficiency in Public Day Schools implementing Nine Year Basic Education (9YBE)¹ policy in Ngoma Sector, Huye District of Rwanda. Since the Government of Rwanda embarked on the implementation of 9YBE policy, the remarkable increase has been achieved in students' enrolments at both primary and secondary education levels. But, little is known about the extent to which the policy has improved the indicators of internal efficiency such as duration of studies, years-input per graduate, survival and wastage rate. Through a descriptive design, data on students' enrolments and graduation at lower secondary education for the cohort 2013/14 and 2017/18 were gathered from all 2 public day schools in Ngoma Sector by use of statistical survey questionnaire. A reconstructed cohort analysis of 1000 students for both cohorts was computed and compared. The findings provided evidence that during the school years 2013/2017 there had been an increase in indicators students' internal efficiency. Nevertheless, dropouts and stagnation have continued to be hindrances to high school internal efficiency at this level of education. The findings suggest further investigation of the causes of students' stagnation and dropout and workable interventions that consider the context of 9YBE policy.

Keywords: Internal efficiency, student-years, cohort, reconstructed cohort, basic education

Introduction

Since the middle of the 20th century, investment in human capital development has increased drastically. People have been considered as the most important factor of production and economic growth. The level of access to and participation in education, therefore, becomes an indication of human capital accumulation which may lead to rapid economic growth. Consequently, countries have put in place education policies to guide the provision of education to ensure that everyone has the right to and participate in education (UNESCO, 2013; Olaniyan & Okemakinde, 2008).

The Latin American and Asian countries adopted a compulsory and free education policy implementable to children aged 6 to 14 both at primary and lower secondary school levels (Gropello, 2006). In India a compulsory and free education policy to ensure that every child has access to the elementary and fundamental stage of schooling (Pandit, 2016). In Africa, many countries adopted Universal Primary Education (UPE) policy along with abolition of school fees in the 1960s right after the independence

¹ 9YBE is an acronym given to Nine-Year Basic Education. According to the Ministry of Education, it is defined as "all children to be able to get an education in nine years, this is made up of six years of primary education and three years of the general cycle of secondary education without paying school fees."

(World Bank, 2009). In East Africa, for example, Kenya adopted Free Day Secondary Education policy to ensure increasing transition rate to secondary schools of pupils graduating from primary schools (Muganda, Simiyu, & Riechi, 2016).

The Nine Year Basic Education (9YBE) policy was adopted by the government of Rwanda in 2008 to guide on compulsory and free from primary to lower secondary education for children of 6 to 15 years old (Ministry of Education, 2013). The overall expectation from the implementation of basic education policies has been to ensure that no one is left behind in accessing and participating in education until completion (UNESCO, 2013).

Education wastage is said when there is an imbalance between education inputs compared to corresponding outputs (UNESCO, 2013). One of the aims of implementing basic education policy has been to ensure that 100 per cent of children that are admitted in primary education in the same school year remain in school until they complete secondary education within the pre-established years (UNESCO, 2013; Ministry of Education, 2013). This means that in a perfect situation the rate of wastage would be equal to one. However, the existence of dropouts and repetition causes some children to go beyond ideal years of schooling a given level of education and consequently increases the rate of wastage.

The study on 'Wastage of secondary education in Ekiti south senatorial district of Ekiti state' indicates an average of 7.5 students - years for one student to complete secondary school instead of 6 students - years. Thus, the wastage ratio at Ekiti state was 1.3 while the internal efficiency was at 76.92% (Adeoye & Olumide, 2014). This implies that policies that are put in place should enable an environment for controlling and minimizing the power of factors contributing to dropout and stagnation of students. A study by Mumina establishes evidence that Free Day Secondary education policy has decreased wastage rates from 44 per cent in the 2006 cohort to 19 per cent in the 2007 cohort in secondary schools in Kathonzi District in Kenya (Mumina, 2011).

Building on how other policies are performing to diminish the rate of students' wastage, and increasing the rate of internal efficiency this study has a purpose to estimate the internal efficiency in Nine Year Basic education schools. The provision of Nine Year Basic Education (9YBE) aimed at accommodating a big number of successful completers from primary schools and retaining them until they complete the lower secondary education level and reduce students' wastage rate in terms of dropout and stagnation rates and then increase school internal efficiency (Ministry of Education, 2013).

This study, therefore, sought (i) to determine the rate of internal efficiency for the cohort 2013/14 and 2017/18 and (ii) to find out whether the provision of basic education up to nine years of schooling affected the rate of internal efficiency.

Materials and Methods

The study was a descriptive survey design using quantitative methods to describe the study variables. The target population which was entirely taken as the sample of the study was 2 public day schools implementing 9YBE in Ngoma Sector, Huye district of Rwanda [Sector Education Report, 2019]. Statistical data on students' enrolments and graduation for the cohort 2013/14 and cohort 2017/18 were collected from Ngoma Sector Education Office by use of survey questionnaire.

The analysis of data collected from the field started by grouping data on enrolments, repetitions and graduations into tables and then analysed by computing students flow rates. To arrive at the rate of internal efficiency, the reconstructed cohort flow analysis based on 1000 student registrations was performed and interpreted through the consideration of rates existing promotion, repetition and dropout rates (Chang, 2006).

Results

This section presents the findings of the study. The first part is about students' enrolment flow rates for the cohort 2013/14 and cohort 2017/18. The second part treats indicators of internal efficiency for both cohorts 2013/14 and 2017/18.

Students' enrolments and flow rates for 2013/14 and 2017/18 cohorts

Table 1 Students' Enrolments in 2013/14 and 2017/18 in 9YBE schools in Ngoma sector

Enrolment	S 1	S 2	S 3	Graduates
Enrolment 2013	279	199	154	146
Enrolment 2014	204	192	153	
Repeaters 2014	17	11	1	
Enrolment 2017	151	168	178	173
Enrolment 2018	168	132	123	
Repeaters 2018	8	8	0	

Source: Adapted from Sector Education Office Reports, 2019

The data in Table 1 indicate students' enrolments in 2013/14 and 2017/18 school years. In 2013/14 enrolments decreased as higher grades are concerned. In contrast, enrolments increased with a higher grade in the school year 2017. The latter is an indication of either transfer or come back students in that year. In 2018 school year, enrolments decreased with higher grades. The general observation is that the increase in the number of students in higher grades compared to low grades is an indication of some transfers (ingoing) from other schools or the comeback students. The decrease in enrolments is then attributable to stagnation and dropout or transfer (outgoing) to other schools. The number of repeaters at the end of 2013 was higher than that of 2017/18.

Table 2: Students' Flow rates in 2013 and 2017

Flow indicators	S1 to S2	S2 to S3	Graduate rate
Promotion 2013	68.8	76.9	94.8
Repetition 2013	6.1	5.5	0.6
Dropout 2013	25.1	17.6	4.5
Promotion 2017	87.42	73.21	97.19
Repetition 2017	5.30	4.76	0.00
Dropout 2017	7.28	22.02	2.81

Source: Research, 2019

The findings in Table 2 revealed the following: (i) a high rate of promotion at the end of senior 1 in 2017 than that of 2013; (ii) a high rate of dropout in 2013 compared to that in 2017; the comparison of flow rates at the end of senior 2 indicates good performance in 2013 for both promotion rate and dropout rates compared to the same indicators in 2017. For the rate of graduates, a better performance was observed in 2017 than in 2013.

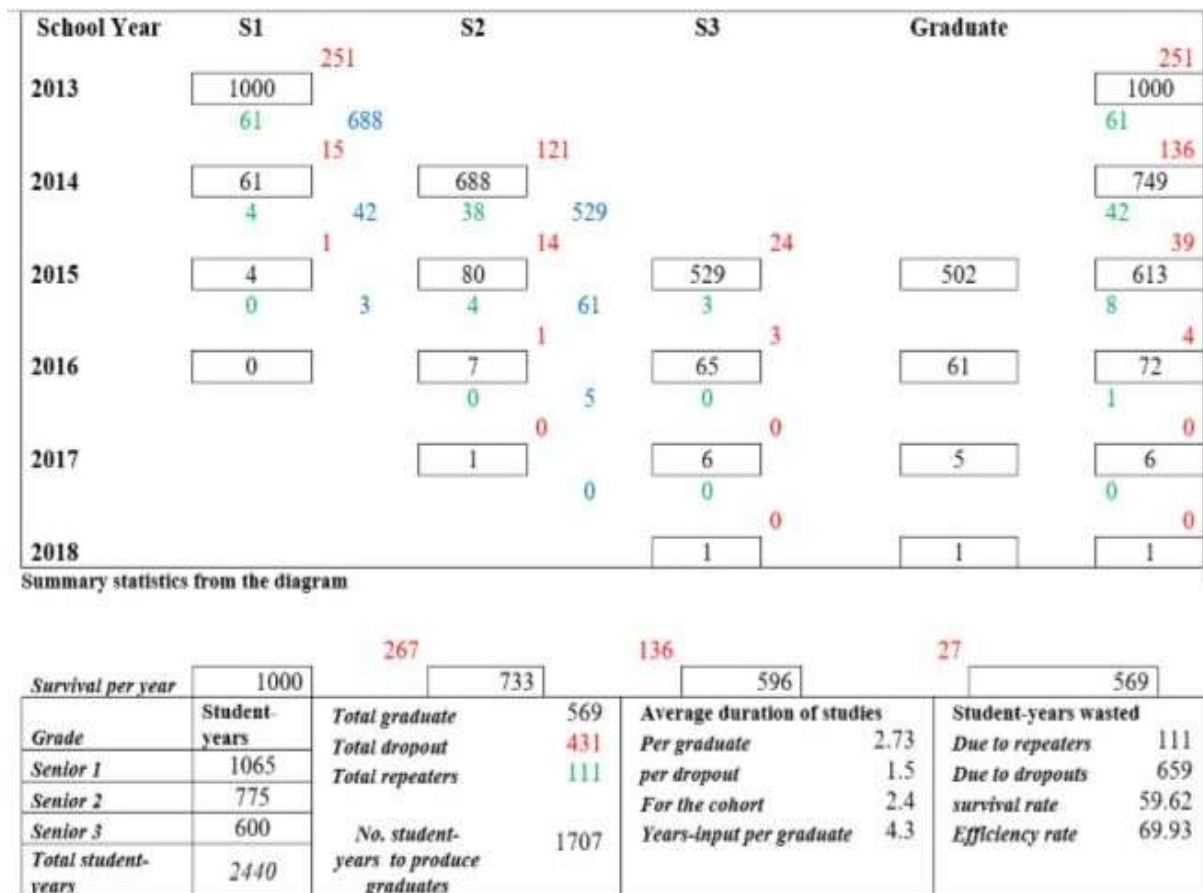


Figure 1. Diagram of reconstructed cohort flow analysis for 2013/14 cohort

From the above diagram, on the initial 1000 students enrolled in senior one, 502 graduated from the cycle without any repetition; 61 graduate with one year of stagnation, 5 with two years of delay, and 1 after having repeated three times. The survival rate of the cohort was, for example, 733 of the 1000 students of the cohort reached Senior 2 and 596 reached Senior 3. With this, the survival rate of the cohort was 59.62%.

By making the sum of the dropouts of each grade, the results indicate 431 students who gave up the cycle without completing lower secondary education² Thus out of 1000 students in the cohort, they were only 569 who completed the lower secondary cycle. The ideal number of student-years to produce the graduates were 1707 whilst the actual number of student-years which were used by the cohort was 2440. Thus, the wastage rate was 1.43 and coefficient of efficiency of the cohort was 0.6993. This finding revealed that public day schools implementing 9YBE policy in Ngoma sector were efficient at 69.93%. In addition to that, the number of the cohort years-input per graduate was 4.3; student-years wasted due to

² Caution has to be taken due to an unknown number of students who transferred to other schools. Here were considered dropping out.

repeaters were 111, and that due to dropouts were 659. The average duration of studies per graduate was 2.73; per dropout was 1.5 and for the cohort was 2.4.

The indicators of internal efficiency were also examined for the cohort 2017/18 as presented in Figure 2 below:

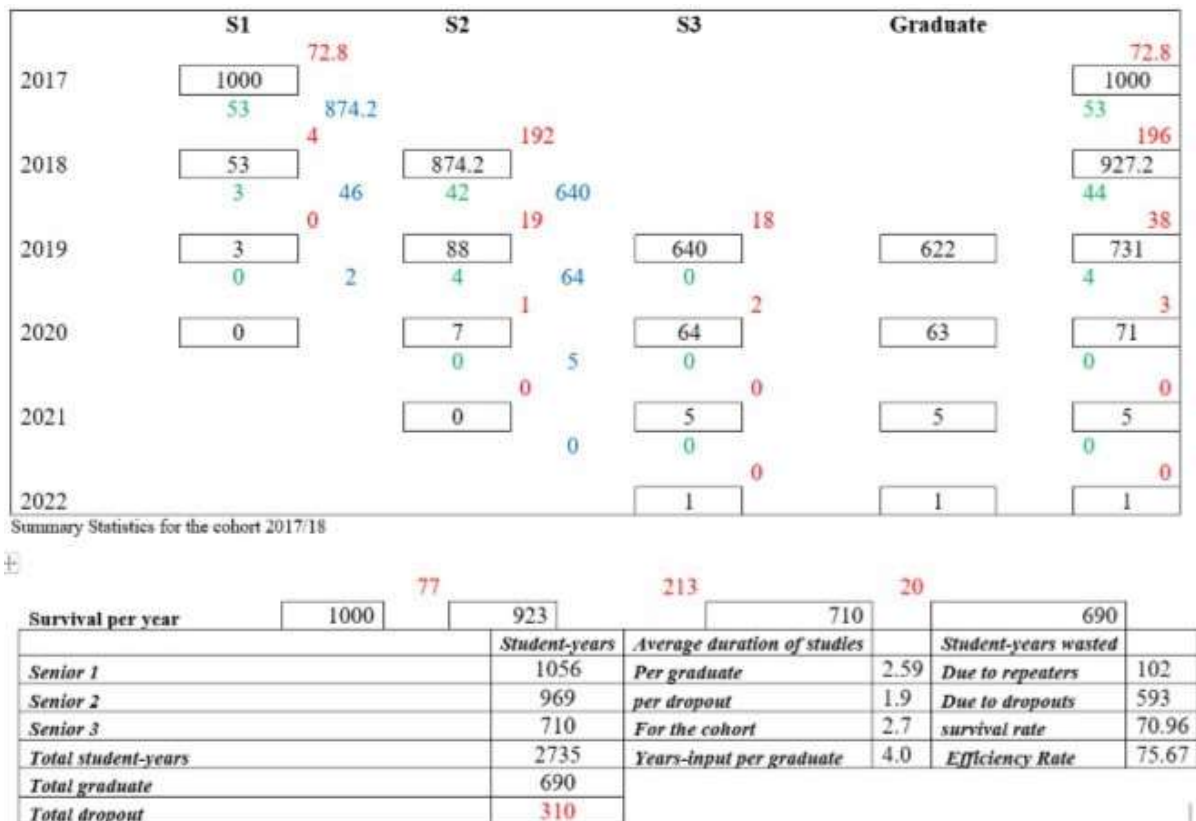


Figure 2: Diagram of reconstructed cohort flow analysis for 2017/18 cohort

The results from diagram of reconstructed cohort flow analysis for 2017/18 cohort revealed on the initial 1000 students enrolled in senior one 690 who graduated from the cycle without any repetition; 63 graduated with one year of repetition, 5 with two years of delay, and 1 after having repeated three times. The survival rate of the cohort was 923 of the 1000 students of the cohort who reached Senior 2 and 710 managed to reach Senior 3.

The survival rate of the cohort was 70.96% which was higher than that of previous cohort 2013/14. By making the sum of the dropouts of each grade, the results indicate 310 students who gave up the schooling system without completing lower secondary education. Thus out of 1000 students in the cohort, they were only 690 who completed the lower secondary cycle. The ideal number of student-years to produce the graduates were 2070. The actual number of student-years who were used by the cohort was 2735. As results, the wastage rate was 1.32 which was less than that of 2013/14. The coefficient of efficiency of the cohort was therefore 0.7567. This means public day secondary schools in Ngoma sector were able to raise internal efficiency to 75.67% in 2017/18 from 69.93% in 2013/14. In addition to that, the number of the cohort years-input per graduate are 4.0, student-years wasted due to repeaters are 102, and due to dropouts are 593. The average studies per graduate is 2.59, per dropout is 1.9 and for the cohort is 2.7.

Discussion

The findings of this study provide evidence that during the school years 2013/2017 there had been an increase of 11.36 points in survival rate, 12.1 points in graduate rates and 5.74 points in school internal efficiency. This implies that over the period under which the 9YBE policy had been on the implementation there had been an improvement in students' retention, completion and time used by students to graduate lower secondary education.

Besides the findings agree with (Muriithi & Oluoch, 2018; Mumina, 2011; Japanese International Cooperation Agency, 2012) that the provision of day schools accompanied with the removal of school fees, in particular, had decreased the incidence of factors contributing to students' dropout and stagnation, hence the increase in efficiency rate. Students' enrolment and internal flow rates have increased due to different intervention put in place during the implementation of basic education policy.

The study validates the results from a systematic review by Snilstveit, and Muriithi and Oluoch which confirm a positive effect of interventions centred on children, household and school on both enrolment and efficiency rate in the delivery of basic education in low and middle-income countries. These interventions include but not limited to the removal of school fees, provision of meal at school, construction of new schools and classroom to accommodate graduates from primary education, flexibility in students' progression principle from one grade to the next grade etc. (Snilstveit et al., 2015; Muriithi & Oluoch, 2018).

Conversely, the findings are in agreement with other studies on the persistence of dropout and stagnation despite the provision of free and compulsory basic education (Belfield & Levin, 2007; Adeoye & Olumide, 2014; Kaume-Mwinzi, 2017).

Conclusion

Upon the findings of this study the following conclusions were drawn:

- i. For the cohort 2013/14, the number of the cohort years- input per graduate was 4.3, the survival rate was 59.62%, the graduation rate was 56.9%, the average studies per cohort was 2.4. Thus the internal efficiency was 69.93%.
- ii. For the cohort 2017/18, the number of the cohort years- input per graduate was 4.0, the survival rate was 70.96%, the graduation rate was 69.0%, the average studies per cohort was 2.7. Thus the internal efficiency was 75.67%.
- iii. The comparison of the characteristics of the two cohorts provides evidence that over the period (2013/2017) of the provision of basic education up to 9 years of schooling, there had been an increase in school internal efficiency with 5.74 points, graduate rates increased with 12.1 points and survival rate with 11.36 points.
- iv. The school system continues to suffer from dropouts and stagnation, especially at the end of senior 1 and senior 2.

Recommendations

Regarding the findings, the following are suggested:

- i. Reinforcing school record-keeping system in a way that it enables data availability and distinguish the number of students who transferred to other schools from dropouts, the number of newly admitted or proposed in a given level from the come-back students
- ii. Strengthening all interventions that reduce the number of stagnation and dropouts without deflating the quality of education
- iii. Establishing a regular assessment of school internal efficiency as one of quality control measures.
- iv. Investigating the causes of students' stagnation and dropout and possible interventions for high school internal efficiency

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THE INFLUENCE OF COMPANY PERFORMANCE ELEMENT, AUDITOR'S REPUTATION AND REPEAT AUDIT TO LENGTH OF AUDIT

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ABSTRACT

This research aims to analyze the influence of company performance elements, auditor reputation and repeat audit on audit duration. The length of the audit is measured from the closing date of the financial year to the date the audit report was issued. The data used in this study are secondary data and sample selection using a purposive sampling method which consists of 320 companies listed on the Indonesia Stock Exchange (BEI) and publishes financial statements consistently in the 2014-2018 period. The method of analysis of this study uses multiple linear regression analysis. Based on the estimation results used it can be seen that only the auditor's reputation variable has no significant effect on the length of the audit, while the other variables are proven to have significant influence as follows: (i) Profitability has a significant negative effect on the length of the audit, (ii) Solvency has a positive influence and significant to the length of the audit, (iii) the size of the company has a negative and significant effect on the length of the audit, (iv) repeat audit has a negative and significant effect on the length of the audit.

Keywords: Length of audit, profitability, solvency, company size, auditor reputation, repeat audit

INTRODUCTION

Economic growth is increasing from year to year. One of the biggest contributors to the national economy is the manufacturing industry as the largest contributor to Indonesia's gross domestic product (Ridwan, 2018). This growth encourages companies to increase and develop their businesses so that they need capital or *investment*. This development effort is carried out by *going public* or *initial public offering* (IPO), namely by registering companies on the Indonesia Stock Exchange (IDX) to open company access to long-term funding or *investment* (GoPublik, 2020).

The investors before investing will check the company's performance, one of which is the company's financial statements. Company performance is a parameter used to assess the overall success of the company in achieving strategic goals that have been set through selected strategic initiatives (Mulyadi, 2007). Measurement of company performance includes profitability, solvency and company size.

Investors and potential investors in the capital market really need accounting information that management reports have high integrity, the indicator is the auditor's reputation used by a company to examine its financial statements. The financial statements provide important information about the company for those who need it, namely creditors, shareholders, and management. Given the importance of company information in decision making, the timeliness of reporting plays a high and valuable role for those in need.

The length of the audit is the audit time gap, which is the time required by the auditor to produce an audit report on the performance of a company's financial statements. This audit gap is calculated from the difference between the date of the company's annual financial statements up to the date of the audit report issued by KAP (Halim, 2007). The length of the audit is the length of time for the completion of the audit measured from the closing date of the financial year to the date the audit report was issued.

The obligation of companies that have *gone public* is to publish financial reports that have been prepared with financial accounting standards and have been audited by public accountants. The auditor has a big responsibility and of course, this makes the auditor work more professionally. One of the criteria for auditor professionalism appears in the timeliness of the delivery of audited reports (Subekti and Wulandari, 2004).

Caslaw and Kaplan (1991) state that *timeliness of reporting* is an important qualitative attribute in financial statements so that financial statements must be accurate and timely (*disclosure*) so that information in financial statements can be useful for its users for economic analysis and decision making.

Malaysia is one of the countries that provide rules for audit research. Che-Ahmad and Abidin (2008) stated that the average length of an audit of a Malaysian company was longer than that of a western country. Multivariate analysis shows that the director's share ownership, total assets, number of subsidiaries, type of audit company, audit opinion and *return on equity* are important determinants of the length of the audit (Che-Ahmad and Abidin, 2008).

Hasan (2012) conducted a study that examined company size, profitability, solvency, auditor's opinion and the size of the Public Accounting Firm. The results of his research show that profitability, auditor opinion, and the size of the Public Accounting Firm are significantly negatively related to the length of the audit.

According to Vuko and Cular (2014), the existence of an audit committee, profitability and *leverage* are statistically significant determinants of the length of the audit in Croatia. The audit report date is the date on which the auditor has obtained sufficient and appropriate audit evidence to support the opinion, including evidence that all financial statements have been prepared.

Based on the description above, it is known that the accuracy of the delivery of financial statements is very important especially for users of financial information in predicting and making decisions. So that the duration of the audit is very crucial because it affects the results of investor decisions. In addition, the

manufacturing industry is the most important industry in Indonesia, so research on "The Effect of Elements of Company Performance, Auditor Reputation and *Repeat Audit* on the Length of Audit" needs to be done.

THEORETICAL AND DEVELOPMENT HYPOTHESES

Theory of Compliance

According to Sulistiyo (2010), there are two basic perspectives in the sociological literature on adherence to the law, that is instrumental and normative. The instrumental perspective assumes the whole person is driven by personal interests and responses to changes in incentives, and penalties related to behavior. The normative perspective deals with what people consider to be moral and contrary to their personal interests.

Theory Agency

Jensen and Meckling (1976) describe the agency theory as the relationship between the agent (management) and the principal (owner). Principals in this case are represented by the shareholders' demand accountability of agents represented by the manager through the reporting of financial information. The agent acts as the party that has the authority to make decisions, while the principal is the party that evaluates.

Profitability

Companies that have higher profitability require faster time in auditing financial statements. This is due to the necessity to deliver the good news as soon as possible to the public. This was also conveyed by Imam Trianto, R. Adri Satriawan and Yuneita Anisma (2014) who conducted research on mining companies listed on the Indonesia Stock Exchange in 2014 whose research results have proven that profitability has a significant effect on the length of the audit.

Based on this description, the following hypothesis is formulated:

H1: Profitability has a negative effect on the Length of Audit

Solvency

Solvency is often called the leverage ratio. LeverageThe company shows how much equity is available to provide collateral for the company's total debt, both current and long-term debt. The effective use of debt will increase the company's income and equity (Munawir, 2001). The greater the level of *leverage* shows the greater the risk in payment of a corporate debt.

The high debt to equity ratio reflects the high financial risk and the company is experiencing financial difficulties which is bad news that will affect the company's condition in the eyes of the public. The management will try to reduce the *debt to equity ratio* as low as possible so that it tends to delay the delivery of financial statements that contain bad news (Utami, 2006). The higher the ratio of debt to capital, the longer the delay in submission of audited financial statements.

Based on the description, the following hypothesis is formulated:

H2: Solvency has a positive effect on the Length of Audit

Company

Size Company size can be seen from the total assets owned by the company. The larger the scale of a company, the time to complete the audit process will be faster than smaller companies. This is because large-scale company management tends to be given incentives to reduce the length of the audit because the company is closely monitored by investors, capital supervisors, and the government. Therefore, large-scale companies tend to experience higher external pressure to announce audit reports earlier.

Rachmawati research results (2008), showed that the size of the company has a significant influence on the length of the audit where the larger the size of the company, the shorter the length of the audit. Vice versa, the smaller the size of the company, the longer the length of the audit. This is because the internal control system of large companies is better so as to reduce the level of error in the preparation of financial statements that make it easier for auditors to audit financial statements.

Based on the description, the following hypothesis is formulated:

H3: Firm Size negatively influences the Length of Audit

Auditor Reputation

The auditor's reputation is measured by the size of the Public Accountant Firm which is divided into public accounting firms that are in the top four, in this case, *the big four* and public accounting firms *non the big four*. The public accounting firm *big four* generally has more resources so that it can conduct audits more quickly and efficiently. This supports the opinion that companies audited by public accounting firms *the Big Four* tend to complete their audits more quickly when compared to companies audited by public accounting firms *non-big four*.

Auditor's reputation can be known from the size of the audit company that conducts audits of annual financial statements, relying on whether the Public Accounting Firm (KAP) is affiliated with *the big four* or not. Lestari (2010) mentions the absence of a significant positive relationship between the length of the audit and the quality of the auditor, Rachmawati (2008) shows a positive correlation between the two things.

The available literature explains that large KAPs, in this case *the big four*, tend to more quickly complete the audit tasks they receive when compared to *non-big four*. The choice of a KAP *big four* by a company is a signal that the company's financial statements are more reliable and credible compared to companies that do not use KAP *the big four*. This is because the KAP of *the big four* has a large number of employees, can audit more efficiently and effectively, has a flexible schedule that allows it to complete audits on time, and has a stronger drive to complete the audit more quickly to maintain its reputation. the reputation they must maintain.

Based on this description, the following hypothesis can be formulated:

H4: Auditor's reputation negatively influences the Length of Audit

Repeat Audit

if the company chooses an auditor who is more likely to agree on the company's accounting practices and methods. If the company meets with a new auditor this year, it is different from the past auditor who might have understood the financial aspects of the company, allowing the new auditor to be totally blind about the company.

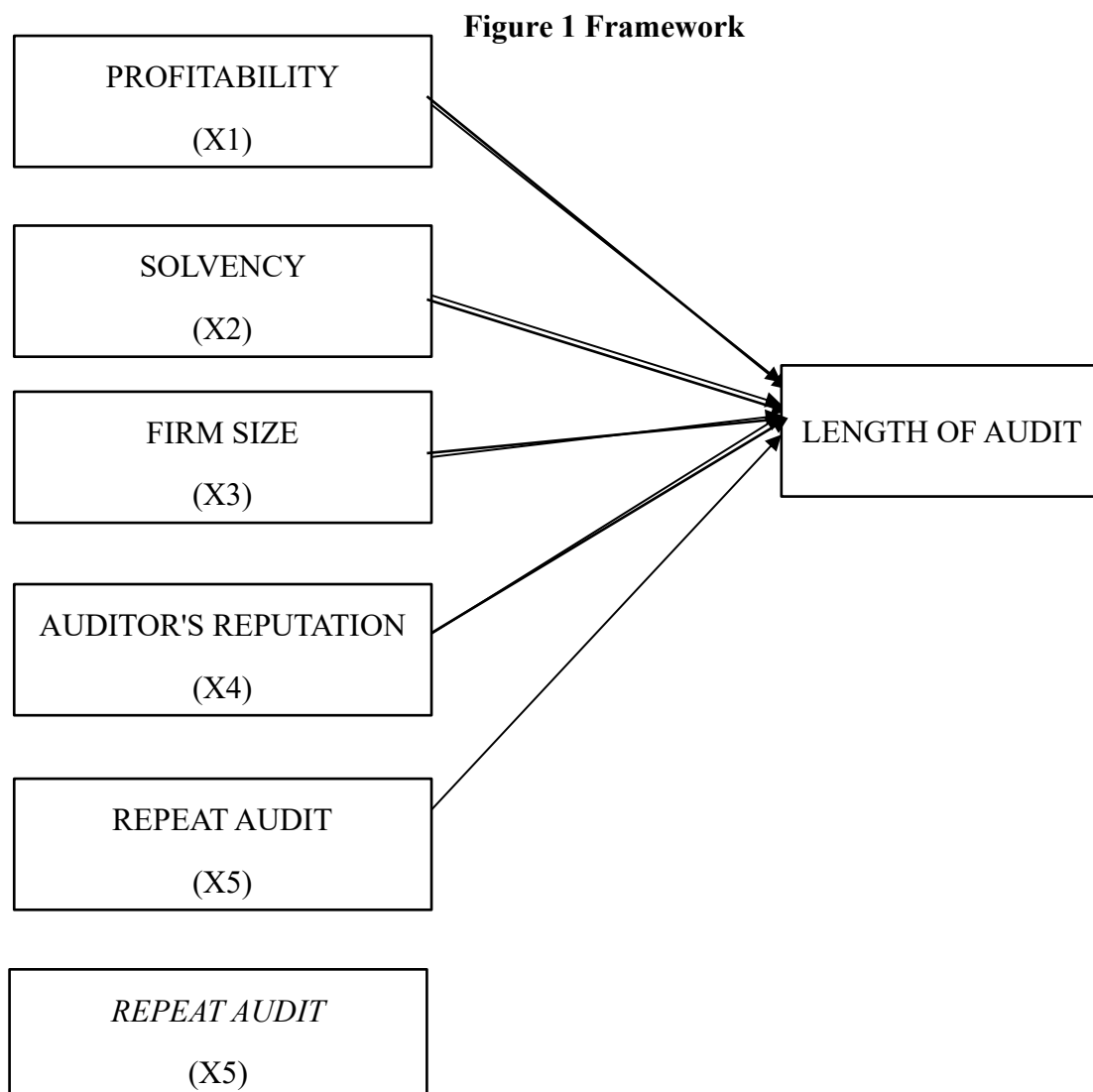
Then the choice to *repeat audit*, or choose an auditor who has done an audit last year to re-audit for the year concerned will be the first choice for the company. Especially if the results of their opinion last year were quite good and the price of assignments for this year is also quite fitting in the company's budget.

Based on the description, the hypothesis can be formulated as follows:

H5: Repeat Audit negatively affects the Length of Audit

Framework for Thinking

Based on the influence of the independent variables on the dependent variable outlined above, the theoretical framework can be described as follows:



METHODS

Population and sample

The population in this study were manufacturing companies listed on the Indonesia Stock Exchange from 2014 to 2018. Sampling in this study was carried out using a purposive sampling method, ie samples selected from a number of populations that met certain criteria and were considered to be able to represent.

The criteria for the companies sampled in this study are:

1. Manufacturing companies listed on the IDX consistently from 2014 to 2018 and were never delisted during that time period.
2. Manufacturing companies that publish financial statements that display data that support the analysis of factors that affect the length of the audit from 2014 to 2018.
3. Manufacturing companies use rupiah in their financial statement data.

Data and Sources of Data

Types of data used in this study include secondary data. Secondary data is a type of research data obtained indirectly by researchers through intermediary media. Secondary data is generally in the form of evidence, historical records or reports that have been compiled for publication or not published.

This study uses secondary data obtained from the Indonesia Stock Exchange website www.idx.co.id. The data in question is an annual report from manufacturing companies listed on the Indonesia Stock Exchange for the period 2014-2018 which contains complete information needed in this study.

Variable and Measurement of Variables

Table 1 Measurement

Variable	Measurement variable
Length of audit	Date audit report minus the date of the financial statements
Profitability	total net revenue divided by total assets multiplied by 100%
Solvency	Total debt divided by total capital multiplied by 100%
Company Size	logarithm natural total assets Ln (total assets)
Auditor reputation	Dummy big four and non-big four KAP
Repeat Audit	Dummy The same KAP from the previous year and that is not the same

The Data Test

the technique of multiple linear regression analysis is used to test the effect of independent variables more than two variables on variables dependent. The regression equation in this study can be formulated as follows:

$$Y = \alpha + \beta_1 \text{ Profit} + \beta_2 \text{ Solv} + \beta_3 \text{ CompanySize} + \beta_4 \text{ Reputation} + \beta_5 \text{ Repeat} + e$$

Description:

Y = length of the audit

α = Constant

Profit = Profitability

Solv = Solvency

Company Size = Company size

Reputation = Auditor reputation

Repeat = Repeat audit

$\beta_1 - \beta_5$ = regression coefficient of each variable

independent

E = error term

DISCUSSION AND ANALYSIS

Sampling

of the existing population, the sample used in this study is as follows.

Table 2 Sample Research Period 2014-2018

Criteria	Number
of Manufacturing Companies listed on the IDX in 2018	163
Companies not listed on the IDX since at least 2014	(99)
Number of sample companies	64
Number of observation years	5
Number of observations sampled during the study period	320

Source : www.idx.co.id, the data processed in the year (2020)

Hypothesis Testing

The Descriptive Statistics

purpose of the statistical description is to provide a brief description of the research variables. The description of the research variables is explained using the minimum, maximum, mean, and standard deviation of each variable. Some variables in this study use indicators based on previous research and other relevant references. The variables used in the analysis "Effect of Elements of Company Performance, Auditor Reputation and Repeat Audit on the Length of Audit" are divided into two, namely the dependent variable and the independent variable. For the dependent variable is the length of the audit, while for the independent variable is profitability measured by *return on assets* (ROA), solvency measured by *debt to*

equity ratio (DER), company size as measured by *LN total assets*, auditor reputation, and *repeat audits*. More specifically, a further explanation regarding statistics can be seen in the following table.

Table 3 Descriptive Statistics

Variable	Obs	Mean	Std. Dev	Min	Max
Number of Audit Days	320	79.14	15.62	32.00	191.00
ROA	320	0.04	0.10	-0.55	0.36
DER	320	1.17	1.87	-8.34	11.10
Company Size	320	14.70	1.76	6.48	19.66
Auditor Reputation	320	0.42	0.50	0.00	1.00
Repeat Audit	320	0.78	0.41	0.00	1.00

Source: Processed Results STATA, 2020.

Based on descriptive statistics table 3, it can be seen that each variable has a number of variables of 320 observations.

Statistical Tests

Table 4 Results of Estimated Effects of Elements of Company Performance, Auditor Reputation and Repeat Audit to Length of Audit

Dependent Variables: Length of Audit	Coefficient
Constant	106,951 (0,000) ***0.000)
Profitability (ROA)	-31,887 (0.005) **
Solvency (DER)DER)	0.4100.410 ((0.088) *
Company Size	-1.628 (0.020) **
Auditor Reputation	4,099 0.250
Audit Repeat	-6,046 (0.062) *
<i>R-squared</i>	0.086
<i>Prob> F</i>	0.002

Note: printed numbers in parentheses are prob values. t statistics that have been adapted to *robust standard errors*, alpha value 10% *; alpha value 5% **, alpha value 1% ***

Source: STATA processed product, 2020.

T Test

Testing the significance of independent variables partially through statistical tests t using 95 percent confidence level ($\alpha = 5$ percent) and 9 percent confidence level ($\alpha = 10$ percent). The estimation results are shown in Table 4.3. Based on Table 4.3 it can be seen that the ROA variable has a p -value of 0.005 <value of α 0.05 and has a negative coefficient direction, so it can be concluded that ROA partially has significant influence with a negative direction on the length of the audit.

Furthermore, DER partially has a significant and positive influence on the length of the audit because it has a p -value of 0.088 <value of α 0.10 and with a positive coefficient direction.

Then, Company Size has a p -value of 0.020 <value of α 0.05 and with a negative direction, so that the Company Size variable partially has a significant effect and with a negative direction on the length of the audit.

The last variable that has a significant influence is *repeat audit* with a negative direction because it has a p -value of 0.062 <value of α 0.10 and with a negative coefficient direction. The auditor's reputation variable apparently did not have a significant effect on the length of the audit. This can be seen from the p -value of 0.250 >value of α 0.05.

F Test

Testing the influence of all independent variables through the statistical test F using a 95 percent confidence level ($\alpha = 5$ percent), Based on the regression results obtained $\text{Prob} > F$ p -value of 0.0016 < α value 0.01, so that together the independent variables, i.e. (i) profitability measured by return on assets (ROA), (ii) solvency measured by debt to equity ratio (DER); (iii) Company size as measured by LN total assets, (iv) auditor reputation, and (v) repeat audits significantly influence the dependent variable (length of audit) (Table 4.3).

Determination Coefficient Test (Goodness of Fit)

Testing the ability of the model to explain the variation of the dependent variable produces R^2 of 0.0863. This means that the regression model can explain the variation of the TFT Indonesian TPT industry by 8.6 percent, while the rest is explained by other variables outside the model used in this study

CONCLUSION AND RECOMMENDATIONS

Conclusion

This study examines the effects of profitability, solvency, company size, auditor reputation, and repeat audits on the length of time for audit completion in manufacturing companies listed on the Indonesia Stock Exchange in the period 2014 to 2018. This study uses a multiple linear regression model with panel data and uses an amethod random effect based on robust standard errors. Based on the estimation results used, the conclusions of this study are as follows.

1. Profitability, as measured by return on assets (ROA), has a negative effect on the length of the audit, which means that if the company has a greater ROA then the time needed to conduct an audit will be shorter.
2. Debt to equity ratio (DER) to the length of the audit has a positive and significant effect. This means that if the company has a DER that is relatively larger than other companies, the time needed to conduct an audit will be longer.
3. Company size has a negative and significant effect on the length of the audit, which means that for larger company size, the audit time will be shorter.
4. The auditor's reputation has no effect on the length of the audit, which means that the Big Four KAP and non-Big Four KAP relatively need the same time in handling the audit report.
5. Repeat audits have a negative and significant effect on the length of the audit, which means that if the company reappoints the same auditor from the previous year, the time required to conduct the audit will be relatively shorter.

Suggestion

Taking into account the results of the analysis, conclusions and limitations that have been put forward, this study provides suggestions for further research as follows.

1. Further research can use other sectors or all sectors of companies listed on the IDX, so they can find out the comparison of the audit duration in each company studied.
2. Future studies can propose other variables than in this study that is thought to affect the length of the audit.
3. Future studies can use longer periods of time and greater observation so that the data that are the object of estimation become more representative of the phenomena that exist.

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A Suggested Proposal for Developing the Dimensions of Administrative Transparency and Intellectual Capital Management of Academic Leaders in the Faculties of Preparing Kindergarten Teachers in the Light of some Developed Countries Experiences'

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Abstract:

The current research aimed at presenting a suggested proposal for developing the dimensions of administrative transparency and intellectual capital management for academic leaders in the faculties of preparing kindergarten teachers in the light of some developed countries experiences'. The researchers utilized the descriptive approach as it suits the research nature and objectives. For data collection, the researchers used a questionnaire- prepared by the researchers- directed to a sample of faculty members and their assistants. The research sample consisted of (60) faculty members and their assistants in the faculties of preparing kindergarten teachers in the Universities of (Cairo- Mansours-Minia). The researchers revealed a set of results; the most significant of which was the achievement of the administrative transparency and intellectual capital management among academic leaders in the faculties of preparing kindergarten teachers to a moderate degree except for the statements in the dimension of administrative transparency which related to (activating the complaints and suggestions boxes), which was achieved below the minimum confidence interval levels, this mainly indicated that it was not achieved. Whereas the statements of (announcing the decisions that govern the faculty's work to achieve the university's goals and publishing real information about the faculty) were achieved to a high degree, which indicated that they were significantly achieved among the Heads of the Departments. Besides, some statements in the dimension of intellectual capital management as (building social networks based on trust, values, and ethics as a stimulator for creativity and innovation) were achieved significantly among the Heads of the Departments. The research concluded with a suggested proposal for developing the dimensions of administrative transparency and intellectual capital management for

academic leaders in the faculties of preparing kindergarten teachers in the light of some developed countries experiences', in addition to providing a set of future studies and research.

Key Words: administrative transparency, intellectual capital management, academic leaders, experiences of some developed countries.

Introduction

Higher education institutions occupy a vital position in facilitating the comprehensive development system, as they are the key tool and focus for meeting the needs of the society, that they create the present and plan the features of its future. The National Authority for Quality Assurance and Accreditation of Education (2009, 1) emphasizes that early education is the best investment in human life, and it has a vital role for society as a whole. Therefore, the state has paid great attention to kindergarten colleges.

There is no doubt that the success of higher education institutions depends mainly on the effectiveness of their administration and leadership. In this context, Haji (2007,71) indicated that management represents the most significant basic elements that work to activate the educational process and a system that involves a group of sub-organizations seeking to achieve a specific goal within a specific environmental and time frame.

The interest in developing some organizational dimensions (administrative transparency, intellectual capital management) increases the effectiveness of higher education organizations in general and their management in particular. Abu Al-Nasr (2015, 113) stressed that applying administrative transparency in higher education institutions helps to fight against administrative corruption and enhance trust between the organization and workers. Moreover, Golshahi. A, et al (2015, 169) indicated that intellectual capital is one of the main drivers of growth and development of organizations in terms of "human capital, structural capital, and relationship capital. In addition, Isaac.R, et al (2010, 313) added that intellectual capital is a competitive advantage and an essential factor in the survival of organizations because intellectual knowledge represents the inductive force that ensures the survival of organizations.

Accrediting the faculty of Early Childhood Education, University of (Cairo-Minia), makes it is a must to achieve growth, not survival; which requires it to search for excellence. Hussein (2015, 97) emphasized that the competitive advantage in higher education institutions enhances the organization's flexibility in order to adapt to changes in a way that enables it to continue to operate, it also affects the overall performance of the organization. Furthermore, it is also considered a weapon to meet the challenges of the corresponding organizations. Its' importance also stems from its ability to achieve harmony between the resources, capabilities ,and culture of the organization and its employment in order to achieve excellence and superiority in the light of the environment in which it operates. Consequently, the overall competitive advantage is achieved by applying some organizational dimensions (administrative transparency, intellectual capital management) to its leaders. This only happens through successful academic leadership. Hassanein (7, 2017) pointed out that leadership is the main driver for the success or failure of the organization, as the leader represents the example that the organization's staff has followed.

The developed countries pay great attention to the important role of universities in establishing

(administrative transparency and intellectual capital management). Whereas, the Shuang, L (2009) study recommended that transparency of education policy should be strengthened. In addition, DOMINIAK.p ,et al (2017, 368) also pointed out the importance of applying mechanisms for managing intellectual capital within higher education institutions (such as creating databases for the task of identifying the intellectual capital owned by the institution and classifying it as human, structural, and relational, to conduct training courses to develop brilliant knowledge, and offering programs that focus on energies and other mechanisms).

Research Problem

The justifications for conducting the current research include the following:

- The current research problem lies in the difficulties and problems facing Egyptian universities in general and their management in particular. Sayed (2018, 214) emphasized that the existence of problems facing Egyptian universities limit their competitive capabilities and sustainable growth, and prevent them from progressing and continuing to catch up with international universities, including those related to management and the quality of education. The decline of Egyptian Universities in the international ranking is worrying and alarming; this requires thinking to stand on the causes of this decline and retreat; seeking to eliminate such causes. Qarni's (2012) study results attributed the reasons for this decline to the rigidity and complexity of laws and regulations organizing work, centralization in management, weak capabilities to apply and use knowledge and ideas, and transferring them to implementation, as well as the weakness of the higher management's conviction of the importance of intellectual capital, its revitalization, and maintenance. While Harb(2012) study attributed these reasons to the imbalances and deficiencies in the practice of administrative leaderships in Egyptian universities for the skills of human relations; some of them may think that they are a group of formalities besides formal work, or that they are indulging in personal matters, which negatively affects the performance of work successfully and effectively, and weakens their powers as leaders of the organization.
- The results and recommendations of previous studies that called for strengthening and enhancing the dimensions of(administrative transparency - management of intellectual capital) in university institutions to avoid administrative problems such as corruption, routine and administrative slack. In this context, the studies of Hassan (2016), Al-Shammari (2015), Ahmed (2014), Al-Harbi (2012), and Harb (2011) recommended the necessity of adopting administrative transparency as an institutional approach in all administrative processes, which contributes in building a system that calls for integrity, through a procedural plan that promotes a policy of disclosure and clarity in its administrative dealings, the establishment of integrity practices, the creation of strong entities to fight corruption and adopt a procedural plan for reward and punishment. Al-Shammari's study (2009) also recommended the necessity of simplifying procedures, disseminating information and disclosing it within university institutions. Furthermore, Abdullah's study (2012) recommended that the university provide protections and guarantees for individuals who contribute to exposing corruption and rewarding them for that. In addition, the study of Muslim

(2016), Abel (2013) and Muhammad (2012) also recommended the need for paying more attention for intellectual capital in universities to become a basis for improving the level of organizational performance. Ahmed (2007) also confirmed that one of the most prominent roles of academic leaders in maintaining intellectual capital is to select employees according to the criteria of distinction and competence.

- The results of the survey, which the researcher conducted to a sample of staff members and their assistants at the faculty of Early Childhood Education, Minia University, which confirmed the existence of deficiencies in the application of the dimensions of administrative transparency and intellectual capital management and the results showed the following:
 - **Concerning the dimension of administrative transparency:** A percentage (36.8%) of the sample confirmed that the administrative transparency was low, (69%) stated that it was medium, and (15.3%) clarified that it was high.
 - **Concerning the dimension of intellectual capital management:** A percentage (46.5%) of the sample confirmed that the intellectual capital management in the faculty was low, (43.8%) stated that it was average, and (9.7%) clarified it was high.
- The results of the personal interview that the researcher applied to some leaders in the Faculty of Early Childhood Education, Minia University, which proved a failure in practicing some organizational dimensions (administrative transparency - management of intellectual capital) in the faculty, and the results showed the following:
 - **Concerning the first question: criteria for selecting human elements:** Selecting members according to seniority and personal acceptance occupied the first rank with the percentage of (60%); in the second rank was the accuracy and activity issued by the members and the extent of his understanding of the task and training courses obtained with the percentage of (20%) and representation of departments and specialization with the percentage of (20%).
 - **Concerning the second question: Supporting creative opinions and ideas:** moral and verbal support came in the first rank with the percentage of (60%) and then the statement of (there are no support and material incentives) with the percentage of (40%).
 - **Concerning the third question: The application of transparency in the systems and laws:** The systems and laws are applied according to personal relations statement came in the first rank with a percentage (60%), while the second rank was (the application of laws and regulations to all) with the percentage of (40%).
- A large number of conferences, seminars ,and agreements that recently called for the necessity of enhancing the dimensions of administrative transparency and management of intellectual capital, and the emergence of Arab and international initiatives to achieve integrity and transparency. Badrawi (2006, 45) referred to the information symposium which aimed to emphasize that institutional capacity building is comprehensive, integrated and necessary in order to reformulate the work of institutions and modernize their management, this requires the application of higher standards of transparency and accountability, as well as the review of laws and regulations that hinder the work of organizations. Mahjoub (2002, 147) also mentioned the Third Arab Conference in Administration, which was held by the Arab Organization for Administrative Development and

was aimed at researching and discussing the foundations of transparency and enhancing accountability and the rule of law. Its results indicated the necessity to spread and deepen awareness of a culture of transparency and accountability. Furthermore, Muhammed (2011, 2877) also mentioned global initiatives in achieving integrity and transparency such as (Transparency International Organization). The Organization for Economic Cooperation and Development and the World Bank (2010) also indicated that Egypt lacks a well-defined strategy for research, development, and innovation, its ability in the field of basic sciences is weak, and its management of research and innovation is insufficient, and that Egyptian universities do not have specific administrative and financial incentives that make them more Innovative and enables them to use resources more effectively.

- The necessity of keeping pace with the experiences of some developed countries that have paid great attention to the role of universities in establishing the dimensions of administrative transparency and management of intellectual capital for their leaders. This is indicated by a study by Hasan (2013) and Alcala (2016) that emphasized the need to study administrative transparency between academic leaders in universities in Armenia and Jordan and reached a set of tools to enhance transparency and accountability within universities such as (the Code of Ethics and Manuals explaining violations and academic discipline and detailed regulations for sanctions, the information network that gives an honest picture of what is going on in the institution). Golshahi. A, et al (2015) study also confirmed the importance of identifying indicators of intellectual capital in institutions of higher education as one of the main drivers of competitiveness and the growth and development of organizations; they have also designed methods to measure intellectual capital effectively.
- As a result of recent developments and obtaining the faculty of Early Childhood Education (Cairo-Minia University) institutional accreditation, the faculty today has required achieving growth, not just survival, which necessitates it to search for excellence. The dimensions of (Administrative Transparency - Managing Intellectual Capital) were the way to do that, and this was confirmed by the study of Al-Faqhah (2012) and Diab (2010) which recommended that higher education institutions should strive to achieve and sustain competitive advantage and benefit from the experiences of some developed countries concerning indicators of competitiveness, as indicated by the Helen,H (2015) study, He stated that universities need to find new sources of competitive advantages for development and growth that are more effective than those used by competitors.

In light of the above, the research questions can be defined as follows:

Research questions:

1. What is the reality of the administrative transparency dimension among the academic leaders of the faculties for preparing kindergarten teachers in light of the experiences of some developed countries (from the viewpoint of the study sample)?
2. What is the reality of the intellectual capital management dimension among the academic leaders of the faculties for preparing kindergarten teachers in light of the experiences of some developed countries (from the viewpoint of the study sample)?

3. What is the suggested proposal for developing the dimensions of administrative transparency and intellectual capital management among academic leaders in the faculties of preparing kindergarten teachers in light of the experiences of some developed countries?

Research Objectives:

The current research aims at:

1. diagnosing the reality of the administrative transparency dimension among the academic leaders of the faculties for preparing kindergarten teachers in light of the experiences of some developed countries (from the viewpoint of the study sample).
2. diagnosing the reality of the intellectual capital management dimension among the academic leaders of the faculties for preparing kindergarten teachers dimension in light of the experiences of some developed countries (from the viewpoint of the study sample).
3. presenting a suggested proposal for developing the dimensions of administrative transparency and intellectual capital management among academic leaders in faculties of preparing kindergarten teachers in light of the experiences of some developed countries.

Research Significance:

The significance of the current research is clear as follows:

1. The current research derives its importance from its subject and sample, as it deals with the dimensions of (administrative transparency - management of intellectual capital) among academic leaders; that this topic receives great attention from other Arab and Foreign Universities in various countries of the world, which seek to obtain sustainable competitiveness of their institutions.
2. The significance of achieving the competitive advantage of higher education institutions, in which the dimensions of (administrative transparency - management of intellectual capital) are the best imperative demands for its growth and survival; especially after achieving quality and accreditation. So that strategic approach which must be educated within the university institutions.
3. The significant role of academic leaders of faculties of preparing kindergarten teachers, and their effective contribution to the success of their institutions, and hence the organizational differentiation of it.
4. The scarcity of research - according to the researcher's knowledge - that dealt with some the dimensions of (administrative transparency - management of intellectual capital) in the faculties of preparing kindergarten teachers in the light of the experiences of some developed countries in Egypt, which makes the current study addition to the Arab Library in the field of administration.

Practical Significance:

1. The suggested proposal presented in the current study may be useful in qualifying academic leaders in the Faculties of preparing kindergarten teachers to practice their managerial and

leadership roles in the future, raise their awareness about the dimensions of (administrative transparency - management of intellectual capital) necessary for their work.

2. The results of the study and the suggested proposal may benefit institutions concerned with monitoring performance within universities, to be used in enhancing integrity and competitiveness among Egyptian Universities; besides increasing the effectiveness of their management to become more flexible and consistent with the ongoing changes.

Research Limitations

The current study was limited to the following:

1. **Thematic Limitations:** The current study was limited to presenting a suggested proposal for developing some organizational dimensions through monitoring the reality in the following dimensions (administrative transparency, intellectual capital management) among academic leaders (the Dean of the Faculty – the Heads of Departments) in the faculties of preparing kindergarten teachers in the light of the experiences of some developed countries (the United States, Japan, China, Russia, Spain, and the Netherlands).
2. **Place Limitations:** The field study was limited to the faculty members and their assistance in the faculties of preparing kindergarten teachers (Cairo, Mansoura, El Minia) to ensure the geographical representation, that Cairo University represents the capital, while Mansoura University represents Lower Egypt and El Minia represents Upper Egypt.
3. **Human Limitations:** The study tool was applied to a sample of the faculty members and their assistants in the faculties of preparing kindergarten teachers in the Universities of (Cairo, Mansoura, and El Minia).
4. **Time Limitations:** The study tool was implemented from 14 October to 19 December in the first semester of the academic year 2019/2020.

Research Methodology

The present study followed the descriptive approach, as it suits the nature and objectives of the study. Shehata and Al-Najjar (2011, 301) said that "It is an approach that does not aim at describing phenomena or describing reality as it is; rather, reaching conclusions that contribute to understanding and developing this reality."

Research Terms

Administrative Transparency

Mahmoud (2015, 113) defined administrative transparency as: "complete clarity in drawing plans, policies and decision-making, and the subjection of management practices to constant monitoring, and access to information."

Hazelkorn, E (2012,143) also defined it as "Clarity of legislation, stability ,and harmony with each other, clarity of its language, flexibility ,and development, in addition to disseminating information and

disclosure so that it is available to everyone in the organization, and is divided into four dimensions (clarity - credibility - disclosure - Participation). "

The current research defined administrative transparency procedurally as an organizational dimension, demonstrating the commitment of academic leaders to disclosure and publicity and complete clarity in (laws, regulations and legislation, decision-making, information flow and communication with subordinates, and administrative evaluation); to achieve the highest levels of efficiency and effectiveness in faculties for preparing kindergarten teachers, and building systems within it.

Intellectual Capital Management

Al-Hilali and Al-Ghabour (2015, 86) defined the management of intellectual capital as: "the economic value of two classes of intangible assets of an organization, which are human capital and organizational capital (structural)."

Indiyati, D (2015, 6034-6035) defines it as: "Intangible assets that can provide added value, and is a mixture of human capital, structural capital, and relationship capital."

The current research defined intellectual capital management as the set of activities and efforts undertaken by academic leaders to provide those intangible assets represented in (human capital - structural capital - relationship capital) in a manner that enhances the competitive position of faculties for preparing kindergarten teachers.

Academic Leaders

Hamid (10, 2012) defined academic leaders as "the people who are assigned administrative work at the university".

The current research defined academic leaders procedurally as those in charge of managing and leading colleges for preparing kindergarten teachers, who are appointed by the president of the university, and who are represented in (the dean of the college - heads of departments).

Experiences of some developed countries

The researcher defined it procedurally in the light of the current research as the set of modern global means, mechanisms, procedures, and controls for some countries, which can be used to develop the dimensions of administrative transparency and intellectual capital management in colleges for preparing kindergarten teachers, in a manner consistent with the nature and capabilities of Egyptian society, and these countries are (United States, Japan, Russia, Spain, Netherlands).

Field Study:

This section covered a detailed description of the procedures that were followed in implementing the field study of the research and includes the research tool (its objectives, procedures, and the final application of the tool), a description of the sample, a statement of the statistical methods that were used in processing the results, and finally the presentation of results and the proposed scenario for developing the dimensions of (administrative transparency - intellectual capital management) in light of the

experiences of some developed countries.

First - The Research Tool:

The following is a detailed view of the field research tool:

a) Objectives of the questionnaire:

This questionnaire aimed to diagnose the reality of the administrative transparency and intellectual capital management dimensions among academic leaders in faculties for preparing kindergarten teachers in the light of the experiences of some developed countries "addressed to faculty members and their assistants".

b) Steps to build the questionnaire:

The researcher followed the following steps in building the questionnaire:

- preparing the initial form for the questionnaire

Educational literature has been reviewed in the field of the following organizational dimensions (administrative transparency, intellectual capital management) among academic leaders. Also, some previous studies related to the current research were reviewed, in addition to the experiences of some developed countries in the aforementioned organizational dimensions, to benefit from them in building the questionnaire, as well as reviewing the roles and tasks of academic leaders in the light of the law regulating of Egyptian Universities to identify the questionnaire study sample. Then the questionnaire was reached in its initial form.

- Ensuring the questionnaire validity through submitting it to the jury members and calculating the internal consistency:

After preparing the initial image of the questionnaire, it was presented to a group of jury members (15) from the professors of the Faculty of Education, specialization of (foundations of education, educational administration, and comparative education), and kindergarten specialization (the principles of child education, educational administration for kindergarten) at Minia and Assuit University, In order to judge the expressions, to express their opinion through adding or deleting some expressions, and after the completion, the percentage of agreement between the jury members was calculated on the expressions of each of questionnaire items, and in light of the opinions of them, the modifications they referred to were made as shown as follows.

Table (1)
Modifications of Jury Members

Dimension	Item number before arbitration	Item before attribution	Item number after arbitration	Item after attribution
Administrative transparency	1	Academic leaders announce regulations and laws to all subordinates within the faculty upon its issuance.	1	Academic leaders announce work-related laws and regulations to all subordinates within the faculty upon their issuance.
	2	Academic leaders announce the decisions taken to conduct the faculty's work in an objective and standard manner.	2	Academic leaders announce the decisions governing the work of the college in objectively.
	3	Academic leaders practiced disclosing and announcing information through (media and press conferences uniformly.)	3	Academic leaders practice the policy of disclosing and announcing information for all faculties' subordinates objectively.
	4	Academic leaders apply all forms of administrative transparency to all faculty subordinates. (Internal transparency related to total relationships, dealings and behaviors, external transparency related to trust and credibility with the external community, transparency in regulations and legislation, transparency in work procedures ...).	4	Academic leaders apply most forms of administrative transparency to all faculty subordinates.

5	Academic leaders avoid applying dubbed transparency (arbitrarily transmitted and transcription-style) and elliptical transparency (which serves the interests and ideology of its source and designer of its mechanisms) that are inconsistent with the nature of work in the faculty.	5	Academic leaders apply transparency neutrally, away from the dubbed and elliptical transparency, which is not appropriate for the nature of work in the faculty.
6	Academic leaders apply administrative transparency policies and mechanisms within the faculty such as (educational programs to educate workers, organizational manuals for labor laws, oversight committees, ethical codes...) in a unified and objective manner.	6	Academic leaders apply administrative transparency mechanisms within the faculty in an objective manner.
7	Academic leaders simplify the mechanisms of administrative and academic work procedures within the faculty, in a manner that allows the performance of work without complication through (procedural guides to clarify work plans - annual reports of what the institution has accomplished ...).	7	Academic leaders simplify administrative and academic work procedures within the faculty, in a manner that allows the performance of work without complication.
8	Academic leaders take over the responsibilities of facilitating the faculty work in a manner that achieves the goals of the university within the limits of the prescribed laws, regulations, and systems.	8	Academic leaders take over the responsibilities of facilitating the faculty work in a way that achieves the goals of the university and the college following the law.
13	Academic leaders provide clear mechanisms for continuously evaluating the performance of all subordinates during the year such as (performance reports, portfolios, self-evaluation ...).	12	Academic leaders provide clear mechanisms for continuously evaluating the performance of all subordinates.

	14	Academic leaders avoid nepotism and favoritism in the process of evaluating the performance of all faculty subordinates.	13	Academic leaders commit to justice in the process of evaluating the performance of all faculty subordinates
	16	Academic leaders involve all subordinates in making decisions regarding work within the faculty.	15	Academic leaders involve some individuals representing all categories of subordinates in making decisions regarding work within the faculty.
	19	Academic leaders accept constructive criticism from the external community and correct their direction according to.	18	Academic leaders accept constructive criticism from the external community and plans in its light.
Intellectual capital management	1	Academic leaders raise the slogan that the human element is the most important resource for the faculty's success in achieving its goals.	1	Academic leaders interest in the human component as one of the most important resources for faculty success in achieving its goals.
	2	Academic leaders provide mechanisms for detecting distinguished cadres working in the faculty.	2	Academic leaders provide mechanisms for detecting the faculty distinguished cadres.
	5	Academic leaders allocate a special department (the information sector) that is responsible for carrying out continuous updating of databases to follow up on subordinates of correspondence and administrative decisions issued by the faculty.	5	Academic leaders allocate a special department (the information sector) that is responsible for carrying out continuous updating of databases to follow up on subordinates of correspondence and administrative decisions issued by the faculty.

7	Academic leaders keen on preparing the infrastructure of equipment and laboratories to help creative workers launch their creativity into the faculty.	7	Academic leaders keen on providing the infrastructure of equipment and laboratories for the creative workers of the faculty.
11	Academic leaders keen on providing programs to develop intellectual capital in the faculty. (The employment and employee selection program, the program that provides a stimulating climate for the creativity of workers, the leadership qualification program, the program to encourage social relations, the program to provide resources for intellectual capital ...)	10	Academic leaders keen to provide programs to develop the faculty's intellectual capital.
12	Academic leaders provide mechanisms for preserving the accumulated experiences of the distinguished employee expected to be left for work due to secondment or retirement.	11	Academic leaders provide mechanisms for preserving the accumulated experiences of the distinguished faculty employee.
19	Academic leaders hold scientific and research protocols with various international and foreign universities to achieve the faculty's competitive advantage.	17	Academic leaders hold scientific and research protocols with various international and foreign universities.

- **Internal consistency validity:**

To calculate the validity of the internal consistency of the questionnaire, the researcher applied it to a sample of (20) individuals from the research community except for the original research sample and the following table showed that:

Table (2)
Correlation Coefficient between the Degree of Each Phrase and the Total Degree of the
Dimension to which It Belongs (n = 20)

Dimension	Items							
Administrative Transparency	Item No.	1	2	3	4	5	6	7
	Correlation coefficient	0.78	0.80	0.81	0.77	0.78	0.76	0.77
	Item No.	8	9	10	11	12	13	14
	Correlation coefficient	0.83	0.67	0.63	0.79	0.56	0.54	0.62
	Item No.	15	16	17	18	19	20	21
	Correlation coefficient	0.64	0.64	0.71	0.84	0.73	0.62	0.57
Intellectual capital management	Item No.	1	2	3	4	5	6	7
	Correlation coefficient	0.62	0.69	0.82	0.70	0.73	0.86	0.70
	Item No.	8	9	10	11	12	13	14
	Correlation coefficient	0.88	0.71	0.65	0.84	0.86	0.93	0.84
	Item No.	15	16		18			
	Correlation coefficient	0.69	0.75	0.82	0.82			

Table (2) clarified the following:

Correlation coefficients between the degree of each item and the total degree of the dimension belonging to it ranged between (0.54: 0.93) which were statistically significant, that mainly indicated the validity of the internal consistency of the questionnaire.

- **Applying the questionnaire to a pilot sample to calculate reliability:**

To calculate the reliability of the questionnaire, the researcher used the Cronbach's alpha coefficient by applying it to a sample of (20) participants from the research community except for the original research sample and the following table shows that:

Table (3)**Reliability Coefficients using the Cronbach's alpha Coefficient for the Questionnaire (n = 20)**

Dimension	alpha Coefficient
Administrative Transparency	0.93
Intellectual capital management	0.94

Table (3) showed the following:

- The alpha coefficients for the questionnaire ranged between (0.92: 0.96), which were statistically significant coefficients and that indicated the reliability of the questionnaire.
- After conducting the modifications mentioned by the jury members- which were previously presented- and after calculating the reliability and validity of the questionnaire; the questionnaire is now in its final form.

c) The final application of the questionnaire:

After calculating the reliability and validity of the questionnaire, the researcher did the following:

1. Taking the approval of the official authorities
2. The final application of the questionnaire to the total sample, in the faculty for the preparing kindergarten teachers (Cairo - Mansoura - Minia), and the final application of the questionnaire was done to the total sample in the period from October 14 to December 19 of the first semester of the year 2019/2020.

Second: The Research Sample:

A random sample of the faculty members and their assistants were chosen in the faculty for the preparing kindergarten teachers (Cairo - Mansoura - Minia), to ensure the geographical representation, that Cairo University represents the capital, while Mansoura University represents Lower Egypt and El Minia represents Upper Egypt so that the results of the study can be generalized to faculties for preparing kindergarten teachers in Egypt. Moreover, it was taken into account as much as possible for this sample to represent the original community according to statistics, and many forms have been excluded because some of them did not fulfill the answer to all the statements, or for the randomness of the responses of others until the final number of the sample became (60).

Third: Statistical Treatment:

After collecting and scheduling data, they were statistically processed. To calculate the results of the research, the researcher utilized the following statistical methods:

- Percentage.
- Correlation coefficient.
- Cronbach's alpha Coefficient.
- Estimated degree.

- Average response rate.

The researcher satisfied (0.05) significance level (0.05), and the researcher used SPSS to calculate some statistical transactions.

Fourth: Answering Research Questions:

Answering the first research question, which was "What is the reality of the administrative transparency dimension among the academic leaders of the faculties for preparing kindergarten teachers in light of the experiences of some developed countries (from the viewpoint of the study sample)?"

The first dimension: administrative transparency

Table (4)

Estimated Degree and Average Response Rate of Sample Opinions for Items Regarding the Dimension of Administrative Transparency among Academic Leaders in the Faculty of Preparing Kindergarten Teachers in the Light of the Experiences of some Developed Countries (n=20)

N	Items	Faculty Dean					Heads of Departments				
		Response					Response				
		Achieved Significantly	Achieved Moderately	Not Achieved	Estimated Degree	Average Response Rate	Achieved Significantly	Achieved Moderately	Not Achieved	Estimated Degree	Average Response Rate
1	Academic leaders announce work-related laws and regulations to all subordinates within the faculty upon their issuance.	18	36	6	132	0.73	25	31	4	141	0.78
2	Academic leaders announce the decisions governing the faculty work or department objectively.	22	23	15	127	0.71	29	28	3	146	0.81
3	Academic leaders practice the policy	20	19	21	119	0.66	25	28	7	138	0.77

	of disclosing and announcing information for all subordinates in the faculty or department objectively.										
4	Academic leaders apply most forms of administrative transparency to all faculty or department subordinates.	13	24	23	110	0.61	27	24	9	138	0.77
5	Academic leaders apply transparency neutrally, away from the dubbed and elliptical transparency, which is not appropriate for the nature of work in the faculty or department.	13	25	22	111	0.62	18	35	7	131	0.73
6	Academic leaders apply administrative transparency mechanisms within the faculty in an objective manner.	13	26	21	112	0.62	23	29	8	135	0.75
7	Academic leaders simplify administrative and academic work procedures within the faculty, in a manner that allows the performance of work without	15	32	13	122	0.68	25	30	5	140	0.78

	complication.										
8	Academic leaders take over the responsibilities of facilitating the faculty work in a way that achieves the goals of the university and the faculty following the law.	23	25	12	131	0.73	28	28	4	144	0.80
9	Academic leadership pursues transparency in implementing the regulations and laws issued in terms of (accuracy and clarity - and applying them without discrimination) to all subordinates in the faculty or department.	19	20	21	118	0.66	24	28	8	136	0.76
10	Academic leaders provide an opportunity for all subordinates of the faculty or department to view the institution's future plans and the formal description of responsibilities and tasks in a formal way.	15	24	21	114	0.63	26	20	14	132	0.73
11	Academic leadership verifies in the	24	25	11	133	0.74	27	25	8	139	0.77

	communication media used for work in order to ensure the speedy arrival of information and decisions for all subordinates in the faculty or department.										
1 2	Academic leaders provide clear mechanisms for continuously evaluating the performance of all subordinates.	10	27	23	107	0.59	16	32	12	124	0.69
1 3	Academic leaders commit to justice in the process of evaluating the performance of all faculty or department subordinates.	19	24	17	122	0.68	27	24	9	138	0.77
1 4	The academic leadership shall inform all subordinates of the faculty or department of the results of their performance evaluation upon its issuance.	9	24	27	102	0.57	15	29	16	119	0.66
1 5	Academic leaders involve some individuals representing all categories of	14	25	21	113	0.63	20	33	7	133	0.74

	subordinates in making decisions regarding work within the faculty or department.										
16	Academic leaders provide open channels of communication with the local community and relevant institutions of the faculty or department.	16	25	19	117	0.65	23	25	12	131	0.73
17	The academic leaders keen to publish real information about the college or department and the services it provides to the external community.	21	21	18	123	0.68	34	19	7	147	0.82
18	Academic leaders accept constructive criticism from the external community and plans in its light.	10	26	24	106	0.59	13	33	14	199	0.66
19	The academic leaders follow up on the annual reports submitted by the faculty members of the college or department regarding their scientific activities and research.	17	16	27	110	0.61	25	29	6	139	0.77

20	Academic leaders make activates the complaints and suggestions boxes to the faculty or department periodically and publicly.	10	18	32	98	0.54	19	23	18	121	0.67
21	Academic leaders submit periodic reports to senior management that clearly show the progress of the faculty or department.	17	22	21	116	0.64	18	25	17	121	0.67
Dimension Total Degree					2443	0.65	Dimension Total Degree		2812	0.74	
minimum confidence interval levels =0.55					Maximum confidence interval levels = 0.79						

Table (4) clarified the following:

- In general, the results indicated that the dimension of (Administrative Transparency) has been achieved moderately among academic leaders in the faculty of preparing kindergarten teachers. That the percentages of the dimension as a whole were (0.56) for the dean and (0.74) for heads of the departments. These percentages ranged from the minimum and maximum confidence interval levels, which revealed that the dimension achieved moderately in the reality of (Administrative Transparency).
- The average response rates for the study sample opinions for this dimension ranged from (0.54: 0.74) for the dean, and (0.66: 0.82) for heads of the departments.
- Most statements on the administrative transparency dimension of academic leaders (the dean - heads of the departments) in the faculty of preparing kindergarten teachers have obtained averages ranging from the minimum and maximum confidence interval level, which indicated that they were achieved moderately.
 - Concerning the statements n. (1), (3), (10) results indicated their achievement moderately, this was due to the fact that advertising through meetings is one of the tasks of academic leaders according to the law on the organization of universities and its executive regulations, as Article (46) confirms that the dean calls for meetings of departmental boards and committees formed in the faculty according to the provisions of this law, as he has to present to them whatever he sees from the topics.

- Concerning the statements n. (4), (5), (6) and (9) results indicated that they were achieved moderately, this was due to the fact that there is a unified law and its executive regulations are the source of the legislation, and that the faculty academic leaders are responsible for implementing and disseminating these laws and regulations to all faculty employees with its application and activation.
- Concerning the statements n. (12), (13), and (14) results indicated that they were achieved moderately, this was due to the fact that academic leaders in faculty of preparing kindergarten teachers depend on annual reports only to evaluate the performance of workers, which are submitted to the Central Personnel Affairs of the university, and that the faculties of preparing kindergarten teachers need advertising and improvement plan to evaluate workers performance, in addition the employees don't not have the opportunity to participate in setting criteria for evaluating their performance, as well as they can't know the positive and negative aspects of their performance appraisal process so that they can benefit from it as a feedback.
- Concerning the statements n. (19) and (21) results indicated that they were achieved moderately, this was due to the fact that following up reports, writing them and submitting them to the higher authorities is considered one of the tasks of academic leaders according to the law regulating universities and its executive regulations; and as in Article (45), the dean presents a report to the president of the university at the end of each year on all aspects of the activity in the faculty and Article (59): "The head of the department reports to the dean at the end of each year on the department's scientific, educational, administrative and financial affairs."
- Concerning the statements n. (11), (16), and (18) results indicated that they were achieved moderately, as it is a requirement and a standard of quality standards, that the use of modern technology and communication media helps to exchange the necessary information Exchanging the necessary information that guarantees the progress of the institution, to develop the faculty's work and keep pace with developments.

The results of the current research concerning (the dimension of administrative transparency among academic leaders) are consistent with the studies of Al-Shammari (2009), Al-Majali (2010), Al-Harbi (2012), Al-Abaniya (2013), Abdullah (2012), Al-Tasha (2014), Al-Shammari (2015), Ahmed (2016) and Hassan (2016) whose results confirmed that the administrative transparency dimensions (transparency in communication, transparency In legislation and laws, transparency in information, transparency in decision-making, transparency in performance appraisal) were moderately practices by Universities academic leaders.

While the results of the current research are inconsistent with the studies of Muhammad (2010) and Harb (2011), whose results confirmed that the practice of administrative transparency by her academic and administrative leaders came to a high degree.

- The average of response ratio for some statements were much less than the minimum confidence interval levels, which illustrated that they were not achieved as statement n. (2). This is due to the fact that there is a general complaints system affiliated with the university administration, which is carried out through interactive electronic platforms launched by the

university for complaints and proposals on its electronic portal, in addition to what was received from the unified electronic complaints system headed by the Council of Ministers to provide documented information and communicate with university employees.

- It is noted also that the response ratio for some the statement n. (2), (8) and (17) were more than the maximum confidence interval levels. This is due to the fact that department heads exercise their duties according to the law regulating universities and its executive regulations. They are keen to announce the decisions and publish information about the college through the meetings held with members of the department as well as the head of the department is keen to supervise the scientific, administrative and financial affairs in the department within the limits of the policy drawn up by the faculty council and the department according to the provisions of the laws, regulations and decisions in force as described in Article (58) of the law organizing universities.

Answering the second research question, which was "What is the reality of the intellectual capital management dimension among the academic leaders of the faculties for preparing kindergarten teachers in light of the experiences of some developed countries (from the viewpoint of the study sample)?"

The Second Dimension: Intellectual Capital Management

Table (4)

Estimated Degree and Average Response Rate of Sample Opinions for Items Regarding the Dimension of Intellectual Capital Management among Academic Leaders in the Faculty of Preparing Kindergarten Teachers in the Light of the Experiences of some Developed Countries (n=20)

N	Items	Faculty Dean					Heads of Departments				
		Response			Estimated Degree	Average Response Rate	Response			Estimated Degree	Average Response Rate
		Achieved Significantly	Achieved Moderately	Not Achieved			Achieved Significantly	Achieved Moderately	Not Achieved		
1	Academic leaders interest in the human component as one of the most important resources for faculty success in achieving its goals.	21	19	20	121	0.67	26	22	12	134	0.74

2	Academic leaders provide mechanisms for detecting the faculty distinguished cadres.	10	23	27	103	0.57	21	23	16	125	0.69
3	Academic leaders categorize Subordinates according to criteria of excellence, not seniority within the faculty or department.	12	24	24	108	0.60	16	23	21	115	0.64
4	Academic leaders provide a database of creative subordinates with distinct experience and knowledge in the college or department.	12	18	30	102	0.57	15	21	24	111	0.62
5	Academic leaders allocate a special department (the information sector) that is responsible for carrying out continuous updating of databases to follow up on subordinates of correspondence and administrative decisions issued by the faculty.	12	36	12	120	0.67	20	27	13	127	0.71
6	Academic leaders allocate specialized committees to follow up the distinguished cadres working in the	8	29	23	105	0.58	13	31	16	117	0.65

	college or department.										
7	Academic leaders keen on providing the infrastructure of equipment and laboratories for the creative workers of the faculty.	14	26	20	114	0.63	17	33	10	127	0.71
8	Academic leaders support creative ideas and opinions financially and morally within the faculty or department.	14	27	19	115	0.64	24	23	13	131	0.73
9	Academic leaders employ human elements with distinct expertise in a way that creates creativity and excellence within the faculty or department.	16	27	17	119	0.66	21	30	9	132	0.73
10	Academic leaders keen to provide programs to develop the faculty's intellectual capital.	11	24	25	106	0.59	15	30	15	120	0.67
11	Academic leaders provide mechanisms for preserving the accumulated experiences of the distinguished faculty employee.	14	19	27	107	0.59	17	21	22	115	0.64
12	Academic leaders have a plan to take	10	23	27	103	0.57	18	23	19	119	0.66

	advantage of the knowledge and experience of distinguished cadres working in the faculty or department.										
1 3	Academic leaders encourage and prepare second-grade cadres in the faculty or department.	13	25	22	111	0.62	20	25	15	125	0.69
1 4	Academic leaders attract distinguished competencies with specialized expertise while supporting distinguished cadres working in the college or department.	14	27	19	115	0.64	20	29	11	129	0.72
1 5	Academic leaders attach the intellectual capital data to the attached financial statement required by the college to submit it to the higher management.	11	26	23	108	0.60	18	22	20	118	0.66
1 6	Academic leaders build social networks within the organization based on trust, values ,and ethics as a motivator for creativity and innovation.	14	29	17	117	0.65	32	20	8	144	0.80
1 7	Academic leaders hold scientific and research protocols	12	25	23	109	0.61	11	27	22	109	0.61

	with various international and foreign universities.										
1 8	Academic leaders encourage faculty members and their assistants to participate in international conferences to produce global knowledge.	17	24	19	118	0.66	23	26	11	132	0.73
Dimension Total Degree					2001	0.62	Dimension	Total	2230	0.69	
minimum confidence interval levels =					Maximum confidence interval levels =						
0.55					0.79						

Table (5) illustrated the following:

- **In general, the results indicated that the dimension of (intellectual capital management)** has been achieved moderately among academic leaders in the faculty of preparing kindergarten teachers. That the percentages of the dimension as a whole were (0.62) for the dean and (0.69) for heads of the departments. These percentages ranged from the minimum and maximum confidence interval levels, which revealed that the dimension achieved moderately in the reality of (intellectual capital management).
- The average response rates for the study sample opinions for this dimension ranged from (0.57: 0.67) for the dean, and (0.61: 0.80) for heads of the departments.
- Most statements on the dimension of intellectual capital management among academic leaders (the dean – heads of the departments) in the faculty of preparing kindergarten teachers have obtained averages ranging from the minimum and maximum confidence interval level, which indicated that they were achieved moderately.
 - Concerning the statement n. (1) results indicated that this statement was achieved moderately. This is due to the conviction and awareness of the academic leaders in the faculty of preparing kindergarten teachers that the human factor is the primary engine and determinant for raising the institution efficiency and developing its performance to make it capable of local and global competition, but the leaders lack the measures that translate these convictions and awareness into practices.
 - Concerning the statements n. (2),(3), (4), (5), (6)and (11) results indicated that they were achieved moderately, because they are quality requirements and standards, therefore academic leaders are keen to place these distinguished cadres in the technical committees

of the department and college; however, some faculties to which the study tool is applied do not obtain quality.

- Concerning the statement n. (7) results indicated that this statement was achieved moderately. This is due to the conviction and awareness of the academic leaders in the faculty of preparing kindergarten teachers as that providing the infrastructure, including equipment and laboratories, is a requirement for approval to open and establish the faculty.
- Concerning the statements n. (9), (10) and (12) results indicated that these statements were achieved moderately; this is due to the academic leaders' keenness to upgrade the faculty and the department through employing those human elements and keeping them in a way that achieves excellence.
- Concerning the statement n. (1) results indicated that this statement was achieved moderately, that academic leaders are keen to encourage members to exchange roles (such as running seminars or giving seminars ...)
- Concerning the statements n. (8) and (15) results indicated that these statements were achieved moderately. This is due to the lack of faculty budgets, lack of incentive rewards and the financial capabilities that support the ideas and creativity that exist in the faculty.
- Concerning the statements n. (17) and (18) results indicated that these statements were achieved moderately. This is due to the fact that the nature of the faculty imposes on us certain types of protocols considering the field (human sciences), and academic leaders encourage members of the teaching staff and their assistants to participate in conferences and scientific celebrations as an executive matter; to ensure the interest of work, to raise the faculty's affairs, and to communicate with other universities.
- Concerning statement n. (14) results indicated that this statement was achieved moderately. This is due to the academic leaders' keenness to host some competencies in the conferences, seminars and scientific conferences in the department to support the distinguished working cadres.

The results of the current research regarding the dimension of (Intellectual Capital Management) are consistent with the results of the studies of Qarni (2012), Abel (2013), Khalif (2014), Zahr (2016), and Rashid (2017) whose results confirmed the availability of intellectual capital and its management by academic leaders inside universities came with a medium degree.

While the results of the current research contradict the results of the study of both Ahmed (2007) and Khalil (2015), whose results confirmed the availability of intellectual capital and its management by academic leaders within universities to a high degree, as the results of the study of Hashem (2016) who stated that the availability and management of the dimensions of intellectual capital came to a low degree by academic leaders within universities, in addition to the study results Bratianu.C (2016), Corcoles-y (2013) Ramirez.Y, et-al (2013) which illustrated that the intellectual capital management and its methods of measurement are high; this is due to the difference in the cultural environment and material capabilities between Arab and foreign countries; as it recognizes the importance of intellectual capital as a dynamic system of intangible elements whose management is essential to creating value in universities.

- It is noted that the average response ratio of some of the statements as statement n. (16) were more than the maximum confidence interval levels, which indicated that they were achieved highly. This is due to the awareness of heads of the departments that caring for human relations helps the organization absorb knowledge and control resources. While this statement was achieved moderately by the dean as a result of his preoccupation with work tasks and time constraints, as the dean under his authority has many departments (academic and technical) while the department is concerned with (technical management) of the department only.

Answering the second research question, which was "What is the suggested proposal for developing the dimensions of administrative transparency and intellectual capital management among academic leaders in faculties of preparing kindergarten teachers in light of the experiences of some developed countries?"

The suggested proposal for developing the dimensions of administrative transparency and intellectual capital management among academic leaders in the faculties of preparing kindergarten teachers in light of the experiences of some developed countries.

a) Principles of building the suggested proposal (the philosophy):

The philosophy of the suggested proposal is based on the following principles:

1. The specificity and importance of faculties of early childhood education and its responsibility for preparing kindergarten teachers, as childhood is considered one of the most important stages in which the basic features of the child's personality are formed, and it also represents the fixed base for raising and educating the child, refining and preparing him for the next educational stages.
2. The success of the faculties of preparing kindergarten teachers depends mainly on the academic leaders' competence level; as the basis for the success of any institution depends on the success of its leaders.
3. The imperative need for some organizational dimensions (administrative transparency - management of intellectual capital) for academic leaders in the faculties of preparing kindergarten teachers, as it is the heart and foundation of management, and its impact on university education organizations in general and its management, in particular, seeking to achieve excellence and institutional competition.
4. Egyptian universities face many local and global challenges, such as accelerating technological changes and increased intensity of local and global competition appearing through international classifications and universities' ranking, which necessitates the need to develop some organizational dimensions (administrative transparency - intellectual capital management) in light of the experiences of some developed countries.
5. The need to develop some organizational dimensions (administrative transparency - management of intellectual capital) for academic leaders in faculties for preparing kindergarten teachers in the light of the experiences of some developed countries; as based

on the results of the current study - and some previous studies - about the necessity of developing the academic leadership performance in some dimensions Organizing which is represented in (administrative transparency - management of intellectual capital).

b) Objectives of the suggested proposal:

The suggested proposal aimed at the following:

1. developing of some organizational dimensions (administrative transparency - management of intellectual capital) among academic leaders in faculties for preparing kindergarten teachers in light of the experiences of some developed countries.
2. providing a guiding model that helps those in charge of leading faculties of preparing kindergarten teachers in applying some organizational dimensions (administrative transparency - management of intellectual capital) in an optimal, more effective, and distinctive way within the organization.
3. providing some procedures, mechanisms ,and requirements for implementing the suggested proposal for developing some organizational dimensions (administrative transparency - management of intellectual capital) among academic leaders in light of the experiences of some developed countries.
4. presenting solutions to face the obstacles of implementing the suggested proposal for developing the dimensions of administrative transparency and intellectual capital management for academic leaders in light of the experiences of some developed countries.

c) Premises of the suggested proposal:

The suggested proposal for the current research is based on the following postulates:

1. The challenges facing Egyptian universities and all of their faculties in general, The challenges facing Egyptian universities and all of their colleges in general, which requires them to shift from traditional performance to competitiveness based performance, and transforms performance quality standards from local standards to global standards, as well as the challenges facing faculties in preparing kindergarten teachers in particular, including (educational challenges) that require modernization in their programs to keep pace with global developments, and (Strategic challenges) that necessitate the identification of the aims, goals ,and policies of university education, in addition to the (administrative, ethical and developmental challenges) that impose on the institution ethical leadership, the development of administrative practices, and the participation of workers in decision-making and taking.
2. The importance of the role of academic leaders in the faculties of preparing kindergarten teachers in achieving their goals, developing them, and bringing them to the highest levels of quality and competitiveness.
3. The need to raise awareness and develop some administrative organizational dimensions (administrative transparency - management of intellectual capital) among academic leaders in light of the experiences of some administratively developed countries, given the

nature of their administrative and leadership roles in general, which in particular necessitates them being able to manage many administrative practices, as well as keeping pace with the nature of the age and community conditions.

4. The possibility of benefiting from the experiences of some leading developed countries in the field of management such as (the United States- Japan - Russia - Spain - the Netherlands)

d) Elements of the suggested proposal and its implementation mechanisms (its features):

Elements of the suggested proposal include what should be some of the organizational dimensions (administrative transparency - management of intellectual capital) for academic leaders in faculties of preparing kindergarten teachers in the light of the experiences of some developed countries (the United States - Japan - Russia - Spain - Netherlands) as shown as follows:

The First Dimension First: Administrative Transparency Dimension

Academic leaderships in faculties of preparing kindergarten teachers should take care of the following practices in the dimension of administrative transparency:

- Academic leaders shall practice the policy of disclosing and announcing work-related laws, legislations, and decisions for all faculties' subordinates as soon as they are issued objectively.
- Apply most forms of administrative transparency represented in (transparency in systems and regulations, transparency in work procedures, transparency in performance evaluation, transparency in management information systems, transparency in administrative communication), while moving away from dubbed transparency (arbitrarily transmitted and transcription-style) and elliptical transparency (which serves the interests and ideology of its source and designer of its mechanisms) that are inconsistent with the nature of work in the faculty or department.
- Simplifying the administrative and academic work procedures within the faculty and the department in a way that allows the performance of the work easily.
- Apply administrative transparency mechanisms within the faculty and department in a uniform and objective manner.
- Provide an opportunity for all faculty subordinates to view the institution's future plans and formal description of tasks and responsibilities in a formal manner, and involving them in decision-making regarding work.
- Providing clear mechanisms to evaluate performance on an ongoing basis, with all subordinates being informed of the results of their performance appraisal as soon as they are issued.
- Diversification in the communication media (written, telephone, photocopy, periodic meetings ...) used by employees to ensure the speedy delivery of information to all subordinates
- Take into account transparency in the information system in terms of (honesty, timeliness, clarity, and accessibility).
- Activating the complaints and suggestions boxes periodically and publicly, and submitting periodic reports to the higher management regarding the workflow of the college and the department clearly.

Suggested implementation mechanisms:

- Presenting awareness programs in forms and mechanisms of administrative transparency for faculty leaders, and the need to respect them within the institution.
- Holding periodic meetings to inform employees of the regulations, laws, decisions, and administrative and academic work procedures in the faculty and the department objectively.
- Issuing and preparing organizational guidelines for laws, regulations, and regulations governing work, with information being made available to workers in a suitable time.
- Forming committees to monitor and follow up the application of transparency mechanisms and policies (transparency in systems and regulations, transparency in work procedures, transparency in performance evaluation, transparency in administrative information systems, transparency in administrative communication) within the college.
- Using information mediators: It is a "team" working group to collect coordinate and classify information in a way that is easily understood and accessible to all employees, by putting this information in a location that facilitates the user to find this information easily "electronic - and paper."
- Using performance reports as a method of evaluating performance, reviewing these reports, and using websites as repositories of evaluation information and publishing them, while activating self-evaluation and presenting its results, taking into account the adoption of objective criteria in evaluating the performance of workers and away from the medium, bias, and favoritism.
- Establishing a network and building a database to monitor the activities of the administrative college, publish results of the performance appraisal for employees, publish information about the institution, and hold webinars on the Internet related to transparency, its forms ,and mechanisms.
- Designing bulletins distributed to employees to display information, decisions, internal regulations and any new ones related to the institution.
- Creating electronic blogs to save personal data of all employees and easy access to information related to the decisions, laws ,and regulations of the college, and the formation of an electronic unit responsible for helping all employees of the college to access any information at any time.
- Activating the "personal offices" responsible for keeping decisions, files, information, and complaints, and a copy of the periodic reports on the work progress of the college, the future plans of the institution, and the results of the staff performance evaluation.
- Diversification in the communication media (written - phone - photocopy - meetings ...), encouraging technological communication between the members of the institution on the one hand and the external community on the other hand, and providing communication channels for complaints and suggestions "telephone - by post - personally".

The Second Dimension: Intellectual Capital Management:

Academic leaderships in the faculties of preparing kindergarten teachers should take into consideration the following practices in the dimension of intellectual capital management:

- Paying attention to the brilliant human elements as one of the most important resources to achieve the faculty's goals and employ these distinguished experiences in a way that achieves creativity and excellence within the faculty and the department.
- Providing mechanisms to discover distinguished and bright cadres, and classifying those distinguished cadres, while providing a mechanism for preserving their accumulated experiences.
- Providing a database for distinguished cadres with creative experiences and knowledge, taking into account the continuous updating of this base, in addition to following up distinguished cadres.
- Supporting creative ideas and opinions financially and morally, while developing a plan to benefit from the accumulated knowledge and experiences of the distinguished cadres working in the faculty.
- Attracting distinguished competences with specialized expertise and developing them professionally, motivating them and increasing their motivation to achieve, while supporting distinguished cadres in the faculty and department.
- Providing the infrastructure of equipment and laboratories for creative workers in the faculty and the department.
- Providing programs aimed at developing human elements and refining their expertise and knowledge to achieve a competitive advantage from a distinguished human resource.
- Working scientific and research protocols with various international and foreign universities.
- Signing scientific and research protocols with various international and foreign universities.
- Encouraging faculty members and their assistants to participate in local and international conferences to produce global knowledge.
- Building social relationships within the faculty based on trust and ethical values as a catalyst for creativity and innovation, with the faculty, constantly monitoring the wishes and needs of the beneficiaries and developing its programs and work mechanisms according to their wishes.

Suggested implementation mechanisms:

- Create a database for creative individuals; its mission is to determine the intellectual capital (human - structural - relations) owned by the faculty, and to classify bright minds according to the criteria of excellence, not seniority, as well as set up specialized committees to follow up on them.
- Create storage chains called (warehouses, live libraries) that contain the accumulated stock of knowledge and help to create social networks and exchange knowledge between individuals and across faculties.
- Organizing workshops as a way to bring together international experts and practitioners to exchange their views and experiences and transfer their creative ideas to these rare bright minds.

- Holding training courses to upgrade the expertise of human elements, with the aim of updating their knowledge and expertise annually.
- Preparing guides for good practices that emphasize the generation of creative ideas and opinions and distributing them to employees with specialized and bright experiences in the college, in addition to strong training campaigns for the distinguished cadres in the institution, and displaying them on the internal information network.
- Attracting distinguished individuals to assist and benefit from them, in addition to carefully selecting and appointing individuals according to specific criteria.
- Motivating employees to provide creative ideas and proposals to develop the performance of the college, by preparing reports of intellectual capital in its three dimensions, explaining the budget needed to support it, its measurement methods and mechanisms, and then raising it to senior management to assess the college's efficiency and the level of support needed.
- Offering programs that focus on cognitive energies and individuals who are able to produce good ideas such as:
 1. **The recruitment and selection program for creative workers:** This includes the recruitment of creative competencies and creative talents in institutions, which allows them to acquire creative ideas, in addition to attracting consultants who have intellectual talents, and the work of meetings, meetings, and discussions between creative human elements and these advisors; to transfer and exchange experiences and study good cases.
 2. **Program to sharpen the workers' intellectual ability:** It requires establishing a series of meetings, in which the human elements present their proposals and opinions and discuss them directly, then develop the competencies and capabilities of mental workers by assigning them to new, difficult and challenging tasks, and setting high standards for the performance of college staff.
 3. **The program providing a stimulating climate for the creativity of workers:** aims to provide the appropriate and stimulating climate to invest the employees' capabilities, skills, knowledge and creative ideas, and to develop a comprehensive policy for creative ideas such as (posters - publications - advertisements), conducting competitions, and giving prizes that motivate those elements.
 4. **The Structural Capital Development Program:** Its goal is to reduce the routine work of creators and enhance their suitability, and the most important elements inside it are technology, pamphlets, data and information.
 5. **The program of encouraging social relations:** creations must take place within the framework of informal groups based on trust, as strong trust between human elements encourages the exchange of knowledge and the cultivation of skills.

6. **Program for providing resources for intellectual capital:** that is, providing advanced technologies, enabling distinguished employees to attend scientific conferences and meetings, providing consultants to help them, and providing budgets to implement these creative ideas.
7. **The research and development program in the field of intellectual capital:** focuses on the interest in research in the field of intellectual capital industry, by providing the opportunity for distinguished human elements to express their views and creative proposals and encourage direct dialogue, for the purpose to mature creative ideas.

- Participating in global databases, providing access to faculty members and their assistants to it, and emptying the distinguished faculty member in search of some days during the week to give him enough time for scientific research and not to be overburdened with routine work.
- Holding seminars and courses locally and internationally, and making scientific and research agreements with various international universities and research institutions.
- Allocate an adequate budget to finance and support research projects, and establishes a mechanism to guarantee copyright and ownership.
- Setting attractive annual awards at the college level for internationally published researches to encourage competitors to compete, and their research output will have an advantage, with the setting of monthly salary allowances in exchange for distinguished research publishing, and the formation of committees that operate according to specific criteria, on the basis of which the distinctive research is chosen, which reduces Patronage and personal interest.
- The formation of faculty research teams contribute to increasing the quality of research performance.
- Establish an effective communication system for communication between faculty employees and beneficiaries across other faculties, both publicly and specifically.

d) Requirements for Implementing the Suggested Proposal:

A set of requirements must be met to implement the suggested proposal mechanisms for the two dimensions of administrative transparency and intellectual capital management in faculties for preparing kindergarten teachers as shown as follows:

- Increase the budget for incentives to be awarded for excellent performance and fund research projects in the college.
- Increase the training programs and courses for academic leaders in faculties for preparing kindergarten teachers in order to build a knowledge base about administrative transparency mechanisms and how to deal with subordinates from the perspective of justice and equality, in addition to increasing training courses for working cadres who are able to produce creative ideas and opinions to refine their expertise and knowledge.

- Linking the passing of these programs and training courses to career advancement to obtain material and moral incentives for those who are distinguished on the other hand, while following up the impact of these training programs within the faculty.
- Providing the necessary material resources (laboratories and equipment, computers, internal information network "the Internet", telephones, faxes ...), diversification in forms of communication within the college from mechanisms (photocopying, writing, technical ..), and providing channels for complaints (telephone, Mailing, personal ..), and announcing college support services "Ethics Hotline, Online Advisory Groups to resolve any ethical dilemma).
- Linking the databases available in the faculty with the databases of the university administration and the agencies affiliated with the work.
- Modifying the performance evaluation form, and diversifying it to monitor the performance of all employees represented in "performance reports, union contracts," performance agreement contracts", periodic and self-evaluation using specific evaluation forms, performance indicator boards.
- Activate the work teams, and announce their tasks and roles with flexibility to replace change and renew their members for the benefit of working in the college, such as (research work teams to increase the quality of research performance and others).
- Updating and modifying the organizational structure of the college to introduce some new units within the college as a "unit of information mediators", and activating the committees and announcing them to all workers to know their roles and tasks, such as the follow-up committee, monitoring procedures and policies, and following up the bright minds of the college, and the ethical committee to report on ethical problems and others.
- Activating effective systems for meetings, workshops and interviews within the college.

e) **Obstacles to Implementing the Suggested Proposal:**

The following table shows some of the obstacles expected to occur when implementing the proposed concept in colleges for the preparation of kindergarten teachers, and the solutions provided to address them:

Table (7)

Obstacles of implementing the suggested proposal, and the proposed solutions to confront it

Obstacles	Suggested Proposal
Poor budget and incentives for good performance, funding for research projects and creative opinions.	Create multiple sources for supporting and self-financing, "as units with a special nature, new study programs, integrated and open education programs, and other self-resources."
The reluctance of the targeted groups to	Linking the passing of these programs and training

"academic leaders and some subordinates who are able to generate creative ideas" to attend courses and training programs to refine their experiences and knowledge about organizational dimensions.	courses to career advancement on the one hand, and obtaining material and moral incentives for those who are distinguished on the other hand, and linking them with certificates of excellence.
Malfunctions of the necessary material resources (laboratories and equipment, computers, internal information network "the Internet", telephones, faxes ...)	Setting specifications and standards according to which the devices are selected at the highest level of quality, with continuous periodic maintenance of the devices, and taking precautionary measures in the event of breakdowns for those who use the internal information network "the Internet".

Fifth: The suggested future research

- The effect of practicing the dimensions of administrative transparency on building a system that calls for integrity and quality administrative performance in higher education institutions.
- Methods of measuring intellectual capital to achieve the competitive advantage of Egyptian universities in light of the experiences of some developed countries.

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Characterization of secondary deposits of columbite-tantalite minerals found in the city of Rorainópolis (RR), Brazil

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Abstract

Many of the studies about mineral deposits are bringing great information to the scientific community, providing, for example, general characteristics of these deposits, possible source areas and its used in some cases as prospective tools to help in geological mapping. In this way, this study aimed to characterize the alluvial secondary deposits of columbite-tantalite that were found near vicinal 12, about 50km north/northeast of Rorainópolis city, between the BR-174 and BR-210 roads, in the state of Roraima (Brazil), bases on 4 samples that were brought by a resident of the region. To fulfill these objectives, some chemical and mineralogical methods were performed: magnetic separation, X-ray diffraction, X-ray fluorescence and petrographic description. The deposits of the region end up being characterized by having a large amount of Fe and Ti (mostly), containing in some places also a large concentration of Niobium and Tantalum. Not all samples have columbite-tantalite, showing that their concentration in some areas of the deposit is quite low. There are samples with less than 1% Nb and Ta and also samples with more than 20% Nb and 6% Ta concentration. These minerals were poorly transported, being identified by the degree of roundness and granulometry of the samples. A weathering cap on some minerals could also be verified. This research work turned out to be relevant, as it provides new data that add to the knowledge of the mineral potential, which has not been fully explored yet.

Keywords: Columbite-tantalite; Geochemical characterization; Chemical elements; Secondary deposits.

1. Introduction

Freitas (2017) made a series of geochemical maps of Roraima, focusing on the chemical anomalies of each region of the state. This is a work focused on deposits of columbite-tantalite in Rorainópolis city, so the main chemical elements of interest are niobium and tantalum. Freitas (2017) states that, about niobium, higher levels (element in soils) were found in an NW strip that runs from the southern part of Rorainópolis to the center of the state. The author also explains that in this region, these high levels are related to

metamorphic and granitoid rocks. The niobium found in placers also occurred in the east of this city, due to the influence of granitic bodies. Now, about tantalum, it did not have as many results in the state as niobium, but there are stream-sediments on metamorphic rocks of the Martins Pereira Suite and also on soils derivative from granitoids of Água Branca Intrusive Suite (Freitas, 2017).

At the end of 2018, a resident of vicinal 12 (near Rorainópolis) with the name Angelo, handed over to this research, about four samples that were collected along this vicinal road in four different Mr. Beterre properties. All samples were concentrated (pan-concentrate) and placed in sealed bags. The resident has brought these with the objective of obtaining results about what minerals and chemical elements have in this area and what's the percentage of each, to obtain information about these secondary deposits.

A series of geochemical and petrographic methods were then applied to the four samples, to characterize these deposits of probable columbites-tantalites in this region, conclude possible source rocks of these deposits, based on mineralogy, chemical signature, and local geology, providing new data that add to the mineral potential knowledge of the region.

1.1 Location Area

The work was made in alluvial deposits, in the Mr. Beterre properties, vicinal 12, located on the right side of the BR-174 (north direction), about 50 km from Rorainópolis (figure 1).

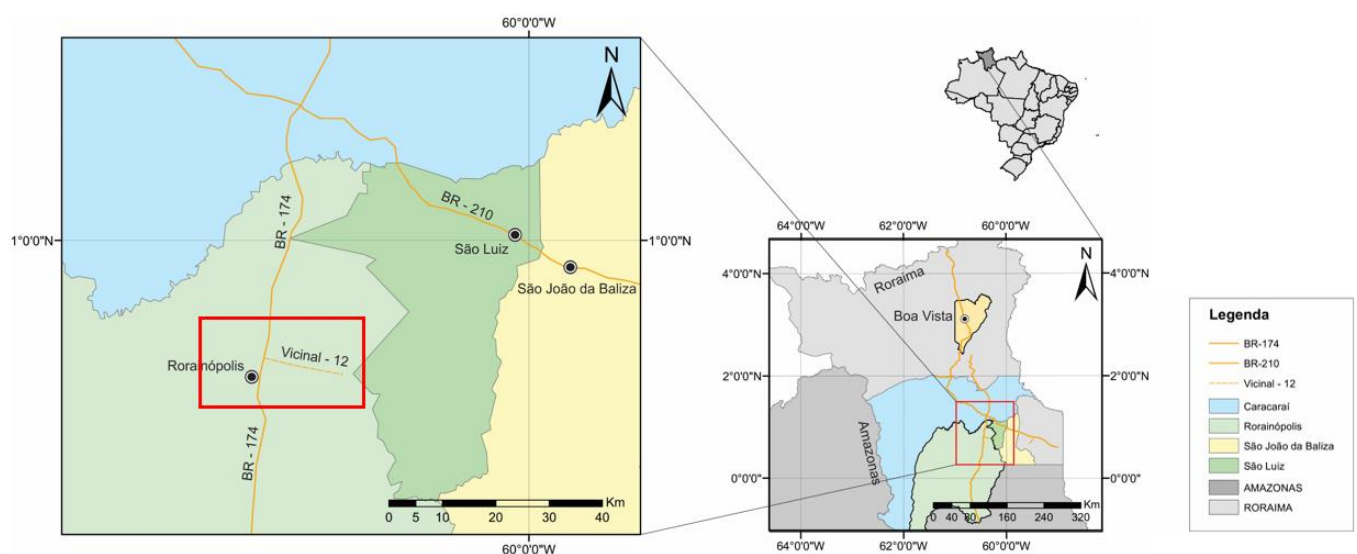


Figure 1. Location map of the study area. Map made with CPRM shapefile.

2. Theoretical Reference

2.1 Regional Geology

The State of Roraima occupies the south-central portion of the Shield of Guyana, the northern portion of the Amazonian Craton, which includes large expanses of tropical forests and constitutes one of the geologically least known regions on earth (Fraga, 2002). The state has an area of around 230,104 km² in the extreme north of Brazil and maintains border boundaries with Venezuela and Guyana (Reis et. al. 2003). Also according to Reis, the recent geological surveys and academic studies allowed a considerable advance

to the regional geological knowledge, offering to the study, its synthesis and approach to the state of the art of the geology of Roraima.

2.1.1 Amazonian Craton

This extensive tectonic entity is centered on the northern portion of the South American Platform, subdivided into two main Precambrian areas, based on lithological and structural data, related to the Guiana Shield to the north, and the Central Brazil Shield to the south, separated by the Phanerozoic basins from Acre, Solimões, Amazonas, and Alto Tapajós (Almeida, 1967).

The knowledge of the evolutionary history of the Amazonian Craton is explored through proposals of tectonic compartmentalization, based on geological, structural, geophysical and geochronological studies, and the subdivision of the craton is based on geophysical and geological information, forming a mosaic of crustal blocks gathered through increased diachronic collisions during the Archean and the Paleoproterozoic (Hasui et al. 1984 and Costa & Hasui, 1997 apud Souza, 2012). These blocks are called provinces. The parameters that will be used in this work will be based on recent data according to Santos et al. (2006) and CPRM (2006), in which, the study area is inserted in the geochronological province: Tapajós-Parima.

2.1.1 Tapajós-Parima Province

Located to the west of the Central Amazon Province, with an orogenic band-oriented to NW-SE, this province has Paleoproterozoic isotopic ages, pointing to rejuvenation from east to west (CPRM, 2006). With the collection of developed works, field reports, geological maps, and remote sensing works, four main domains are proposed for the section of Roraima (Fraga and Reis, 1998, 2000 apud Reis et al. 2003): Urariquera, Parima, Uatumã- Anauá and Central Guiana, where these domains are characterized by geological associations, ages, and specific structural features. The research area is part of the Uatumã-Anauá domain, nicknamed by CPRM (2006), north of the Amazonas Sedimentary Basin.

2.2 Local Geology

Uatumã-Anauá Domain comprises the south-southeast region of Roraima and the northeast of Amazonas, which is limited to the northeast with the Guianas. Reis & Fraga (2000) and Reis et al. (2003) named the south-southeast portion of the state of RR “Anauá-Jatapu Domain” characterized by structural control and arrangement of lines with NW-SE to NE-SW directions and determinedly EW. Faria et al. (2005) designates the northeast portion of Amazonas as the “Uaimiri-Anauá” domain. The units associated to Uatumã-Anauá domain that belongs to the study region are Anauá Complex, Granite Martins Pereira, Água Branca Intrusive Suite, Igarapé Azul Intrusive Suite, Mapuera Intrusive Suite and Modern Granite (figure 3).

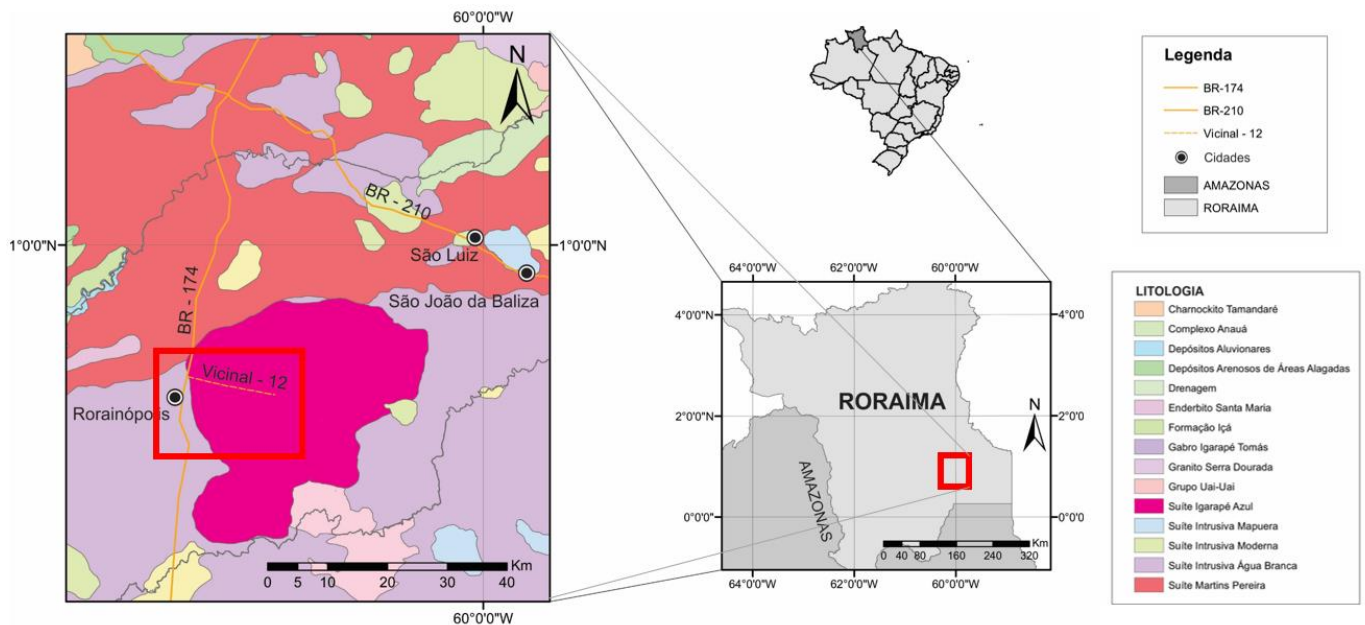


Figure 2. Local geology map of the area. Focus on the vicinal 12 region. Map made with CPRM shapefile.

2.2.1 Anauá Metamorphic Complex

The name Anauá Metamorphic Complex is used by Faria et al. (2000, apud Vedana, 2010) to gather as low to high-grade metamorphic rocks and signs of subordinate acid and ultrabasic, outcrops in the south-southeast region of the state of Roraima. This complex represents the oldest set of metamorphic rocks in the region, being represented by migmatites, granites, charnokites and some metabolites and amphibolites, in addition to orthoderivated gneisses with granulite enclaves (Muller & Carvalho, 2005).

2.2.2 Martins Pereira Granite

Martins Pereira Granite is formed by alkaline, metallic and peraluminous rocks, high K and pointed as type I granite, showing enrichment in LILE (K, U, and Th, for example) and ETR (Almeida, 2006), aged 1,99 Ga (Almeida et al., 2002). According to Almeida et al. (2007), it consists of rocks that have anatexis, probably generated in the collisional phase of the tectonic evolution of the orogenic arch of Anauá. In terms of mineralization, the primary occurrences of gold are hosted by Martins Pereira granitoids (Almeida, 2006).

2.2.3 Água Branca Suite

It is appointed as type I Cordillera granite, a metaluminous to slightly peraluminous origin and calcined specificity (Almeida et al., 2002; Faria et al., 2000), which indicates a geochemical affinity for granitoids originating from the partial part of the mantle and/or crustal, tending to mark subduction attributes. Almeida et al. (2002) recorded geochronological data in recent research, showing granite crystallization averages of 1.90-1.89 Ga. CPRM (2006) individualizes these granitoids through gray, equigranular to porphyritic types, with a predominance of granodiorites composed of hornblende and biotite, in addition to monzogranites, tonalites, monzodiorite quartz and diorite quartz, with accessory minerals mostly containing titanite, epidote, apatite, allanite, and zircon.

2.2.4 Igarapé Azul Suite

Igarapé Azul Granite is divided into three main facies (Vila Catarina, Saramandaia and Cinco Estrelas) and is essentially composed of monzogranites with a low content of mafic minerals that are generally hydrothermalized (Almeida, 2006). Also according to the author, these granitoids occupy in the QAP diagram the field of crustal granites and are chemically calcium-alkaline rocks, pointed out as type I granites with high K, rich in SiO₂ and slightly peraluminous, showing enrichment in LILE and varied patterns of ETR. They are also characterized by a wide range of enclaves: 1) rich in biotite (surmicaceous); 2) metagranitic (Martins Pereira); 3) para-gneissic (Cauarane type); 4) tonalitic-granodioritic micro granular (Almeida, 2006). Alluvial occurrences of Nb-Ta are found in the Igarapé Azul Granite (Almeida, 2006).

2.2.5 Mapuera Suite

The petrographic analyzes made by Lombello et. al. (2009) and Lombello (2011), show that Granite Abonari has a syenogranitic to monzogranitic composition, with alkali-feldspar granites and quartz-alkali subordinate syenites and which also has many accessory minerals such as titanite, allanite, epidote, apatite and zircon, with three different facies, a microgranitic, a sieno-monzogranitic and another alkali-feldspar granite. They have a meta-peraluminous composition, high K sub alkaline, with characteristics of type A granites (Araújo Neto & Moreira, 1976).

2.2.6 Modern Granite

Moderna Granite (Moderna-Madeira magmatic event, 1.81Ga) and Madeira Granite are characterized by type A and peralkaline granites (Elias, 2018). Moderna granite, monzogranite with variations for sienogranite, is housed with NE-SW elongation in the contact zone between the calc-alkaline granites Martins Pereira (1.96 Ga) and Caroebe (1.89 Ga) and is in transitional contact with these units, marked by features of hydrothermal alteration associated with plastic deformation, responsible for its characteristic red color, which does not affect the magmatic orientation of the rock (Elias, 2018). Pegmatites with amethyst are present in bodies related to Modern Granite (Almeida, 2006).

2.3 Niobium and Tantalum

Niobium and Tantalum are transitional metals with very similar physical and chemical properties, and are commonly grouped. They do not occur naturally as free metals, but are essential components in a range of mineral species, the majority of which are oxides (Shaw et.al., 2011). The most common ore minerals containing Nb and Ta are minerals from the pyrochloric supergroup, minerals from the columbite-tantalite, struverite, loparite and euxenite series (Mackay and Simandl, 2015).

About primary deposits, those of Nb and Ta are often associated with igneous rocks, including granites, pegmatites, syenites and carbonatites. These deposits can be divided into three main types, based on the igneous rocks with which they are associated: carbonatites and associated rocks; alkaline to peralkaline granites and syenites; and granites or pegmatites present in the LCT family (enriched in lithium (Li), Cesium (Cs) and tantalum) (Shaw et.al., 2011).

The secondary deposits that are known are those in which the minerals that have Nb and Ta have been

concentrated through weathering and other sedimentary processes (Shaw et.al., 2011).

3. Materials and Methods

The work was carried out following the methodology model used in works of geological nature, which consists of the division of the methods in the following stages:

3.1 First Stage

3.1.1 Bibliographic Search

A survey of geological information about the work area was carried out. Theoretical studies were also carried out on geochemical methods, igneous rocks, niobium and tantalum deposits and general concepts on geology. The data obtained in this stage consisted of research and readings carried out in publications of articles, books, dissertations, classes and periodicals that involve the geological knowledge of Roraima. At the current stage, samples brought by resident Angelo were also received. The collect context was not specified by the resident.

3.2 Second Stage

3.2.1 Sample Preparation

Stage where the samples were prepared for laboratory analysis. Four samples were used with the following names: A01 - R, A02 - R, A03 - B and TF04 -R. Part of them was removed (quartering) to be sprayed for X-ray fluorescence and diffraction. The materials used were: the samples, a mortar and pistil of both agate and porcelain and a spray mill from the Pavitest brand. The mortar was used to spray samples of smaller granulometry, while the mill was used to spray larger samples more quickly. In the mill, the material to be sprayed is inserted into the grinding pan (in which it has several cylinders inside), the pan is selected according to the purpose of the sample. After that, the pan is placed inside the mill which then, through predominantly horizontal vibratory movements, the material is reduced/pulverized by impact and friction, having used a sample time of approximately 30s.

3.2.2 X-Ray Fluorescence (XRF)

X-ray fluorescence spectrometry is a non-destructive technique that allows the identification of chemical elements that are present in a sample, thus establishing the concentration of each element in the referred sample (UFRG, 2017). The chemical elements of the main interest that were analyzed, are niobium and tantalum, elements found in columbite-tantalite. As material, all four samples and the Epsilon 3 XL model X-ray fluorescence spectrometer, brand Malvern Panalytical, were used. It can quickly and accurately analyze the most diverse materials, which can be liquids, solids, etc.

3.2.3 X-Ray Diffraction (XRD)

This analytical technique of X-ray diffraction was used to obtain data from the interpretation of the spectra emitted by the XRD. It has the purpose of validating the mineralogical identification of the samples, emphasizing to the columbite-tantalite, and to solve any doubts. The analysis was done with the part of the

samples previously sprayed. The materials in this phase were all the four samples and the X-ray diffractometer, Shimadzu - model XRD 6100. It allows analysis of solid crystalline materials (phases that compose rocks, which is the objective of this work) as well as industrial materials (for example: ceramics, cements, slag, among others).

3.2.4 Magnetic Separation

It is used to separate mixtures containing minerals with a magnetic character. This separation is achieved by changing the flow of particles, using in this case the FRANTZ magnetic separation equipment. In this process, an electromagnetic field is applied to the samples that, due to the different magnetic susceptibilities that the minerals have, it is possible to separate them precisely, as they are affected in a different way and intensity, resulting in the intended separation (Lopes, 2014). The materials were: samples, magnet, sieve (0.84mm) and FRANTZ separator. In this separation phase, only three samples were used, which were those with lower particle size: A02 - R, A03 - B and TF04 - R. The current intensities used were from 0.1A to 0.5A, as the columbite-tantalite is attracted to a current intensity of 0.5A. Finally, samples were obtained attracted by the magnet, attracted to amperages less than 0.5A, to amperages greater than 0.5A and those attracted only in a current of 0.5A. These samples can be seen in figure 3.



Figure 3. Samples already separated by the FRANTZ Magnetic Separator.

3.2.5 Mineralogical Description

Use of binocular loupe to identify minerals present in samples with a focus on columbite-tantalite. The materials were: petri dish, watch glass, tweezers and spatulas. The samples used were only three, which were those with lower particle size: A02 - R, A03 - B and TF04 - R. The sample A01 - R, being larger, was

analyzed unaided eye.

3.3 Third Stage

3.3.1 Data Interpretation and Integration

This stage consisted of joining all the data previously collected for the interpretation and elaboration of a result/report/final work, integrating rationally and completely all the results obtained in the analyzes and the literature review.

4. Results and Discussions

4.1 X-Ray Fluorescence

After all samples were sprayed in the first stage, they were sent to XRF, obtaining the results in relation to the oxides / chemical elements that can be analyzed in table 1.

Table 1. Comparison of the concentrations of the main oxides and chemical elements of the samples identified by XRF.

	A01 – R (%)	A02 – B (%)	A03 – R (%)	TF04 – R (%)
Al₂O₃	0,881	0,629	1,038	1,012
SiO₂	1,139	2,183	6,685	6,911
P₂O₅	0,394	0	0,401	0
K₂O	0	0	0,107	0
CaO	0,105	0,328	0,130	0,273
Ti	13,640	46,156	33,821	42,537
V	0,087	0	0	0,345
Cr	0	0	0,025	0
Mn	0,398	1,020	4,927	0,634
Fe₂O₃	82,720	16,803	52,267	21,239
As	0	0,003	0	0,003
Se	0	0,031	0	0,022
Y	0	0,242	0,004	0,755
Ni	0,013	0	0	0
Cu	0,001	0	0	0
Zn	0,031	0	0,047	0
Rb	0	0	0,006	0
Zr	0,002	0,205	0,010	0,456
Nb	0,074	22,397	0,193	17,807
Ag	0,119	0,257	0,143	0,256
Sn	0,070	0,233	0	0,593
Nd	0	0,667	0,046	0,493
Sm	0	0	0	0,002
Ta	0,011	7,128	0,093	5,993
W	0	0,209	0,034	0,217
Pb	0	0,103	0	0,070

Bi	0,049	0	0,019	0
Th	0	0,241	0	0,206
U	0	0,073	0	0,054
Sc	0,010	0,084	0	0,038
Pd	0	0,007	0	0
Eu	0,254	0	0	0
Lu	0,002	0	0	0
Pt	0	0	0,003	0
Yb	0	0	0	0,084

Also making a comparison between the samples in terms of the concentrations of the main chemical elements of this research (Nb and Ta) and the most abundant (Fe, Ti and Mn), table 2 was prepared.

Table 2. Comparison of the concentrations of the main chemical elements of the samples identified by XRF.

Samples \ Elements	Nb (%)	Ta (%)	Fe (%)	Ti (%)	Mn (%)
A01 - R	0,105	0,016	79,101	17,827	0,538
A02 - B	24,234	7,693	12,675	49,600	1,100
A03 - R	0,250	0,120	46,564	41,813	6,252
TF04 - R	20,102	6,740	16,680	47,466	0,711

It is noticed that there are the same chemical elements in the four samples analyzed (table 2), but with different percentages of occurrence. As a result, the sample with the highest concentration of Fe is the first (A01 - R) and the value of Ti concentration in the three other samples is similar and high. Finally, it should be noted that samples A02 - B and TF04 -R have high values for Nb and Ta in relation to the other samples, so they are likely to have more columbite-tantalite (figure 4).

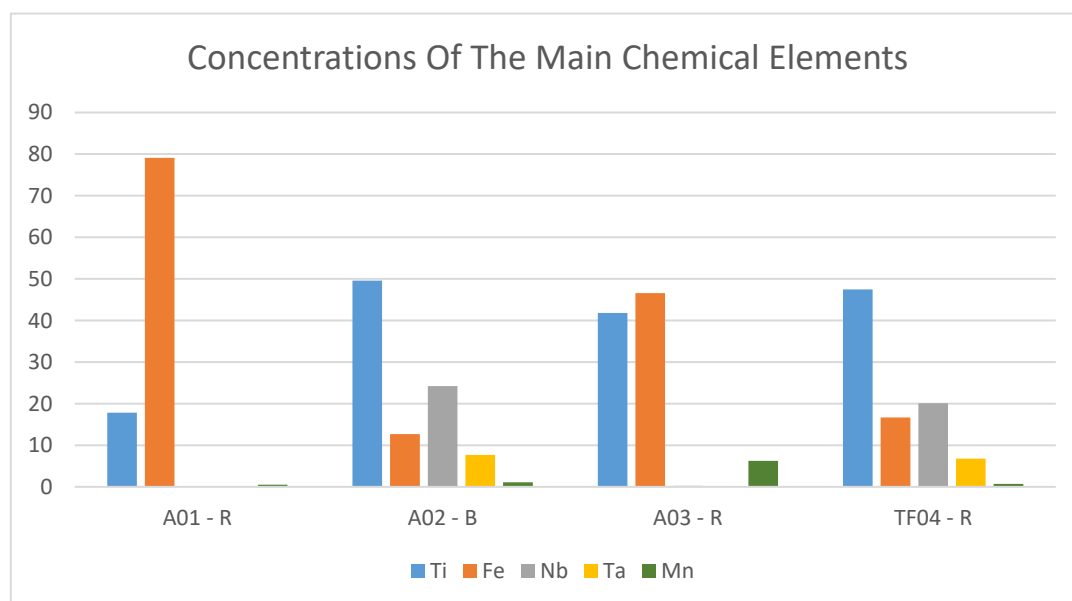


Figure 4. Comparison of the concentrations of the main chemical elements found in the four samples.

4.2 X-Ray Diffraction

A01 - R

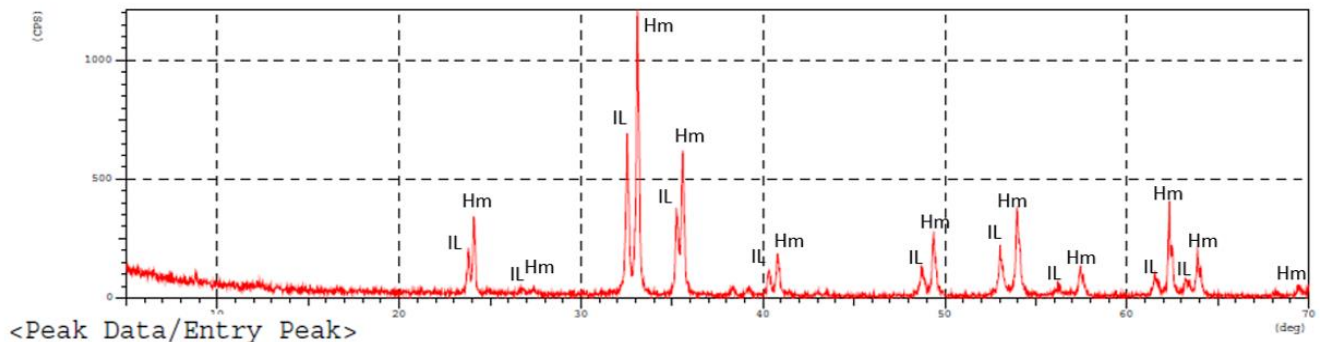


Figure 5. Diffractogram of sample A01 - R, two main minerals were found, hematite (Hm) and ilmenite (IL).

Two main minerals were found, hematite (Fe_2O_3) and ilmenite ($\text{Fe}_2 + \text{TiO}_3$). Hematite had the highest peaks, while ilmenite had high peaks, but smaller than those of hematite. This is a sample with a high content of Fe and Ti.

A02 - B

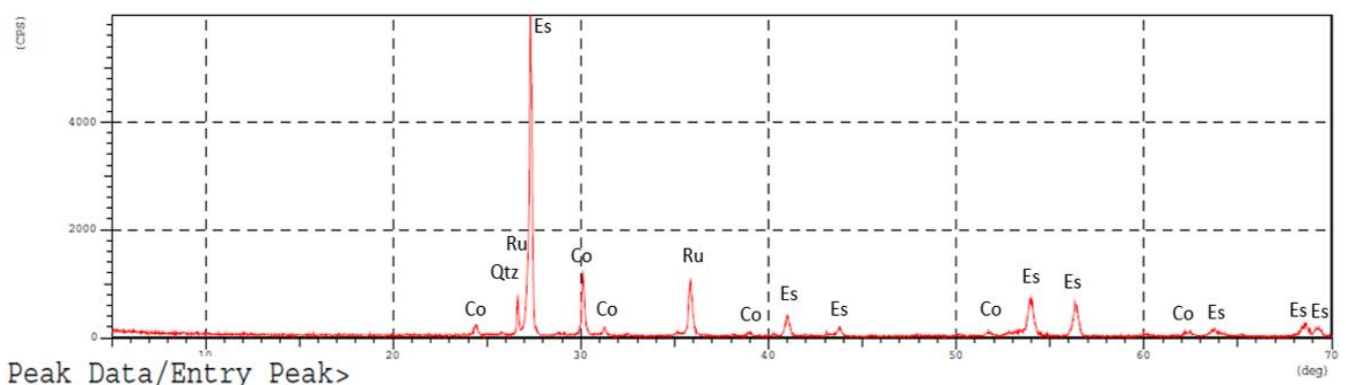


Figure 6. Diffractogram of sample A02 - B, four main minerals were found, rutile (TiO_2), titanium oxide, tantalum, niobium and iron (struverite - Es), ferrocolumbite with manganese (Co) and quartz (Qtz).

Four main minerals were found, rutile (TiO_2), struverite ($(\text{Ti}, \text{Nb}, \text{Ta}, \text{Fe})_2\text{O}_4$), ferrocombite with manganese ($(\text{Fe}, \text{Mn})(\text{Nb}, \text{Ta})_2\text{O}_6$) and quartz (SiO_2). The highest peaks belong to titanium oxide, tantalum, niobium and iron. It is clear that this sample has high levels of Fe, Ti, Ta and Nb.

A03 - R

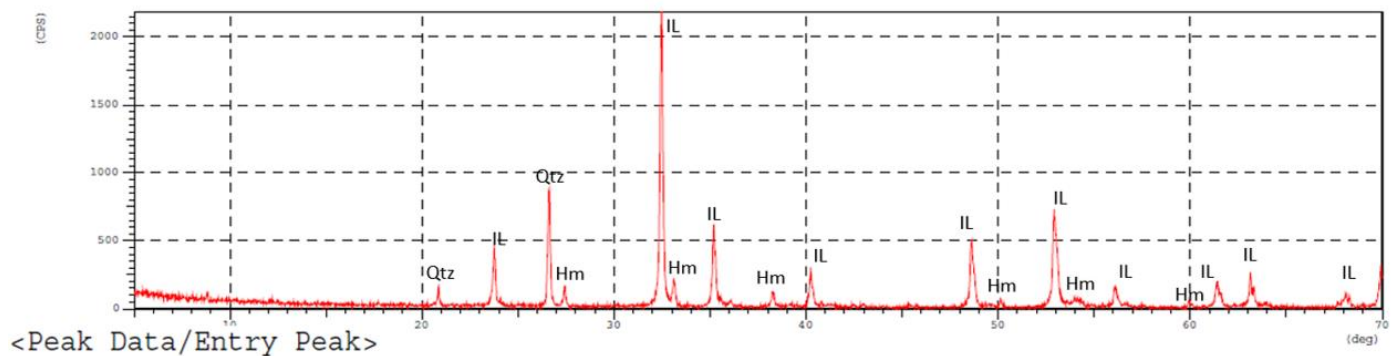


Figure 7. Diffractogram of sample A03 - R, three main minerals were found, quartz (Qtz), hematite (Hm) and ilmenite (IL).

Three main minerals were found, quartz (SiO_2), hematite (Fe_2O_3) and ilmenite ($\text{Fe}_2 + \text{TiO}_3$). The biggest peaks belong to the ilmenite. The sample presents high levels of Fe and Ti.

TF04 - R

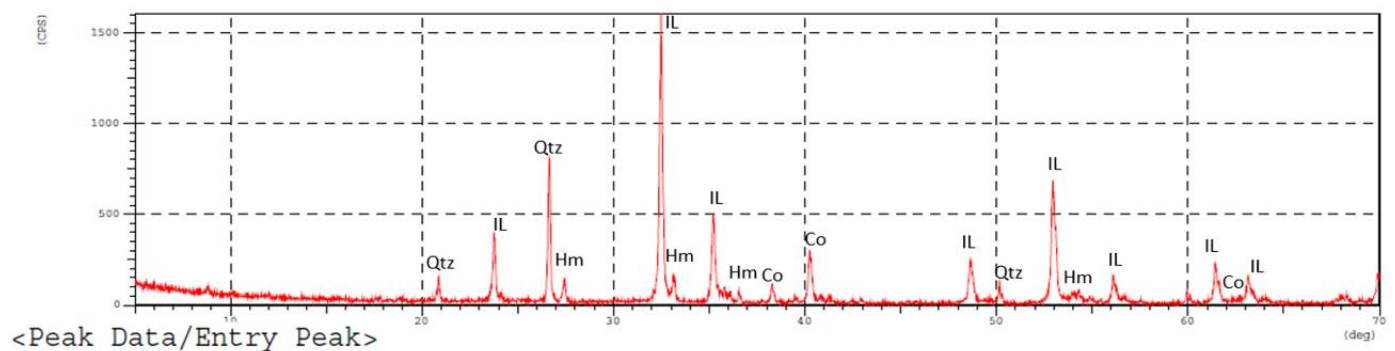


Figure 8. Diffractogram of sample TF04 - R, four main minerals were found, quartz (Qtz), hematite (Hm), ferrocolumbite with manganese (Co) and ilmenite (IL).

Four main minerals were found, quartz (SiO_2), hematite (Fe_2O_3), ferrocolumbite ($\text{Fe, Mn (Nb, Ta)}_2\text{O}_6$) and ilmenite ($\text{Fe}_2 + \text{TiO}_3$). The biggest peaks belong to the ilmenite. It is noticed that this sample has high levels of Fe, Ti, Ta and Nb, and may also contain struverite.

4.3 Mineralogical Descripton

4.3.1 First Sample



Figure 9. Angular minerals belonging to sample A01 - R.

A01 - R: Analyzed with the naked eye, as they have sizes ranging from 0.5 to 3.5 cm. Most of the grains in the sample are sub-angular and few are very angular (figure 9), indicating little transport. Were identified: quartz (figure 10A), hematite (figure 10B) and ilmenite (figure 10C).



Figure 10. A. Quartz grain. B. Hematite. C. Ilmenite. All from sample A01-R.

4.3.2 Second Sample

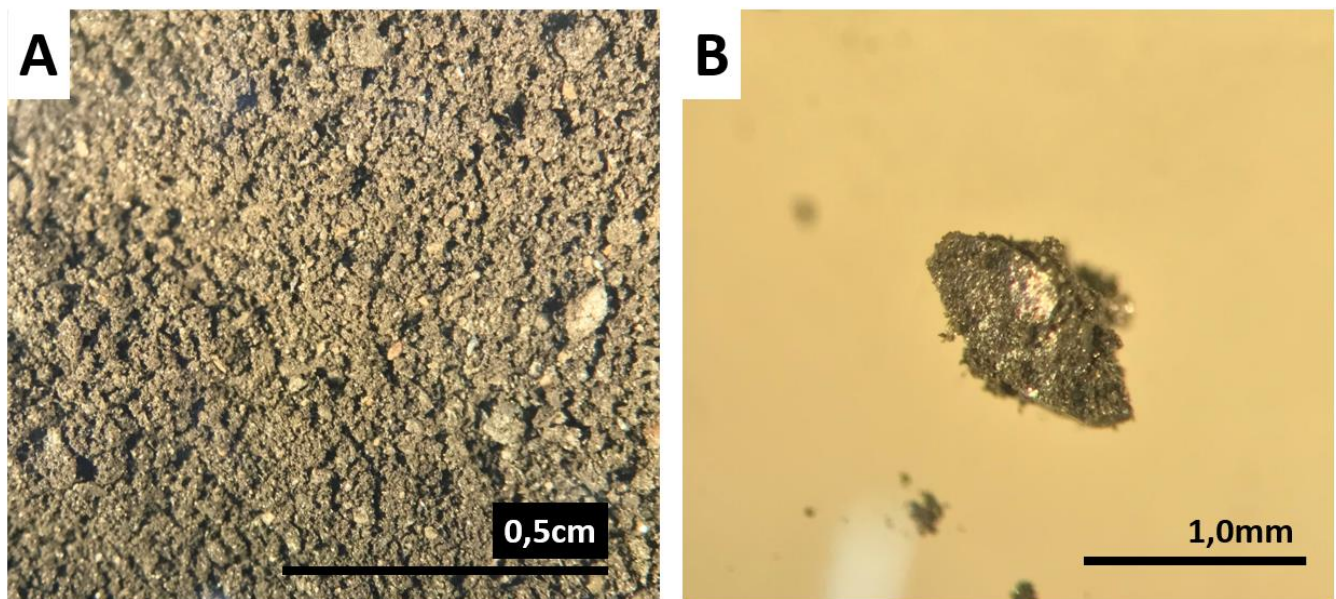


Figure 11. A. Binocular magnifier view of partially pulverized minerals. **B.** Columbite-tantalite. All from sample A02-B

A02 - B: Analyzed in the binocular loupe, as they have sizes less than 1mm. Regarding the rounding of minerals, it was not possible to be analyzed because all samples were partially pulverized (figure 11A), leaving only a few grains that could be identified: quartz and columbite-tantalite (figure 11B).

4.3.3 Third Sample

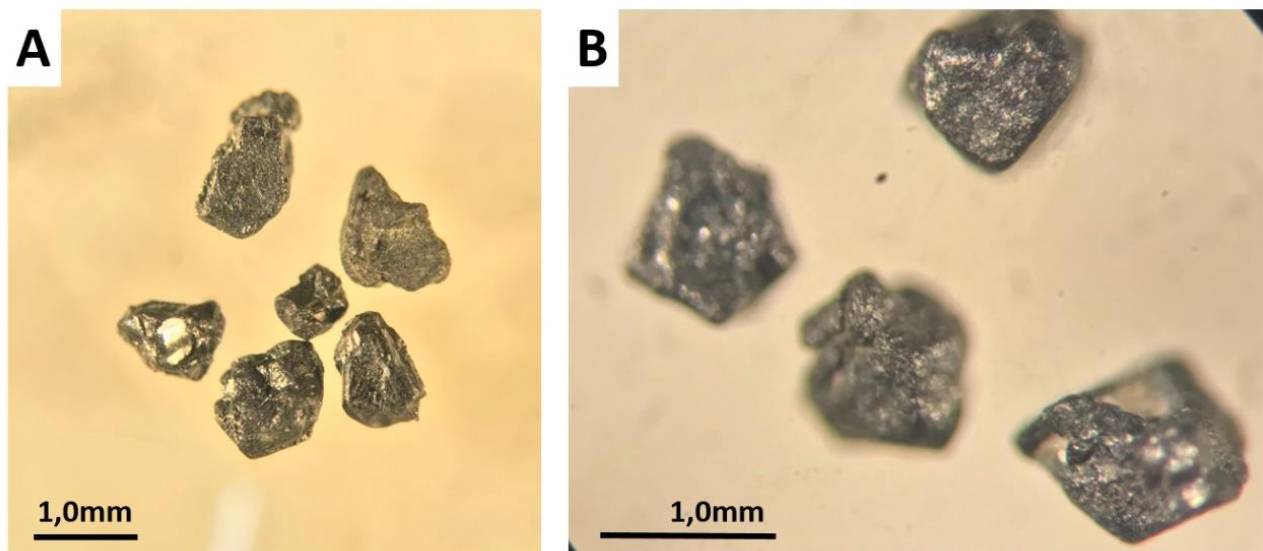


Figure 12. A. Possible columbite-tantalite. **B.** Probable Ilmenites. All belonging to sample A03-R.

A03 - R: They were analyzed in the binocular loupe as they were smaller than 2mm. Most of the grains in the sample are sub-angular and a few are angular (figures 12A and B), already containing a greater degree of sphericity than the other samples, indicating little transport. Some show a weathering cover. Ilmenite

and columbite/tantalite were identified.

4.3.4 Fourth Sample

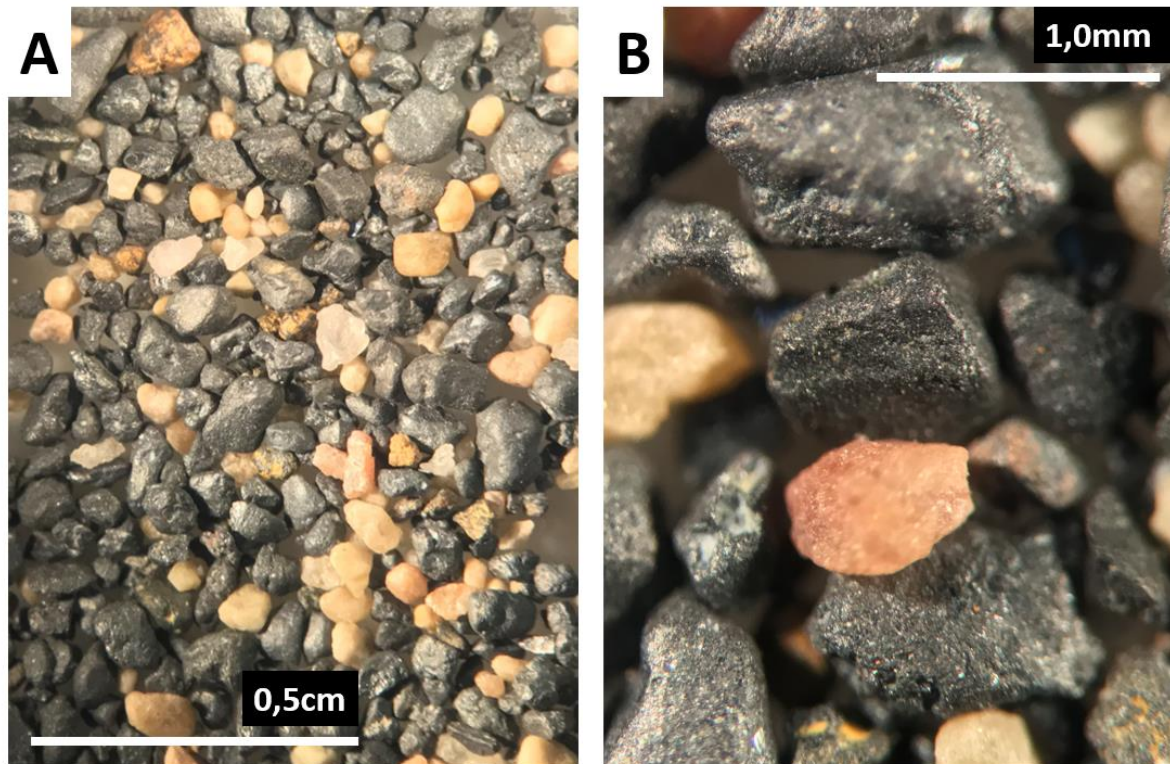


Figure 13. A and B. Overview in the binocular magnifying glass of minerals. All of the sample TF04-R.

TF04 - R: Analyzed in the binocular loupe, as they have sizes smaller than 3mm. Most of the grains in the sample are sub-angular to angular (figure 13), indicating little transport, with some grains having a greater sphericity than others. Some show a weathering cover. Were identified: quartz (figure 14) and columbite-tantalite (figure 15).

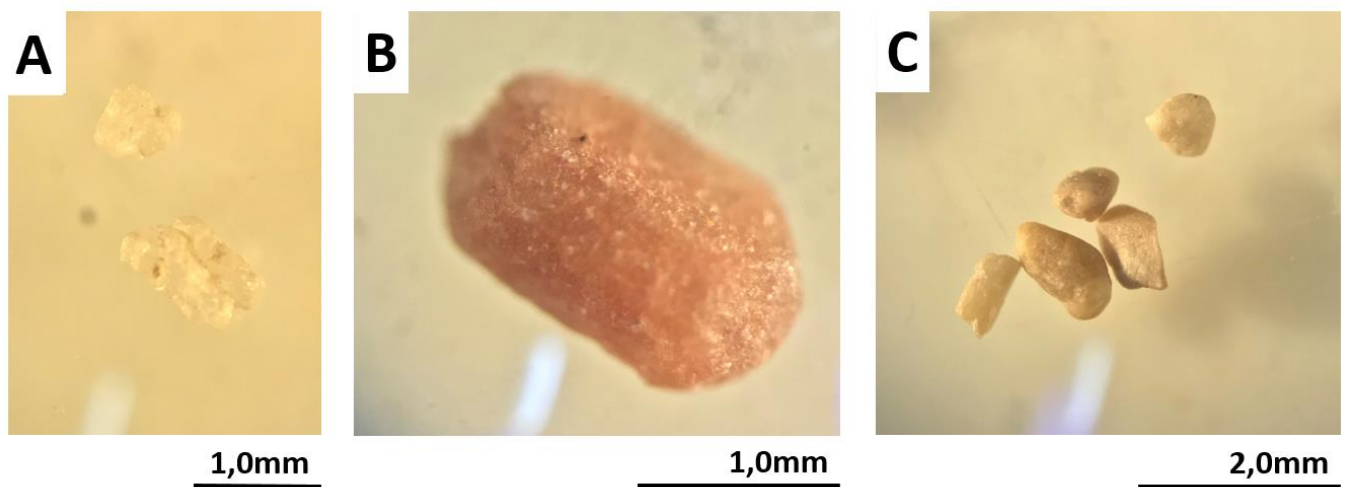


Figure 14. A, B and C. Overview of the quartz crystals found in the binocular loupe. All of the sample TF04-R.

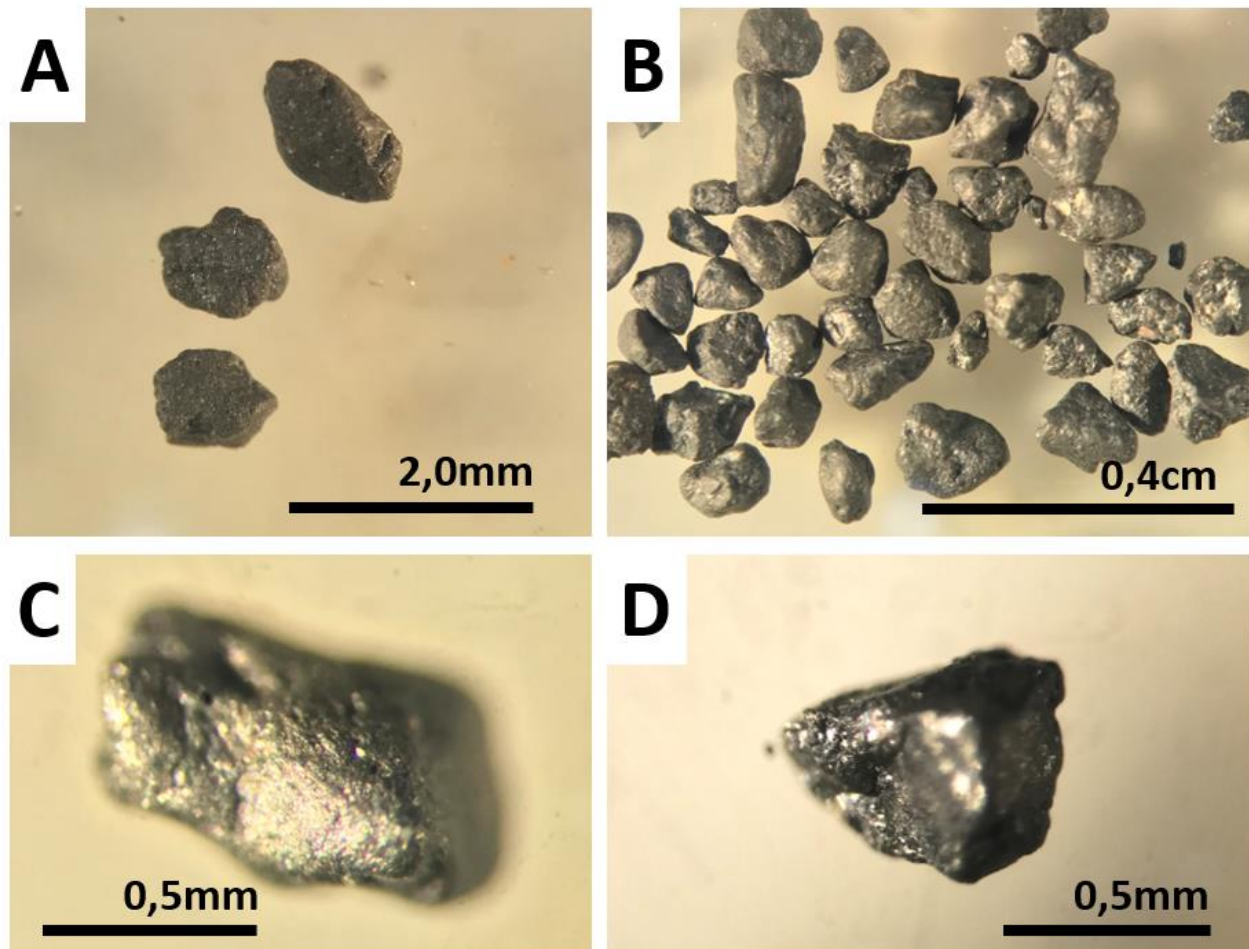


Figure 15. **A.** Presence of streaks in columbite-tantalite. **B.** Overview in the binocular magnifying glass of minerals. **C and D.** Metallic shine of the mineral. All of the sample TF04-R.

4.3 Discussions

The X-Ray Fluorescence allowed us to identify the chemical elements present in the samples. With this, it was possible to identify a large amount of iron and titanium in all these samples, as well as a significant amount of niobium and tantalum in some of these. In addition to the main elements identified, some other elements are associated with the anomalies of Nb and Ta. Some of these are the Rare Earth Elements (RET), more precisely scandium (Sc), yttrium (Y), neodymium (Nd), ytterbium (Yb) and samarium (Sm), the last two appearing in only one of the samples containing columbite-tantalite. All probably concentrated in their secondary form in the alluvial deposits of the area. Among the RET, monazite (Ce, La, Di) PO₄ and xenotime (YPO₄) are usually associated with columbite-tantalite in pegmatites, showing that these are rocks that should be explored in this area because they are probably the source rocks. According to Freitas (2017), he states that: high levels of scandium appear sporadically in isolated areas on gneissic and migmatitic rocks in the regions of Rorainópolis, Caracaraí and Urariquera river; about the yttrium, the most striking area of high levels is east of Rorainópolis (upper Anauá river basin), where these levels are related to the orthoderivative metamorphic rocks of the Martins Pereira Suite and granitoids of the Mapuera Intrusive Suite. Associated with regional geology, it can also be said that they are probably associated with

Martins Pereira Suite, Igarapé Azul Suite or the Modern Granite, as these, contain RET, in addition to the presence of pegmatites. In addition to the RET, there is also the presence of some actinides, such as thorium (Th) and uranium (U), both with radioactivity, also probably associated with the Martins Pereira or Igarapé Azul Suite, due to the regional geology affirming the enrichment in LILE and RET.

X-ray diffractometry allowed the identification of the minerals found in each of these samples, more specifically showing the presence of titanium oxide, tantalum, niobium and iron ((Ti, Nb, Ta, Fe) $2O_4$), also known as struverite, and ferrocombite with manganese (Fe, Mn) (Nb, Ta) $2O_6$). With this, almost all the minerals found are oxides, among them ilmenite (Fe $_2$ + TiO $_3$), hematite (Fe $2O_3$) and rutile (TiO $_2$), obtaining columbite-tantalite in two of the four samples.

The methods used, also including petrography, allowed not only to identify the chemical and mineral elements that make up these deposits, but also made it possible to advance the discussion regarding the transport processes that acted on these minerals.

With all the analyzes, it can be said that the minerals from this secondary deposit were little transported, being identified by the low degree of selection of the samples. However, there was a tractive transport causing alluvial deposits. Not all samples had fine granulometry, showing that it varies throughout the deposit. It was possible to verify a weathering layer in some minerals, being more characteristic in the ilmenites, identified through the binocular loupe.

The study region (vicinal 12) is located exactly in the Igarapé Azul Suite and, because little transport was also identified in the samples, it can be inferred that somewhere nearby there may be pegmatites or other igneous rocks in this suite, which may come to be the source rock of these deposits. Or the source rock may also be associated with the Martins Pereira Suite due to the presence of ETRs and actinides (Th and U). According to Freitas (2017), through the geochemical atlas of the region of Roraima (CPRM), he states that in the region they may have placer deposits.

5. Conclusion

The deposits in this area are characterized by having high percentages of Fe and Ti (mostly), containing, in some places, large concentrations of niobium and tantalum, finding minerals such as struverite. Not all samples had columbite-tantalite, showing that their concentration in some places of the deposit is very low. There are samples with less than 1% Nb and Ta and there are also samples with more than 20% Nb and more than 6% Ta.

A primary deposit of niobium and tantalum present in the northern region, is the Pitinga Mine. This mine has a content of niobium of 0.202% and tantalum of 0.028%, showing that in comparison with these deposits of Rorainópolis, it has a very high content (vicinal 12), which can also infer that its primary source probably also has elevated content of niobium and tantalum.

All methods proved to be quite suitable for the analysis of alluvial deposits found in this location. They made it possible to advance in the discussions about the deposit and also about the transport processes that occurred in these minerals, concluding that they were little transported, being identified by the low degree of selection and rounding of the samples, and it can also see a layer of weathering in some of these deposit minerals, allowing better identification of some grains such as ilmenites.

X-ray diffractometry showed that in the samples there are up to two types of niobium and tantalum minerals: struverite and ferrocombite with manganese. Samples that contain a high content of niobium and tantalum are probably closer to each other than the two samples that do not have a high content.

The Nb and Ta were probably originated from some igneous rock (pegmatite, for example) close to the region, containing a lot of RET, which may be from the Igarapé Azul Suite itself or the Martins Pereira Suite. The regional geology states that there is the presence of pegmatites in the Martins Pereira and Granito Moderna Suite, being potential areas for future prospecting.

6. Acknowledgment

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Quantitative methods and study of the *parth dependence* effect of Douglass North from the cocoa production index (CPI) in Rondônia, Brazil

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Abstract

Objective: to analyze the path dependence effect of Douglass North from the construction of the cocoa production index (IPC) using quantitative methods, aiming to contribute to the discussions on the "conservation and development" trade-off in the Amazon. **Methods:** this is a hypothetical-deductive study. The CPI was calculated following the factorial analysis techniques presented by Hair et al [11], Santana [12,13] and Cavalcante [14] and the SPSS (Statistical Package for Social Sciences) was used. **Results:** in

Brazil the level of performance of cocoa production, when considering the number of cocoa producing municipalities and the indicators, area destined to harvest (hectares), quantity produced (ton), average production yield (kilograms per hectare) and value production (thousand reais) is very low, almost inefficient. Rondônia follows the logic found in Brazil. **Conclusions:** despite the importance of cocoa production, there are still no regional development centers for cocoa cultivation in Rondônia. All cocoa producing municipalities had low levels of PCI performance. The fact that CEPLAC develops its actions exclusively in the East Rondoniense portion of the State only reinforces the analysis in this direction, which helps to understand the path dependence character of the cocoa policy in Rondônia.

Keywords: CPI. Factor analysis. Douglass North. CEPLAC. Rondônia. Brazil.

I. INTRODUCTION

The study follows the theoretical precepts of Douglass North's institutional view. According to this theory, institutional models tend to reinforce themselves, even when they are socially inefficient. It is easier for individuals to adapt to existing rules than to try to modify them. When development takes a certain direction, the organizational culture, customs and mental models of the social world reinforce this trajectory, that is, they propel it to move in the same direction [1].

North [1] uses the example of piracy. According to him, the fact that a society whose institutional matrix rewards piracy, pirate organizations will tend to prosper. As highlighted by Toyoshima [2], this example shows that developed institutions are not necessarily efficient for the economic development of countries, given that institutional arrangements are shaped, in large part, by the interests of those who have bargaining power. If pirates have such power in society, institutions tend to serve their interests primarily. In this way, this activity starts to work only as a form of wealth distribution that annihilates the right to property and, with that, eliminates the necessary feedback for the recognition of a whole process involved in the design of a product, which when made available to the market in an unofficial way, ends up destroying an entire scientific and technological apparatus capable of positively boosting societies to a more mature stage of development.

North's work [1] clearly illustrates the different trajectories followed by countries such as the United States, which historically had a strong institutional heritage from England, based on the solid tendency to reduce transaction costs, and from Third World countries that, unlike the first, they were influenced by personalism in economic and political relations and property rights, often inadequately defended by Portuguese and Spanish crowns. Thus, for North if such self-reinforcing mechanisms work, the past history of the institutions is important for determining the present institutional structure, and this, in turn, will influence the future institutional matrix. The connection of the past with the present and the future is given by history, and it means that institutions have path dependence characteristics [2].

In this sense, institutions come to occupy a central place in the analysis of the economic development process, because they define the environment in which the economy works and facilitate the interaction

between individuals, and because institutional change defines how society evolves over time. [3]. In this way, aspects inherent to the relationship of space and power from an environmental perspective may be acting in order to dictate the rules and the direction of development in Rondônia.

Oliveira et al [4] stated that the socioeconomic development of Brazilian regions occurred at a different pace throughout history and solidified a scenario of profound regional inequalities. The implementation of policies to counteract the forces of concentration of development and recent phenomena, such as the economic opening of the Brazilian economy and the increase in global globalization, have not been effective in significantly changing the profile of inequalities and increasing the economic dynamism of places less prosperous in the national territory [4].

According to Mota, Gazoni [5], the accelerated economic growth has generated great benefits to human society, promoting, at the same time, the compromise of a large part of the available natural resources, causing damage, many irreversible, to ecosystems and local communities. In addition, the loss of environmental services has promoted socioeconomic losses, especially in nations less prepared to face these changes. In this context, debates on the commitment of basic resources are intensified, including those present in the territory of the Amazon.

For Allegretti [6], the policies implemented in the Amazon in the last decades resulted from the search for solutions to problems external to the region. In the case of colonization projects, the Amazon was seen as an empty space and as a way to avoid carrying out agrarian reform in the Center-South. Thus, in the case of agricultural and mineral projects, the Amazon came to be understood as a resource frontier for economic sectors established outside the region. The activities implemented in this period disaggregated the environment and did not increase regional income [6]. Historically, there has always been a large gap between public policies for economic development and those for environmental protection, which contributed to the high degree of deterioration of ecosystems in Brazilian territory [7].

Becker [8, 9] highlights that public policies for the Amazon express divergent and conflicting interests. To illustrate this aspect, the author states that, on the one hand, some are based on favoring new support infrastructures for economic development, especially large-scale agribusiness, and, on the other hand, other public policies appear focused on interests of local populations and socio-environmental sustainability.

Within this focus, Becker [8,9], when studying the regional occupation process, affirmed that it followed an exogenous model, through public investments in infrastructure and private investments in agribusiness. Today, however, due to the demands of local groups, national interest and / or national and international environmental pressures, the endogenous model is rescued in territorially differentiated projects, through local-global relations that are established through information networks. The author also points out that two parallel and conflicting public policies induce these models. The compatibility of conservationist and developmental interests, that is, of the two models, is essential to achieve sustainable development.

In this context, political leaders can play a vital role as catalysts in the development of institutions. Functional leadership can encourage deliberative processes that allow public policies and institutions to

adapt to the needs and demands of society with great potential for strengthening institutional performance. However, leadership can also be ineffective. Rather than contributing to institutional development, ineffective leaders can have the opposite effect. The accumulation of power allows them to get things done, but at the expense of weakening institutions, as pointed out by the Inter-American Development Bank - IDB [10].

The focus of our interest is the policy of the Executive Committee of the Cacao Plantation Plan (CEPLAC) in Rondônia. CEPLAC is a public research institution linked to the Ministry of Agriculture, Livestock and Supply of Brazil. It was created in 1957, a time when the cocoa economy was going through a serious crisis, and its activity, in its beginnings, was basically focused on supporting cocoa culture.

CEPLAC has its competences established by law and among these competencies are I - to propose and implement plans, programs, projects, information systems, actions and activities aimed at promoting in the cocoa-producing regions of Brazil: a) sustainable rural development, research, innovation, technology transfer, technical assistance, rural extension, agricultural technological qualification, certification and territorial and socio-productive organization; b) fundraising and access to rural credit; and c) the improvement of the cocoa production chain and the associated agroforestry systems; II - formulating proposals and participating in negotiations and entering into agreements, contracts and other similar instruments, concerning the development of the cocoa crop and associated forest systems in conjunction with the relevant units of the ministry; III - coordinate the preparation, promote the execution, supervision, monitoring, inspection, audit and evaluation of plans, programs and actions in the middle and end areas of its competence; IV - manage the resources from the General Cocoa Fund; and V - guide and coordinate activities related to the Regional Superintendencies for the Development of Cacao Crop.

Given the above, it is worth highlighting the following epistemological questions of this work. Does the policy of regional development of cacao cultivation in Rondônia, through the policy triggered by CEPLAC, during its activity in the territory of Rondônia, present a characteristic path dependence, according to the institutional theory of Douglass North? From the point of view of CEPLAC's institutional matrix and organizational vision, in Rondônia, how do these characteristics relate to the mesoregional aspects of the State? The cocoa policy in the regional scenario obeys the logic of recovering degraded areas, which would be linked to those areas already deforested, or adopts a logic of income generation as a mechanism for improving the quality of life, allowing even those areas still considered environmentally preserved can benefit from the benefits of the same policy? These are the questions that guided the research.

The research aims to analyze the path dependence effect of Douglass North from the construction of the cocoa production index (CPI) using quantitative methods, aiming to contribute to the discussions on the "conservation and development" trade-off in the Amazon.

II. METHODS

This research was structured based on aspects of interdisciplinary research given the complexity that surrounds the theme. This is a hypothetical-deductive study. Graphs and tables were constructed using

SPSS, version 22, based on data from the Brazilian Institute of Geography and Statistics - IBGE (municipal agricultural production). The CPI was calculated following the factorial analysis techniques presented by Hair et al [11], Santana [12,13] and Cavalcante [14]. The statistical tool SPSS (Statistical Package for social sciences) was used, which enabled the application of mathematical knowledge and allowed the construction of the cocoa production index (IPC) based on the indicators adopted in the research, which were: area for harvesting (hectares), harvested area (hectares), quantity produced (tons), average production yield (kilograms per hectare) and production value (thousand reais).

2.1 ANALYTICAL RESEARCH MODEL

Method: Construction method of Cocoa Production Index (CPI)

The method used in this study followed the logic of factorial analysis, which can be seen in the matrix form as in Dillon and Goldstein[15]:

$$X = \alpha F + \varepsilon \quad (1)$$

Then

X = is the p-dimensional vector transposed from observable variables, denoted by $X = (x_1, x_2, \dots, x_p)$;

F = is the q-dimensional vector transposed from non-observable variables or latent variables called common factors, denoted by $F = (f_1, f_2, \dots, f_q)$, where $q < P$;

ε = is the p-dimensional vector transposed from random variables or unique factors, denoted by $\varepsilon = (\varepsilon_1, \varepsilon_2, \dots, \varepsilon_p)$;

α = is the array (p, q) of unknown constants, called factorials loads.

According to Gama *et al*[16], Santana[17], in the factorial analysis model it is assumed that specific factors are orthogonal, among themselves, with all common factors. Normally, $E(\varepsilon) = E(F) = 0$ and $Cov(\varepsilon, F) = 0$.

According to the authors, the initial structure used to determine the array of factorials loads, in general, may not provide a significant pattern of variable loads, so it is not definitive. This initial structure can be done by several methods of rotation of the factors, as Dillon and Goldstein[15], Johnson and Wichern[18]. It was used the VARIMAX method of orthogonal rotation of the factors for this study.

The VARIMAX method is a process where the reference axes of the factors are rotated around the source until some other position is reached. The objective is to redistribute the variance of the first factors to others and to achieve a simpler and more theoretically significant factorial [19,11,13,16,17].

The choice of factors was carried out through the technique of latent root. So, the array of factorials loads, which measures the correlation between the common factors and observable variables, is determined by means of the correlation matrix, as Dillon and Goldstein [15].

For determining cocoa production index (IPC) it was used the matrix of factorials scores estimated by the orthogonal base factorial rotation process, as pointed out by Santana[20]. The factorial score puts each observation in the gap of the common factors. For each factor f_j , the i-th factor score extracted factorial score is defined by F_{ij} , expressed as follows [15]:

$$F_{ij} = b_1 x_{i1} + b_2 x_{i2} + \dots + b_p x_{ip} \quad F_{ij} = b_1 x_{i1} + b_2 x_{i2} + \dots + b_p x_{ip} \quad (2)$$

Then:

b_i = are the estimated regression coefficients for the n Common factorials scores;

x_{ij} = Are the n Observations of p Observable variables.

$i = 1, 2, \dots, N$.

$j = 1, 2, \dots, p$.

To reach the equation that is the perception index [16], [17], show the sequence evolution of the formulas from the previous equation. It turns out that even if the variable F_{ij} is not observable it can be estimated through the factorial analysis techniques, using the matrix of observations of the vector x of observable variables. In factorial notation, equation 2 becomes:

$$F_{(n \times q)} = X_{(n \times p)} b_{(p \times q)} \quad F_{(n \times q)} = X_{(n \times p)} b_{(p \times q)} \quad (3)$$

In Equation 3, F is the matrix of the estimated regression from the n Factorials scores and it can be affected by both the magnitude and the measurement units of the variables x . To work around this kind of problem, replace the variable x by the standard variable w , given the ratio of the deviation around the average and the standard deviation of x , as follows:

$$\frac{x_i - \bar{x}}{S_x}$$

With these values, Equation 3 is modified making equation 4 possible, then:

$$F_{(n \times q)} = W_{(n \times p)} \beta_{(p \times q)} \quad F_{(n \times q)} = W_{(n \times p)} \beta_{(p \times q)} \quad (4)$$

Based on equation 4, the beta weights matrix (β) with q standardized regression coefficients, replaces b , given that the variables are standardized on both sides of the equation. Pre-multiplying both

sides of equation 4 by the value $\frac{1}{n} \frac{1}{n} w'$, in which n is the number of observations and W is the transposed matrix of w' , it makes it possible to reach the following equation:

$$\frac{1}{n} w'_{(p, n)} F_{(n, q)} = \frac{1}{n} w'_{(p, n)} W_{(n, p)} \beta_{(p, q)} = R_{(p, p)} \beta_{(p, q)} \quad (5)$$

The Matrix $\frac{1}{n} \frac{1}{n} w' w$, therefore is the matrix of intercorrelated variables or correlation matrix among the observations of the matrix x , designated by R . The Matrix $\frac{1}{k} w' F \frac{1}{k} w' F$ It represents the correlation between the factorials scores and the factors themselves, denoted by Λ . With this, rewriting the equation 5, one must:

$$\Lambda_{(p \times q)} = R_{(p \times p)} \beta_{(p \times q)} \quad \Lambda_{(p \times q)} = R_{(p \times p)} \beta_{(p \times q)} \quad (6)$$

If the matrix R is non-singular, one can pre-multiply both sides of equation 6 by the inverse of R , obtaining:

$$\beta = R^{-1} A \quad \beta = R^{-1} A \quad (7)$$

Substituting the β vector into equation 4, we obtain the factorial score associated with each observation, as follows:

$$F_{(n,p)} = W_{(n,p)} R_{(p,p)}^{-1} A_{(p,q)} \quad F_{(n,p)} = W_{(n,p)} R_{(p,p)}^{-1} A_{(p,q)} \quad (8)$$

The main formula of the perception index is reached where the IP is defined as a linear combination of these factorial scores and the proportion of the variance explained by each factor in relation to the common variance. The mathematical expression is represented by the following formula:

$$IP_i = \sum_{j=1}^q \left(\frac{\lambda_j}{\sum_{j=1}^q \lambda_j} FP_{ij} \right) \quad IP_i = \sum_{j=1}^q \left(\frac{\lambda_j}{\sum_{j=1}^q \lambda_j} FP_{ij} \right) \quad (9)$$

Then:

$i = 1, 2, \dots, n$.

λ = is the variance explained by each factor;

$\sum \lambda$ = is the total sum of the variance explained by the set of common factors.

The factorial score was standardized (FP) to obtain positive values from the original scores and allow the hierarchies of the cities as the values of the performance index are located between zero and one. The formula that allows this tiering can be seen by the following equation:

$$FP_i = \left(\frac{F_i - F_{\min}}{F_{\max} - F_{\min}} \right)$$

It can be seen that F_{\min} and F_{\max} are the maximum and minimum values observed for the factorial scores associated with the parameters observed in Brazil e Rondônia. It is based on this understanding that it was possible to calculate the production index adopted in this study.

2.2 SCALE LEVELS

The classification used by the research to express the results achieved by the IPC is described in table 1.

Table 1: Analysis scale adopted by the research.

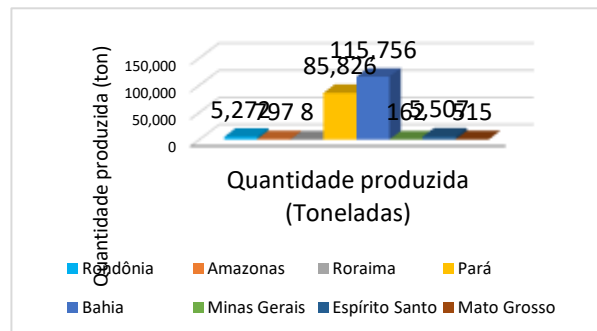
Scale	Description IPC
0.801 a 1.000	Great
0.601 a 0.800	Good
0.401 a 0.600	Regular
0.201 a 0.400	Bad
0.000 a 0.200	Terrible

Source: Own Elaboration.

III. RESULTS AND DISCUSSION

3.1 Cocoa production in Brazil

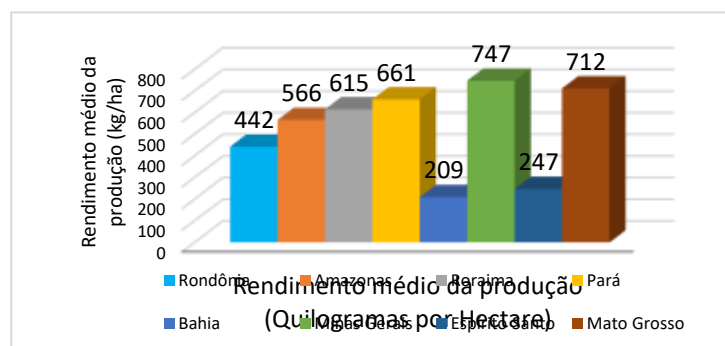
The production potential of cocoa in Brazil, based on the last survey available by the IBGE in 2016, was concentrated in the state of Bahia (115,756 tons), responsible for 54.13% of cocoa production in Brazil and the state of Pará (85,826 tons), responsible for 40.14% of Brazilian production. Cocoa production in the states of Bahia and Pará represents 94.27% of cocoa production in Brazil that year. (graphic 1).



Graph 1 - Quantity of cocoa produced (tons), by State, in 2016.

Source: IBGE (Municipal agricultural production).

The highest average yields of cocoa production in Brazil were registered in the state of Minas Gerais (747 kg / ha), followed by Mato Grosso (712 kg / ha), Pará (661 kg / ha), Roraima (615 kg / ha), Amazonas (566 kg / ha) and Rondônia (442 kg / ha). The lowest average cocoa yields are registered in the state of Bahia (209 kg / ha) and Espírito Santo (247 kg / ha). (graph 2).

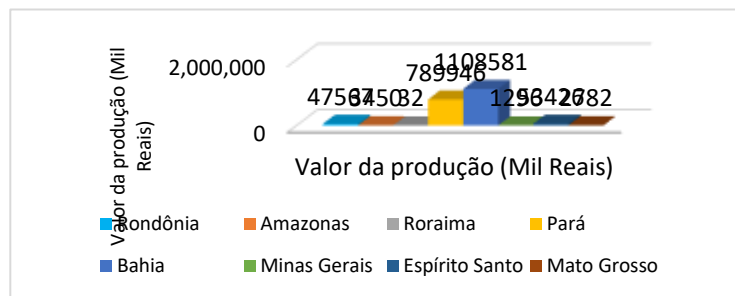


Graph 2 - Average yield of cocoa production (kg / ha), by State, in 2016.

Source: IBGE (Municipal agricultural production)

The state of Bahia (Northeast region of Brazil) obtained the highest value of cocoa production with more than 1 billion and 100 million reais (Brazilian currency). The state of Pará (Northern Brazil) moved production in the amount of approximately 800 million reais for the same period. The State of Espírito Santo (Southeast region) handled approximately 53.43 million reais and Rondônia (North region), profited R \$ 47.6 million reais from the sale of cocoa in 2016. The states of Amazonas and Roraima (North region),

Minas Gerais (Southeast region) and Mato Grosso (Midwest region) obtained incipient values of cocoa production. (graph 3).



Graph 3 - Value of cocoa production (Thousand Reais), by State, in 2016.

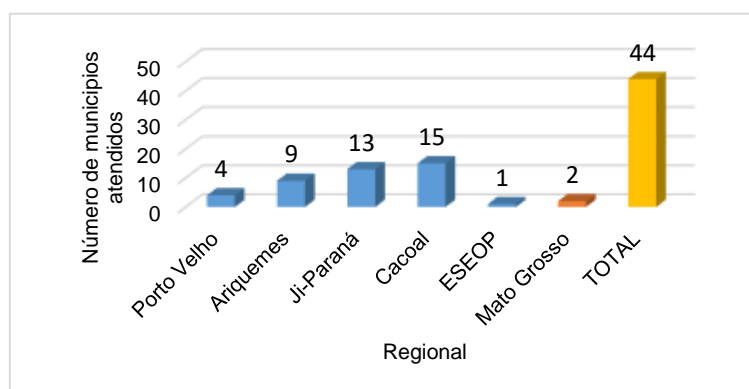
Source: IBGE (Municipal agricultural production).

3.2 Cocoa production in Rondônia

The Development Superintendence of the Cocoa Region of the State of Rondônia (SUERO), CEPLAC's unit in Rondônia, from an institutional point of view, operates in five regions of the State and another region in the state of Mato Grosso. The regions of Rondônia are: Porto Velho, Ariquemes, Ji-Paraná, Cacoal and Ouro Preto do Oeste Experimental Station (ESEOP). In addition to these there is also a region served in Mato Grosso. This spatial distribution helps to configure the institutional matrix of competence of CEPLAC's Superintendence in Rondônia.

With this spatial distribution of CEPLAC's performance, it is evident that the cocoa development policy in the state of Rondônia is located on the East Rondoniense axis, along the federal highway BR 364. In this configuration, the institutional presence of the agency was not observed in relation to the Madeira-Guaporé Mesoregion, which represents the most preserved region of the state of Rondônia.

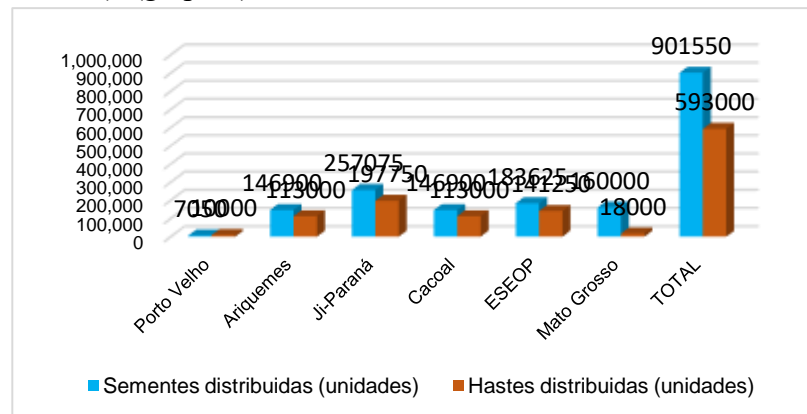
In 2018, 44 municipalities were served by cocoa policy, through CEPLAC's Superintendence in Rondônia, from the 5 regional offices. The Porto Velho regional serves 4 municipalities, the Ariquemes regional serves 9 municipalities, the Ji-Paraná regional, 13 municipalities, the Cacoal regional, 15 municipalities, the Ouro Preto do Oeste Experimental Station, 1 municipality and the State of Mato Grosso, 2 municipalities. (graph 4).



Graph 4 - Number of municipalities served by CEPLAC / RO regional offices, in 2018.

Source: CEPEX / CEPLAC / SUROM, June 2018.

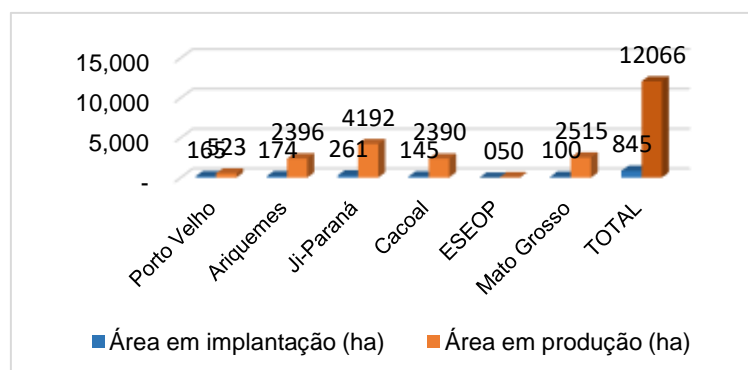
In 2018, approximately 901.5 thousand seeds and 593 thousand stems were distributed, with the Ji-Paraná region receiving the most seeds and stems (approximately 257 thousand seeds and 197.5 thousand stems), followed by the Ouro experimental station Preto do Oeste (183.6 thousand seeds and 141.3 thousand stems), Mato Grosso (160 thousand seeds and 10 thousand stems), Cacoal (146.9 thousand seeds and 113 thousand stems), Ariquemes (146.9 thousand seeds and 113 thousand stems) and Porto Velho (7 thousand seeds and 10 thousand stems). (graph 5).



Graph 5 - Cocoa seeds and stems distributed, total and by regional CEPLAC, in 2018.

Source: CEPEX / CEPLAC / SUROM, June 2018.

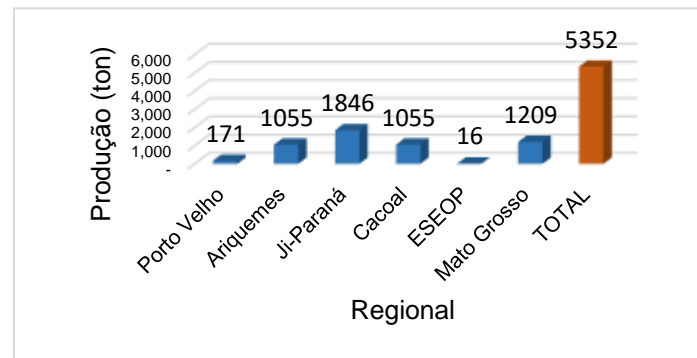
Under the jurisdiction of SUERO / CEPLAC there are just over 12 thousand hectares of consolidated areas of cocoa in production, the largest records being for the region of Ji-Paraná (4.2 thousand ha), Mato Grosso (2.5 thousand ha), Ariquemes (2,400 ha), Cacoal (2,400 ha), Porto Velho (523 ha) and the Ouro Preto do Oeste experimental station (50 ha). (graph 6).



Graph 6 - Area under implantation and production of cocoa (hectares), total and by regional of CEPLAC, in 2018.

Source: CEPEX / CEPLAC / SUROM, June 2018.

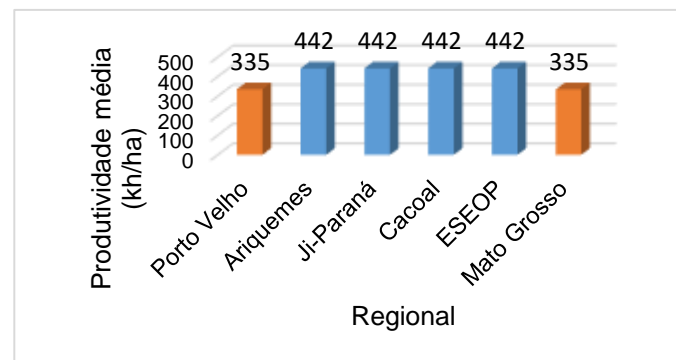
In 2018, approximately 5.4 thousand tons of cocoa beans were produced in the SUERO / CEPLAC area of influence. The largest productions were in the region of Ji-Paraná (1.8 thousand tons), Mato Grosso (1.2 thousand tons), Cacoal and Ariquemes (1.1 thousand tons each), Porto Velho (171 tons) and station Ouro Preto do Oeste (16 tonnes). (graph 7).



Graph 7 - Cocoa production (tons), total and by regional CEPLAC, in 2018.

Source: CEPEX / CEPLAC / SUROM, June 2018

From the point of view of average yield, a pattern was found in the regions of influence of SUERO / CEPLAC, where the regions of Ariquemes, Ji-Paraná, Cacoal and ESEOP had an average yield of 442 kg / ha and the regions of Mato Grosso and Porto Velho yield was slightly lower, at 335 kg / ha. (graph 8).

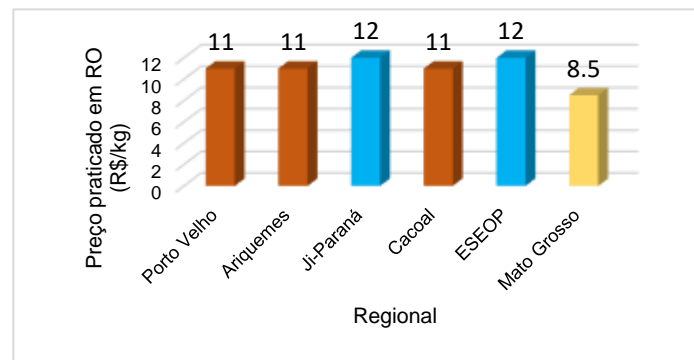


Graph 8 - Average cocoa productivity (kg / ha), by CEPLAC regional, in 2018.

Source: CEPEX / CEPLAC / SUROM, June 2018.

With regard to the price charged by the market for the purchase of cocoa beans, there was little variation in Rondônia, where the price in reais per kilo reached R\$ 12.00 in the region of the Ouro Preto do Oeste experimental station and Ji-Paraná and R\$ 11.00 in other regions of the State.

In Mato Grosso, a significantly lower value of R\$ 8.50 was observed. The fact that the main buyers are located near the Ouro Preto do Oeste and Ji-Paraná regions may be influencing this price dynamics, which partly justifies the lower value purchased in Mato Grosso, where transportation ends up exercising a greater influence over price. (graph 9).



Graph 9 - Price charged in Rondônia (R\$ / kg), by CEPLAC regional, in 2018.

Source: CEPEX / CEPLAC / SUROM, June 2018.

Currently there are 4.010 families in Rondônia and 22 entrepreneurs registered in the cocoa industry. The region of Ouro Preto do Oeste, where CEPLAC's main and only experimental station is located in the State, has 649 registered families. (table 2).

Table 2: Main cocoa producers in the state of Rondônia.

Main producers			
Register	Families	Businessmen	TOTAL
4.010	4.010	22	4.032

Source: CEPEX / CEPLAC / SUROM, June 2018.

The main consumers of cocoa, that is, the buyers of this raw material are located in Ouro Preto do Oeste (80%) and in Jaru (20%), which places the two regions in a strategic position in relation to the activity market. cacao in Rondônia. (table 3). Regarding the suppliers of inputs for the activity, it was found that 75% of them are located in the municipality of Ouro Preto do Oeste and 25% in Mirante da Serra. (table 4).

Table 3: Main cocoa consumers in Rondônia.

Main consumers	
Company nome	Source
Barry CallebautLtda	Ouro Preto – Rondônia
Cerealista Vale do Cacau Ltda	Ouro Preto – Rondônia
Casa do Cacau Ltda	Jaru – Rondônia
Cargill Agrícola S.A.	Ouro Preto – Rondônia
C.F. Rondônia Ltda - ME	Ouro Preto – Rondônia

Source: CEPEX / CEPLAC / SUROM, June 2018.

Table 4: Main suppliers of inputs for cocoa activity in Rondônia.

Main Suppliers of Inputs	
Company nome	Source
Casa da Lavoura e Máquina e Imp. Agr. Ltda	Ouro Preto/RO
Fernandes & Costa Pr. Agr. Ltda	Ouro Preto/RO
Nunes & Galdencio Ltda – ME	Ouro Preto/RO
Barrela Agr. S. e Prod. V. Ltda – ME	Mirante da Serra/RO

Source: CEPEX / CEPLAC / SUROM, June 2018.

From the market point of view and within the scope of the cereal market, it was observed that 100% of the raw material (cocoa beans) are traded in the region of Rondônia. (table 5).

Table 5: Coverage of the cereal market in Rondônia.

Market coverage (%) – scope of cerealists				
Region	State	National	International	TOTAL
100	0	0	0	100

Source: CEPEX / CEPLAC / SUROM, June 2018..

From the perspective of the processed products market, 5% is destined for the Rondônia market and 95% for other Brazilian states. In Rondônia, cocoa products are sold to small industries and chocolate shops. (table 6).

Table 6: Coverage of the processed market in Rondônia.

Market coverage (%) – scope of processors				
Region	Stado*	National	International	TOTAL
0	5	95	0	100

(*)Small industries and chocolate shops.

Considering CEPLAC's policy, triggered in Rondônia at the beginning of the colonization process in the State and its strategy of consolidating cocoa culture in the territory of Rondônia, it ended up being directed to the most impacted regions resulting from agricultural activities. In view of this scenario and considering that today cocoa culture can serve as an action to correct environmental liabilities, that is, the cocoa culture can be used in actions to recover degraded areas, which in addition to fulfilling its environmental role in recovering soil quality, it can represent economic gains for the producer, it only reinforces the self-reinforcing vision of perpetuating its regional development policy in the East Rondoniense region of the State.

Therefore, even if some still use the argument that the decision of the agency to settle in the East Rondoniense mesoregion arose from the poverty of the soils of the Madeira-Guaporé mesoregional portion, now it no longer seems to make sense, considering that the aforementioned cacao culture can be used for the recovery of degraded areas, therefore, indicated for areas with characteristics of weak soils and of low quality. As a result, it is evident that soil poverty is not the reason for CEPLAC's territorial distribution in Rondônia, but rather to see it historically as a culture linked to the correction of environmental liabilities resulting from agribusiness. In the face of this scenario, the cocoa policy followed in the footsteps of the agricultural sector, which pulled the policy in its direction.

Thus, the cocoa culture, institutionally established in the early 1970s, seems to have impacted CEPLAC / RO's planning and actions in focusing its efforts on the most economically dynamic region of Rondônia, since it is exactly in these regions that the major problems of soil degradation were more worrying. Therefore, the fact already demonstrated by Cavalcante [14], in which the Madeira Guaporé mesoregion is based on the main environmental policy of the State, where, like the municipality of Guajará-Mirim, represents 92.06% of its territory [21], helps to further understand this scenario of institutional vacuum in these more environmentally preserved regions.

Everything indicates that CEPLAC / RO's vision of action is more linked to the context of recovering degraded areas than as a regional development policy. But this can be better discussed when analyzing the cocoa production index - CPI, built by this research and which can bring new perspectives of analysis in this regard, when analyzing the Rondônia scenario, in particular.

This aspect explains the fact that in these nearly 50 years of CEPLAC's existence in Rondônia, it is still possible to verify its institutional presence, exclusively in the East Rondoniense mesoregion in the state of Rondônia. The municipality of Nova Mamoré, distant approximately 40 km from Guajará-Mirim, today accounts for the second largest cattle herd in the state, which, by logic, now becomes a priority area for CEPLAC actions, as the municipality in question has demonstrated the main prerequisite for this, the increase in degraded areas. Nova Mamoré is located in the Madeira-Guaporé mesoregion (outside the axis of the BR 364 highway). This CEPLAC vision of action only reinforces the self-reinforcing characteristics based on Douglass North's institutional theory.

Even in this direction, efforts to expand CEPLAC to the Madeira-Guaporé mesoregion are still inefficient, but this may be linked to other factors. In part, conditioned by the very culture established in the body that seems to plaster such an initiative, maintaining its action structure along the BR 364 highway in East Rondoniense. On the other hand, it is worth mentioning other external factors such as the federal government's contingency policy, where many agencies have been suffering budgetary and financial cuts, which hampers any initiative to expand and invest in new infrastructure.

The cocoa production index - CPI, built and designed for the Brazilian municipal level, which covered all cocoa producing municipalities, in relation to 2016, helps to understand this scenario a little more.

3.3 Cocoa Production Index - CPI

The results of the IPC at the national level will be presented below.

CPI for the state of Amazonas. In the state of Amazonas of the 20 cocoa producing municipalities, only the municipalities of Humaitá (CPI 0.187), Codajás (CPI 0.172) and Pauini (CPI 0.160) stand out with the best results of the CPI. These indexes for the classification of the level of the scale adopted are considered (CPI Very Bad). The other 17 municipalities also have poor CPI. There were no major differences in performance between the municipalities, which tends to notice a certain pattern considered to be low in performance. (table 7). The municipalities of Humaitá and Codajás stood out in the average production yield indicator (kilograms per hectare), with yields of 1000 and 900 kg / ha, respectively.

Table 7: CPI of municipalities in the state of Amazonas.

Municipalities	CPI	Municipalities	CPI
Alvarães	0.139	Itacoatiara	0.129
Apuí	0.140	Itapiranga	0.101
Autazes	0.101	Jutaí	0.104
Barcelos	0.115	Manicoré	0.127
Boca do Acre	0.110	Nova Olinda do Norte	0.086
Borba	0.136	Novo Aripuanã	0.147
Coari	0.146	Pauini	0.160
Codajás	0.172	Silves	0.115
Fonte Boa	0.114	Tefé	0.141
Humaitá	0.187	Urucará	0.147

Source: Own elaboration.

CPI for the 111 municipalities in the state of Bahia. The municipalities of Ilhéus (CPI 0.432) considered as a Regular performance index, Ibirapitanga (CPI 0.246), Wenceslau Guimarães (CPI 0.211) and Una (CPI 0.209), indexes considered Bad are the municipalities that stand out in the state of Bahia. 108 cocoa producing municipalities in the state of Bahia have a very poor CPI. (table 8).

Table 8: CPI of municipalities in the state of Bahia.

Municipalities	CPI	Municipalities	CPI	Municipalities	CPI
Aiquara	0.115	Ibirapitanga	0.246	Mucuri	0.089
Alcobaça	0.062	Ibirataia	0.179	Muniz Ferreira	0.104
Almadina	0.101	Igrapiúna	0.121	Mutuípe	0.164
Amargosa	0.105	Iguaí	0.119	Nazaré	0.072
Amélia Rodrigues	0.067	Ilhéus	0.432	Nilo Peçanha	0.148
Apuarema	0.103	Ipiaú	0.135	Nova Canaã	0.087

Arataca	0.187	Itabela	0.108	Nova Ibiá	0.171
Aratuípe	0.072	Itabuna	0.145	Nova Redenção	0.104
Aurelino Leal	0.129	Itacaré	0.196	Nova Viçosa	0.054
Barra do Rocha	0.124	Itagi	0.133	Pau Brasil	0.112
Barreiras	0.097	Itagibá	0.182	Piraí do Norte	0.151
Barro Preto	0.118	Itagimirim	0.059	Porto Seguro	0.072
Belmonte	0.150	Itaju do Colônia	0.067	Potiraguá	0.072
Boa Nova	0.088	Itajuípe	0.167	Prado	0.121
Bom Jesus da Lapa	0.096	Itamaraju	0.207	Presidente Tancredo Neves	0.119
Buerarema	0.116	Itamari	0.163	Santa Cruz Cabralia	0.096
Caatiba	0.080	Itambé	0.097	Santa Cruz da Vitória	0.077
Cachoeira	0.066	Itanhém	0.087	Santa Luzia	0.157
Cairu	0.115	Itapé	0.072	Santo Amaro	0.075
Camacan	0.149	Itapebi	0.083	Santo Antônio de Jesus	0.130
Camamu	0.175	Itapetinga	0.073	São Francisco do Conde	0.086
Canavieiras	0.116	Itapitanga	0.103	São José da Vitória	0.086
Candeias	0.061	Itororó	0.109	São Miguel das Matas	0.132
Caravelas	0.082	Ituberá	0.135	Simões Filho	0.115
Coaraci	0.129	Jaguaquara	0.114	Taperoá	0.114
Cravolândia	0.107	Jaguaripe	0.094	Teixeira de Freitas	0.092
Dário Meira	0.133	Jequié	0.142	Teolândia	0.124
Dom Macedo Costa	0.072	Jiquiriçá	0.161	Terra Nova	0.115
Elísio Medrado	0.131	Jitaúna	0.115	Ubaíra	0.142
Eunápolis	0.099	Jucuruçu	0.100	Ubaitaba	0.117
Firmino Alves	0.079	Jussari	0.092	Ubatã	0.115
Floresta Azul	0.095	Laje	0.153	Una	0.209
Gandu	0.184	Macarani	0.087	Uruçuca	0.189
Gongogi	0.099	Maraú	0.174	Valença	0.144
Guaratinga	0.115	Mascote	0.128	Varzedo	0.112
Ibicaraí	0.097	Mata de São João	0.083	Vereda	0.087
Ibicuí	0.123	Medeiros Neto	0.115	Wenceslau Guimarães	0.211

Source: Own elaboration.

CPI for the 39 municipalities in the State of Espírito Santo. Of 39 cocoa-producing municipalities, only the municipalities of Aracruz (CPI 0.204), Linhares (CPI 0.246), São Domingos do Norte (CPI 0.268) stand

out as poor performance indexes. 36 cocoa producing municipalities in the state of Espírito Santo are in accordance with the classification scale with very poor CPI. (table 9).

Table 9: CPI of the municipalities of the state of Espírito Santo.

Municipalities	CPI	Municipalities	CPI
Afonso Cláudio	0.115	João Neiva	0.081
Águia Branca	0.164	Laranja da Terra	0.104
Alfredo Chaves	0.129	Linhares	0.246
Anchieta	0.129	Marilândia	0.142
Aracruz	0.204	Nova Venécia	0.078
Baixo Guandu	0.094	Pancas	0.181
Barra de São Francisco	0.139	Pinheiros	0.079
Boa Esperança	0.079	Rio Bananal	0.087
Cachoeiro de Itapemirim	0.100	Rio Novo do Sul	0.129
Colatina	0.135	Santa Leopoldina	0.127
Conceição da Barra	0.075	Santa Maria de Jetibá	0.139
Ecoporanga	0.186	Santa Teresa	0.059
Fundão	0.172	São Domingos do Norte	0.268
Governador Lindenberg	0.073	São Gabriel da Palha	0.062
Guarapari	0.064	São Mateus	0.068
Ibiraçu	0.092	São Roque do Canaã	0.086
Iconha	0.132	Serra	0.115
Itaguaçu	0.129	Sooretama	0.101
Itarana	0.084	Vila Valério	0.083
Jaguaré	0.081		

Source: Own elaboration.

The best CPIs in the state of Mato Grosso, represented by the municipalities of Novo Mundo (0.215) and Alta Floresta (0.209) have CPIs considered Bad and the other 9 cocoa producing municipalities have CPIs considered to be Poor. (table 10).

The municipalities of Alta Floresta and Novo Mundo stood out in relation to the average production yield (kilograms per hectare), with yields of 1,200 and 1,120 kg / ha, respectively.

Table 10: CPI of municipalities in the state of Mato Grosso.

Municipalities	CPI	Municipalities	CPI
Alta Floresta	0.209	Novo Mundo	0.215
Aripuanã	0.101	Porto Estrela	0.115

Brasnorte	0.186	Rondolândia	0.104
Carlinda	0.100	Terra Nova do Norte	0.129
Colniza	0.111	Nova Monte Verde	0.158
Cotriguaçu	0.116		

Source: Own elaboration.

The state of Minas Gerais, despite not having a CEPLAC Superintendence, is one of the Brazilian cocoa producing states. The CPIs of the municipalities of Minas Gerais are considered to be Poor due to the scale provided in the research. (table 11). The municipalities of Bandeira and Jordânia stood out in relation to the average production yield (kilograms per hectare), with yields of 833 and 840 kg / ha, respectively.

Table 11: CPI of the municipalities in the state of Minas Gerais.

Municipalities	CPI
Almenara	0.152
Bandeira	0.163
Jordânia	0.164
Mantena	0.130
Palmópolis	0.145

Source: Own elaboration.

The municipality of Medicilândia in the state of Pará is the largest cocoa producer in Brazil, being the only one with CPI considered Excellent (CPI 1,000). The municipalities of Uruará (CPI 0.361), Placa (CPI 0.335), Tucumã (CPI 0.266), São Félix do Xingu (CPI 0.258), Novo Repartimento (CPI 0.239), São Geraldo do Araguaia (CPI 0.237), Brasil Novo (CPI 0.233), Altamira (CPI 0.229), Cumaru do Norte (CPI 0.216) and Vitória do Xingu (CPI 0.215) are municipalities considered to have a poor performance index. The municipalities of Medicilândia and Uruará stood out for their area for harvesting, harvested area and quantity produced.

Of the total of 56 cocoa producing municipalities in the state of Pará, 45 municipalities have CPI on the analysis scale, considered a poor performance index. (table 12).

Table 12: CPI of municipalities in the state of Pará.

Municipalities	CPI	Municipalities	CPI	Municipalities	CPI
Abaetetuba	0.088	Igarapé-Miri	0.097	Placas	0.335
Acará	0.151	Inhangapi	0.188	Porto de Moz	0.163
Água Azul do Norte	0.187	Irituia	0.115	Prainha	0.151
Alenquer	0.121	Itaituba	0.122	Rurópolis	0.171
Almeirim	0.156	Itupiranga	0.159	Santarém	0.117

Altamira	0.229	Jacareacanga	0.115	São Domingos do Araguaia	0.173
Anapu	0.196	Limoeiro do Ajuru	0.109	São Domingos do Capim	0.118
Aveiro	0.118	Medicilândia	1.000	São Félix do Xingu	0.258
Baião	0.103	Mocajuba	0.124	São Geraldo do Araguaia	0.237
Bannach	0.169	Moju	0.108	Senador José Porfírio	0.129
Barcarena	0.104	Monte Alegre	0.150	Tailândia	0.110
Brasil Novo	0.233	Muaná	0.100	Tomé-Açu	0.220
Breu Branco	0.137	Nova Ipixuna	0.115	Trairão	0.135
Cametá	0.190	Novo Progresso	0.187	Tucumã	0.266
Castanhal	0.160	Novo Repartimento	0.239	Tucuruí	0.184
Concórdia do Pará	0.143	Oeiras do Pará	0.130	Uruará	0.361
Cumarú do Norte	0.216	Ourilândia do Norte	0.180	Vitória do Xingu	0.215
Eldorado do Carajás	0.175	Pacajá	0.163	Xinguara	0.121
Gurupá	0.174	Parauapebas	0.159		

Source: Own elaboration.

In the state of Rondônia, the CPI of the 44 municipalities has indexes considered to be very poor. The municipalities of Seringueiras (CPI 0.158) and Nova Mamoré (CPI 0.199) stood out in relation to the average production yield (kilograms per hectare), with yields of 800 and 1083 kg / ha, respectively. (table 13).

Table 13: CPI of the municipalities of the state of Rondônia.

Municipalities	CPI	Municipalities	CPI
Alta Floresta D'Oeste	0.118	Alto Alegre dos Parecis	0.092
Ariquemes	0.152	Alto Paraíso	0.072
Cabixi	0.094	Buritis	0.125
Cacoal	0.089	Novo Horizonte do Oeste	0.095
Cerejeiras	0.100	Cacaulândia	0.086
Colorado do Oeste	0.085	Campo Novo de Rondônia	0.087
Corumbiara	0.088	Castanheiras	0.082
Espigão D'Oeste	0.115	Cujubim	0.086
Jaru	0.116	Governador Jorge Teixeira	0.103
Ji-Paraná	0.106	Ministro Andreazza	0.087
Machadinho D'Oeste	0.090	Mirante da Serra	0.122
Nova Brasilândia D'Oeste	0.084	Monte Negro	0.080
Ouro Preto do Oeste	0.125	Nova União	0.125

Pimenta Bueno	0.115	Parecis	0.115
Porto Velho	0.113	Primavera de Rondônia	0.100
Presidente Médici	0.127	São Felipe D'Oeste	0.114
Rio Crespo	0.082	Seringueiras	0.158
Rolim de Moura	0.085	Teixeirópolis	0.113
Santa Luzia D'Oeste	0.115	Theobroma	0.127
Vilhena	0.100	Urupá	0.138
São Miguel do Guaporé	0.125	Vale do Anari	0.123
Nova Mamoré	0.199	Vale do Paraíso	0.117

Source: Own elaboration.

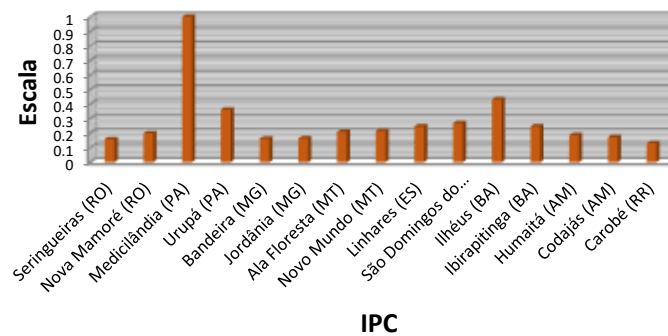
In the state of Roraima, only the municipality of Caroebe has cocoa production. In Caroebe, the CPI index of 0.131 was observed, considered very poor. (table 14).

Table 14: CPI of the municipality of the state of Roraima.

Municipalities	CPI
Caroebe	0.131

Source: Own elaboration.

In summary, Graph 10 represents the best municipal CPI performances by State and region of Brazil served by CEPLAC actions and which registered cocoa production in 2016. This result does not only take into account the volume of production or size of area produced, in isolation, as initially shown in this work. Here, it is a look at the sector's performance considering the studied variables, which after factor analysis, using multiple regression methods, allowed the construction of the cocoa production index in Brazil (CPI). Based on this result, it was possible to verify that certain municipalities with little expression in cocoa production performed better than those from more traditional regions based on cocoa activity. This is because the factor analysis used allowed to capture statistical variations considered important and that give weight to these variations. This explains, for example, the case of the municipality of Nova Mamoré showing the best performance in Rondônia, even though its productive area was low in relation to other municipalities in the state. The point is that the productive yield was decisive, in our view, for this fact, since it is practically double that observed for the other cocoa producing regions. It is worth mentioning that the data used in the factor analysis for the production of the CPI were all researched by the IBGE, and that, therefore, they were constructed according to official data from Brazil.



Graph 10 - Municipalities with the highest CPIs by cocoa producing states.

Source: Own elaboration.

The representation of the municipalities with the highest CPIs by cocoa producing states in Brazil (graph 10) helps to understand that the most dynamic municipalities in Brazil are Medicilândia, state of Pará and Ilhéus, in Bahia. Thus, in view of the Brazilian scenario, in general, and in the Rondônia scenario, in particular, with the exception of Medicilândia basically, there are no development poles for the cocoa crop in Brazil, since the performance presented by the IPC is, in general, very low. This helps to highlight, once again, the scenario of stagnation in which the sector lives, despite a promising horizon. The Brazilian performance index (CPI) shows a deficit. It is noticed that there is a low level in terms of performance of cocoa production in the country.

Brazil with continental dimensions in the state of Bahia historically producing cocoa has 111 producing municipalities, Pará with 56 municipalities, Rondônia with 44 municipalities, Espírito Santo with 39 municipalities, Amazonas with 20 municipalities, Mato Grosso with 11 municipalities and Roraima with only 1 municipality .

Thus, with regard to the state of Rondônia, which follows a national logic, it allows us to realize that there is room for growth in the face of an increasingly demanding market for cocoa raw materials, especially for the chocolate industry. However, based on what has been discussed in relation to the state of Rondônia in this work, it is more evident that, at the level of that state, there is still no development pole for cacao cultivation, since the results indicate a certain standardization at a low level of performance . Thus, the vision, discussed here, of looking at the sector as a means of recovering degraded areas makes it difficult to act in favor of the economic dynamics of cocoa.

Given this scenario, cocoa production in Rondônia is no longer a "protagonist" of regional development for a "supporting" stance in this process. This view allows us to see the cocoa policy going after the negative effects of agribusiness in the state of Rondônia. This view helps to explain the concentration of efforts in the East Rondoniense mesoregion, leaving an institutional vacuum of cocoa policy in the Madeira-Guaporé mesoregional portion, which if it were not for the logic of the policy for the recovery of degraded areas, there would probably be a presence most effective in this region. This analysis is corroborated by

Cavalcante, Góes [21,22], Cavalcante et al [23]. In this direction are the interpretations of [25], [26]. The basis of the research analysis is supported by North [27, 28, 29, 30].

Aiming at correcting this process, a project was launched, in partnership with CEPLAC, for the Technological Showcase of cocoa at the Guajará-Mirim University Campus of the Federal University of Rondônia - UNIR. This initiative aims to strengthen cocoa policy at the local level, outside the axis of the federal highway BR 364. However, many obstacles need to be overcome, despite the good interinstitutional relationship between the Academic Department of Social and Environmental Sciences, the Study Group and Research in Social and Environmental Sciences and Public Policies - GEPCAP and CEPLAC / RO.

V. CONCLUSIONS

Despite the importance of cocoa production, there are still no regional development centers for cocoa cultivation in Rondônia. All cocoa producing municipalities had low levels of IPC performance.

The fact that the organ in question is located exclusively in the eastern Rondoniense portion of the state only reinforces the analysis in this direction, which helps to understand the path dependence character of the cocoa policy in Rondônia.

The view that the cocoa culture can and should be stimulated as an action for the recovery of degraded areas, throughout the history of CEPLAC / RO, has impacted the organ's strategic vision aimed at correcting the negative impacts caused by the advance of the agribusiness in the State. And that view ended up "covering up" another view based on "protagonism" as an agent of social change and regional development.

The inversion of this logic seems basic, but it is believed that it will have a logical weight of completely different objectives and goals, since the look starts to contemplate the economic aspect, without forgetting its environmental function. However, not as a corrective action, as it is today at CEPLAC / RO, but as a proposal for a development model that can improve the quality of life of the population and with capillarity for the generation of jobs and income, besides, of course, its environmental importance. What is perceived here is a mistake to consider this activity only as a recuperator of degraded area and to leave the economic issue to the background. It is exactly the reverse that we are pointing out.

Without reversing this logic, the path dependence effects will continue to dictate the rules of the game and the organizational culture will continue to focus on cocoa policy as an activity for the purpose of correcting environmental liabilities. In this regard, areas consolidated with agriculture and livestock, which suffer the consequences of years of inadequate use of natural resources, will continue to be seen as priority areas by the agency. However, the view suggested here, on the other hand, may result in different regions of the State benefiting from the cocoa policy, since the focus is no longer on recovering a degraded area, but simply believing in cocoa activity as a driver of the regional development, through the consolidation of a solid and viable economic matrix.

The logical inversion of these visions would, for example, allow the municipality of Guajará-Mirim to come under this policy, since currently, due to the fact that it has more than 92% of its territorial area in the form of nature conservation units and indigenous lands, makes it a non-priority region in terms of cocoa policy in the State.

The municipality of Nova Mamoré, approximately 40 km from Guajará-Mirim, which in recent years has stood out in livestock production, occupying the post of second cattle herd in Rondônia, which when experiencing the loss of quality of its soils due to the aforementioned livestock activity, is included in the ranking of priority municipalities for cocoa policy. Only now?

Well, it is hoped, with this, to have contributed to the discussion on cocoa policy in Rondônia and the strategic vision that CEPLAC / RO has been demonstrating throughout its institutionalization in the State. However, it is not intended to abandon the agency's policy for purposes of environmental liabilities, it is believed that this is even one more opportunity in terms of strengthening the sector. But this should not be the main focus of cocoa policy. It is much more than that. Cocoa culture needs to be seen as a regional development strategy, with quality and performance indexes monitored based on the vision of the local productive arrangement. Without this perspective, unfortunately, this activity in the State will continue as a "trailer" for the agricultural sector.

Therefore, what is expected is that CEPLAC / RO occupies the "leading role" of regional development in Rondônia and conducts a policy for all regions that see cacao as a source of opportunity and life change.

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Influence of Headteachers' Motivation Practices on Girls' Access to Public Primary Education in Garissa Sub-county, Garissa County, Kenya

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Abstract

Introduction of Free Primary Education has increased demand for primary education. However, the number of girls' accessing primary education is still below expectations with the ratio of boys to girls being 5:2 in Garissa Sub-County. The purpose of this study was to assess the influence of headteachers' motivation practices on girls' access to primary education in Garissa Sub-County, Garissa County, Kenya. The study was guided by the Management Practices and Pearson's Gender Relations Theories. The study adopted mixed methodology and descriptive research design. Qualitative data were analyzed thematically along the objectives and presented in narrative forms. Quantitative data were analyzed using descriptive statistics such as frequencies, percentages, mean and standard deviation and inferentially using Pearson's Product Moment Correlation with the help of Statistical Package for Social Sciences (SPSS Version 23) and presented using tables. The study established that headteachers' motivation practices influence girls' access to public primary education. Thus, the study recommends that headteachers need to change their approaches of motivating girls to enroll in schools. School supervision by the headteacher and the Directorate of Quality Assurance and Standards should be enhanced for monitoring to give proper guidance to the headteachers on the need to implement child rights education in their schools.

Keywords: Headteachers' motivation practices, girls' access to public primary education

Introduction

Motivation and interest arouse a girl's curiosity to learn, respond and attend to subject matter. According to Brista (2015), girl's ability to learn is affected by both extrinsic motivation, that is, their involvement with a subject or activity in order to receive reward or avoid punishment and intrinsic motivation, that is, involvement because it is personally satisfying and unrelated to the external reward or punishment they might receive. This points to the fact that management practices most schools adopt play critical roles in enhancing girl's access to primary education. To lend credence to these assertions, Unterhalter and Dutt (2011), in a study conducted in India, posit that the vast amount of research, which has been done on the relationship between these two types of motivation and learning, indicates that intrinsic motivation is of particular significance to sustained girl learning. Unterhalter and Dutt (2011) further posit that intrinsic motivation is enhanced when headteachers' management practices promote a girl's sense of personal

autonomy, when they feel supported and safe, when their school work is challenging but also relevant to their lives and when it builds on their experiences.

Unterhalter and Dutt (2011) believe that a girl's experience in the classroom such as interactions with the curriculum, teachers and peers, has a strong effect on her involvement and learning in a subject. Consistent with these assertions, Stacki and Pigozzi (2015), in a study carried out in 17 Grade III schools in South Asia, noted that, in some schools, the interest, motivation and achievement of boys is enhanced as a practice, while females experience discouragement due to factors related to curriculum, instruction and assessment. Stacki and Pigozzi (2015) cite a commonly noted bias as the portrayal of men as "active" in the generation and application of knowledge, while females are portrayed as "passive" and occupying subordinate positions. Examples of local scientific practice and indigenous knowledge production in which females are directly involved are even more likely to be absent. Girls' dissatisfaction with the way in which teaching is presented in the classroom has a negative impact on their interest in the subject.

In most countries in Sub-Saharan Africa, studies have shown such connections are of interest to both boys and girls, with girls particularly drawn to topics that involve helping others (Stacki & Pigozzi, 2015). Yet despite efforts in some countries to address these biases, they persist.

This lack of motivation has made girls to shy away from schools which has, in turn, impacted on their enrolment in schools.

In a study conducted in Nigeria, Igbuzor (2011) revealed in schools where management offers different forms of motivation to girls, their number tends to increase as more get enrolled. However, Igbuzor (2011) underscore the fact that, in many schools, teachers tend to give boys more education feedback than girls, call on boys more often, give them longer time to answer, and more frequently ask them higher order questions than they do girls. Praise, encouragement and feedback are more often directed to boys (Igbuzor, 2011). In Kenya and Garissa Sub-County in particular, motivation strategies teachers adopt play an influential role in schools and act as a primary source of gendered messages received by girls (Sifuna, 2016). The majority of time at school is spent with teachers, who are responsible for curricular and organization decisions and hold a position of authority relative to their girls. Teaching has also traditionally been done in a more competitive and teacher centered manner, which has tended to dampen girls' interest in going to schools.

A study conducted in Garissa Sub-County by UNICEF (2014) echoes similar views. The study reveals that girls are given less time than boys for a task in science classrooms and boys are generally given more opportunities to ask and answer questions, to use equipment and learning materials, and to lead groups. That is, interactions with girls tend toward social, non-academic topics, and girls are less frequently called on to help with demonstrations or experiments. However, UNICEF (2014) and other empirical studies have fallen short of specifying each form of motivation practices and approaches adopted enhance girls' access to public primary schools. UNICEF (2014) has not indicated how different motivation practices adopted by primary school headteachers enable girls to be actively engaged in going to school and undertake academic activities, boost their self-confidence given that very little is done to enhance their motivation to enroll and pursue education; thus, the study.

Statement of the problem

Girls' access to primary education has been low. Statistics has shown that girls' access to primary education in Garissa Sub-County is lower than that of boys with ratio of boys to girls being 5:2 in public primary schools (UNICEF, 2014). Ministry of Education (2015) on the other hand found out that although Free Primary Education (FPE) introduced in 2003 arguably raised the gender enrolment rate to from 68.2% in 2002 to 88.2% (63.0% for boys and 37% for girls), the regional disparities are evident in enrolment and performance in KCPE. Coupled with effective headteachers' management practices, such initiatives should enhance girls' access to primary education. However, MoE (2015) noted that, despite the effort being put by various stakeholders, the realization of girls' access to public primary education has been impeded by a number of factors. Despite these observations, few empirical studies have interrogated the extent to which headteachers' motivation practices influence girls' access to primary education, hence the need for this study.

Theoretical Framework

The study was guided by Management Practices Theory which as postulated by Kuo (2009). This theory addresses how managers and supervisors relate to their organizations in the knowledge of its goals, the implementation of effective means to get the goals accomplished and how to motivate employees to perform to the highest standard. The rationale of using management practices theory in this study is that to enhance girls' access to primary education, school managers ought to appreciate the important role they play in their respective organizations if they are to achieve improved enrolment of girls. The school managers need to adopt practices geared towards increasing enrolment of girls into such schools and to promote excellence among all learners in such schools. This study was also based on Pearson's gender relations theory which was postulated by Pearson (1995). One of the premises of this theory is that society views all activities that are carried out to be based on social roles and interactions of men and women. In the same token, the relevance of Pearson's gender relations theory in this study is that it underscores the fact that school practices and norms, just like in any other society, affect girl's enrolment and participation in school activities.

Delimitations of the Study

This study was conducted in public primary schools in Garissa Sub-County only. The study focused on the influence of headteachers' motivation practices on girls' access to primary education. The study adopted mixed methodology and thus, applied descriptive research design. Questionnaires were applied to gather quantitative data from teachers whereas interview guide was applied to collect qualitative data from headteachers.

Research Methodology

The study adopted mixed methodology and descriptive research design. The target population comprised of 28 headteachers and 302 teachers all totaling to 330 respondents from which 180 respondents were determined using Yamane's Formula. Stratified sampling was used to create three strata based on the number of zones in Garissa Sub-County. From each zone, four headteachers and 56 teachers were selected using simple random sampling to avoid bias. The procedures adopted enabled the researcher to sample 12 headteachers and 168 teachers. Qualitative data were analyzed thematically along the objectives and presented in narrative forms.

Quantitative data were analyzed using descriptive statistics such as frequencies, percentages, mean and standard deviation and inferentially using Pearson's Product Moment Correlation with the help of Statistical Package for Social Sciences (SPSS Version 23) and presented using tables.

Results and Discussions

The study sought to:

- i. Assess the influence of headteachers' motivation practices on girls' access to public primary education in Garissa Sub-county, Garissa County, Kenya.

Response Rate

In this study, 168 questionnaires were administered to teachers out of which 160 questionnaires were filled and returned. At the same time, the researcher also interviewed ten headteachers. This yielded response rates shown in Table 1;

Table 1: Response Rates

Respondents	Sampled Respondents	Those Who Participated	Achieved Return Rate (%)
Headteachers	12	10	83.3
Teachers	168	160	95.2
Total	180	170	94.4

Table 1 shows that headteachers and teachers registered a response rate of 94.4%. This confirmed the findings of Creswell (2014) that a response rate above 75.0% is adequate and of suitable levels to allow for generalization of the outcomes to the target population.

Motivation Practices and Girls' Access to Primary Education

This study sought to assess the extent to which headteachers' motivation practices influence girls' access to primary education. The findings are presented in Table 2;

Table 2: Influence of Headteachers' Motivation Practices on Girls' Access to Primary Education

Test Items	Ratings					Mean	Std. Dev.
	SA	A	U	D	SD		
	%	%	%	%	%		
Recognition of their efforts enable headteachers to attract girls to primary schools	75.0	11.5	4.5	7.5	1.5	4.531	0.368
Use of social rewards such as recognition of girls' efforts has enabled headteachers to enrol many of them to primary schools	65.0	10.5	3.0	11.5	10.0	3.927	0.319
In many primary schools, headteachers use praise and rewards to entice girls to enrol into schools	75.0	10.5	2.5	9.0	3.5	4.531	0.368
Use of praise and rewards has enabled headteachers to enrol many girls in primary schools	88.5	2.5	1.5	4.5	3.0	5.347	0.434
Headteachers often acknowledge girls' efforts as a way of attracting them to primary schools	65.5	11.5	4.0	13.0	6.0	3.957	0.321

Table 2 shows that 120(75.0%) of the teachers strongly agreed with the view that recognition of girls' efforts enable headteachers to attract them to primary schools as did 19(11.5%) who agreed. Only a paltry 8(4.5%) were undecided, 12(7.5%) of the teachers disagreed whereas 1(1.5%) strongly disagreed. The study also found out that 104(65.0%) of the teachers strongly agreed with the view that use of social rewards such as recognition of girls' efforts has enabled headteachers to enrol many of them to primary schools. 17(10.5%) agreed. 5(3.0%) were undecided, 19(11.5%) disagreed whereas 16(10.0%) strongly disagreed. These findings corroborate the assertions of Brista (2015) that motivation and interest arouse a girl's curiosity to learn, respond and attend to subject matter. Brista (2015) further indicated that girlchild's ability to learn is affected by both extrinsic motivation, that is, their involvement with a subject or activity in order to receive reward or avoid punishment and intrinsic motivation, that is, involvement because it is personally satisfying and unrelated to the external reward or punishment they might receive. This points to the fact that recognition and motivation practices most schools adopted by schools play critical roles in enhancing girlchild's access in schools and the level at which they drop out.

The study also revealed that three-quarters, 120(75.0%) strongly agreed with the view that, in many primary schools, headteachers use praise and rewards to entice girls to enrol into schools. 17(10.5%) agreed. 4(2.5%) were undecided, 15(9.0%) disagreed whereas 6(3.5%) strongly disagreed. 142(88.5%) of the teachers strongly agreed with the view that use of praise and rewards has enabled headteachers to enrol many girls in primary schools. 4(2.5%) agreed. 1(1.5%) were undecided, 8(4.5%) disagreed whereas

5(3.0%) teachers strongly disagreed. These findings lend credence to the findings of a study conducted in Nigeria in which Igbuzor (2011) asserted that praise, encouragement and feedback are important in enhancing access of both boys and girls into schools. Hence, these findings point to the fact that motivation strategies such as praise and recognition teachers adopt play an influential role in schools and act as a primary source of gendered messages received by girls.

Majority 105(65.5%) of the teachers strongly agreed with the view that headteachers often acknowledge girls' efforts as a way of attracting them to primary schools. 19(11.5%) agreed. 7(4.0%) were undecided, 21(13.0%) disagreed whereas 10(6.0%) strongly disagreed. These findings are consistent with the assertions of Unterhalter and Dutt (2011) who posit that intrinsic motivation is enhanced when school management practices acknowledge and promote a girl's sense of personal autonomy, when they feel supported and safe, when their school work is challenging but also relevant to their lives and when it builds on their experiences. These findings indicate that schools which acknowledge and believe that a girl's experience in the classroom such as interactions with the curriculum, teachers and peers, has a strong effect on her involvement and learning in a subject.

Table 2 shows that the mean ranged between, $\bar{x} = 3.5$ and 5.5, whereas the standard deviation ranged between, $\sigma = 0.3$ and 0.45. This further affirms the fact that it is agreeable that all forms of motivation practices adopted by headteachers cumulatively contribute to girls' access to primary education with little variations (standard deviation < 1). To verify the relationship between headteachers' motivation practices and girls' access to primary education, data were collected on how often headteachers motivate girls and the number of girls in the sampled primary schools. The results are shown in Table 3:

Table 3: Results of How Often Headteachers Motivate Girls and the Number of Girls Enrolled in Public Primary Schools

How Often Headteachers Motivate Girls	Number of Girls Enrolled in Public Primary Schools
1	124
1	134
1	177
2	178
2	234
2	239
3	245
3	267
4	341
4	359

Table 3 shows that different motivation practices adopted by school management enhance girls' access to primary education. In primary schools, where headteachers frequently motivate girls, their number is high compared to those schools where levels of motivation are very low and rarely undertaken. These findings further affirm the fact that recognition and motivation practices most schools adopted by schools play

critical roles in enhancing girlchild's access in schools and the level at which they drop out. These results were subjected to Pearson's Product Moment Correlation Analysis and the results are shown in Table 4:

Table 4: Relationship between Motivation Practices and the Number of Girls Enrolled in Public Primary Schools

		Motivation Practices	Number of Girls Enrolled in Primary Schools
Motivation Practices	Pearson Correlation	1	.952*
	Sig. (2-tailed)		.001
	N	5	10
Number of Girls Enrolled in Public Primary Schools	Pearson Correlation	.952*	1
	Sig. (2-tailed)	.001	
	N	10	10

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4 shows that there is a strong positive correlation between headteachers' motivation practices and the number of girls enrolled in public primary schools ($r(10) = 0.952$, $p = 0.001$ at $\alpha = 0.05$). These results are consistent with the findings of a study conducted by Sifuna (2016) which generated a p-value of $0.027 < 0.05$.

These findings thus attest to the fact that each form of motivation practices and approaches adopted by school management influence access of girls in public primary school and thus enable girls to be actively engaged in going to school and undertake academic activities, boost their self-confidence given that very little is done to enhance their motivation to enroll and pursue education. Headteachers were also interviewed to evaluate how headteachers' motivation practices influence girls' access to primary education. The interviewees also responded in favor of the view that recognizing girls' efforts influence their number enrolled in schools and also determine the number of girls who might drop out after access. These views thus point to the fact that recognition and motivation practices most schools adopted by schools play critical roles in enhancing girls' access to primary education. On further probing, headteacher, H1, noted:

"In my primary school, we have adopted several approaches to motivating girls to come to school. These include materials rewards such as sanitary towels and money for best performing girls"
(Male, BEd).

These views further lend credence to the views expressed in Nigeria by Igbuzor (2011) indicated that praise, encouragement and feedback are important in enhancing access of girls into schools. Given these views, motivation strategies such as praise and recognition teachers adopt play an influential role in schools and act as a primary source of gendered messages received by girls. The headteachers also noted that acknowledging girls' efforts influence their number enrolled in schools and those who are likely to drop out of school. Like in quantitative findings, these views thus, affirm the fact that schools which acknowledge and believe that a girl's experience in the classroom such as interactions with the curriculum,

teachers and peers, has a strong effect on her involvement and learning in a subject. In addition, any form of motivation practices and approaches adopted by school management influence access of girls in public primary school and thus enable girls to be actively engaged in going to school and undertake academic activities, boost their self-confidence given that very little is done to enhance their motivation to enroll and pursue education.

SUMMARY OF FINDINGS AND CONCLUSIONS

From the study findings, it is evident that there are different practices adopted by headteachers which influence girls' access to primary education. These include; motivation, involvement of female teachers, counselling and girls' protection practices. From the study findings, most girls are not very often recognized for good efforts, not praised and rewarded for good work in school nor are they get acknowledged upon good performance. This points to the fact that schools where management offers different forms of motivation to girls, their number tends to increase as more get enrolled. Recognizing girls' efforts, praising and rewarding girls and acknowledging girls' efforts influence their number enrolled in schools influence their enrollment in schools and rates at which they drop out.

RECOMMENDATIONS

The study recommends that headteachers need to change their approaches of motivating girls to enroll in schools. School supervision by the headteacher and the Directorate of Quality Assurance and Standards should be enhanced for monitoring to give proper guidance to the teachers on the need to implement child rights education in their schools.

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Influence of Blended family Structures on Socio-emotional Development of Pre-priamry School Learners in Ganze Sub-county, Kilifi County, Kenya

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Abstract

Families provide a conducive environment which necessitate acquisition of self-esteem, self-confidence and self-efficacy amongst learners in pre-primary schools. However, pre-primary school learners have manifested and continue to manifest instances of low self-esteem, low self-confidence and self-efficacy levels. This study sought to assess the influence of contemporary blended family structures on socio-emotional development of pre-primary school learners. The study was guided by the family systems theory. The study adopted mixed methodology and thus applied concurrent triangulation research design. Qualitative data were analyzed thematically along the objectives and presented in narrative forms. Quantitative data were analyzed descriptively using frequencies and percentages and inferentially using Pearson's Product Moment Correlation Analysis in Statistical Packages for Social Sciences (SPSS 23) and presented using tables. The study established that pre-primary school learners manifest instances of low self-esteem, low self-confidence and low self-efficacy. The study also established that there are different dimensions of blended family structures which influence socio-emotional development, that is, self-esteem, self-confidence and self-efficacy, of pre-primary school learners. Thus, the study recommends that parents who are in blended family structures should adopt mechanism of enhancing the socio-emotional development of their children. Government and other stakeholders should provide necessary support meant to help such families improve the socio-emotional development of their children. Government agencies should create funds and kitties meant to for the upkeep of children who are orphans and vulnerable.

Keywords: Blended family structures, socio-emotional development, pre-primary school learners

Introduction

The blended family is one that has started to become the focus of many more studies in the last couple of decades especially when the family is formed after a divorce. According to Fergusson, Dimond and Horwood (2008), a blended family consists of two adults, the children they have from previous marriages or relationships and the children they may have together. In a study conducted in the Netherlands, Ermisch and Marco (2010) posit that blended families are very common in today's society since approximately 70%

of divorced adults remarry. However, Ermisch and Marco (2010) note that 60% of the blended families that are formed will end up in divorce. These divorces are more likely to happen in the first two years of the marriage because of the tremendous amount of change and stress a new marriage can put on the members of the new family. The study further notes that pre-primary school learners from such family arrangements suffer deleterious consequences. That is, they manifest low self-esteem, low self-confidence and put little effort in their academic studies.

In a study carried out in Kuala Lumpur, Carlson (2011) identified three different types of blended families and four important tasks the family must complete in order to survive. The author established that the three types of blended families are the neotraditional family, the romantic family, and the matriarchal family (Carlson, 2011). The study further indicated that the four tasks a new blended family must take into careful consideration are the formation of the step-parent and step-child roles, being able to separate the new marriage from the first, coping and managing with psychological change, and understanding the roles of the nonresidential parent and former spouses. The study established that when a second family and a second marriage dissolve, the children internalize the lessons that marriage is not permanent, that a home is never stable, and that they cannot trust the people they love. This formation affects their socio-emotional development and is a possible outcome when the children form strong attachments to the new parent and the new family.

In Africa, a blended family structure is a commonplace and has its fair share of challenges. For example, in a study conducted amongst households in Lesotho, Evans, Jonathan and Richard (2013) asserted that at best, blended families go through difficult periods of adjustment, particularly during the first two years of living together. In Kenya, Kithika (2016) posit that blended families are formed when adults in a new relationship decide to live together. Children of one or both partners may live with the couple full-time or come to visit. In a study conducted in Nairobi, Wachira (2011) reveals that pre-primary school learners from such families find it hard to adjust to the changes. They may be confused about where they belong and worry about things such as moving house or schools, or losing touch with friends (Wachira, 2011). Wachira (2011) suggests that, while new stepparents may want to jump right in and to establish a close relationship with stepchildren, they should consider the child's emotional status and gender first. In Ganze Sub-county, blended families are a common phenomenon and has occasioned most pre-primary school learners to manifest diminished self-esteem, self-confidence, self-efficacy and motivation to work hard (Musyoka & Kimani, 2012). Musyoka and Kimani (2012) assert that when a blended family forms, the struggles for performance increase and become more complicated. While competition among siblings exists in all families, rivalry with non-biological siblings can be especially bitter. There is more frequent fighting, and encourage the children to compete against their own personal best instead of what their siblings may be capable of doing.

Musyoka and Kimani (2012) further note that several aspects of forming a new family can create identity issues for young children. For example, if the mother's name changes to the last name of the new husband while the children of the mother keep their own last name, children may feel suddenly abandoned (Musyoka & Kimani, 2012). Further, pre-primary school learners feel confused about their feelings for a step-parent. However, much still needs to be done since Musyoka and Kimani (2012) have not articulated how different

forms and dimensions of blended families influence socio-emotional development amongst learners in pre-primary schools.

Statement of the problem

Family structures such as contemporary blended family formations play an important role in the socio-emotional development of pre-primary school learners. According to Ayieko (2013), such family structures develop self-esteem and well-adjusted behavior patterns. However, in Ganze Sub-county, the situation is quite different with many pre-primary school learners manifesting instances of low self-esteem, emotional maladjustment and poorly developed self-efficacy skills. Ayieko (2013) reports that 45.8% of pre-primary school learners in Ganze Sub-county either have low self-esteem, lack self-confidence, manifest instances of emotional maladjustment and unacceptable forms of behavior which interfere with their concentration in class. Yet, it was not clear how blended family structures influence socio-emotional development of pre-primary school learners.

Theoretical Framework

This study was guided by the family systems theory which was postulated by Murray Bowen (2004). This theory suggests that individuals cannot be understood in isolation from one another, but rather as a part of their family, as the family is an emotional unit. Families are systems of interconnected and interdependent individuals, none of whom can be understood in isolation from the system. Members of the system are expected to respond to each other in a certain way according to their role, which is determined by relationship agreements. Within the boundaries of the system, patterns develop as children's behavior is caused by and causes other family member's behaviors in predictable ways. Thus, the relevance of this theory in this study is that it underscores the fact that different family systems or structures organize themselves into subsystems to accomplish the tasks and goals of the family.

This study was also guided by socio-emotional theory which was postulated by Maurice (2006) as a process of acquiring core competencies to recognize and manage emotions, set and achieve positive goals, appreciate the perspectives of others, establish and maintain positive relationships, make responsible decisions, and handle interpersonal situations constructively and ensure that concepts and approaches that have proven to have beneficial effects on the development of socio-emotional skills in children. In this study, intentional teaching combined with adult prompting, positive reinforcement, peer-to-peer monitoring and student monitoring promotes the use of the learned skills throughout the school day and in settings outside of the school community. This instruction, practice and generalization build the foundation for children to become skilled at social problem-solving and responsible decision making. As children master the skills, they are on their way to knowing how to conduct themselves with personal, moral and emotional responsibility.

Delimitations of the Study

This study was carried out among public pre-primary school schools in Ganze Sub-county. This study assessed the influence of blended family structures on socio-emotional development amongst pre-primary school learners. In this study, mixed methodology was applied and thus concurrent triangulation research design was adopted. Questionnaire was used to collect quantitative data from pre-primary school teachers, interviews were used to gather qualitative data from headteachers and parents' representatives whereas observation checklist was used to collect data from pre-primary school learners.

Research Methodology

The study adopted mixed methodology and thus applied concurrent triangulation research design. Target population comprised 137 headteachers, 274 pre-primary school teachers, 137 parents' representatives and 4216 pre-primary school learners totaling to 4764 from which a sample of 369 respondents was determined using Yamane's Formula. Stratified sampling was used to create four strata based on the number of zones in Ganze Sub-county. From each zone, four headteachers, 25 pre-primary school teachers and four parents' representatives were selected using purposive sampling. However, from each zone, 59 pre-primary school learners were selected using simple random sampling. This procedure enabled the researcher to sample 16 headteachers, 100 pre-primary school teachers, 16 parents' representatives and 237 pre-primary school learners. Qualitative data were analyzed thematically along the objectives and presented in narrative forms. Quantitative data were analyzed descriptively using frequencies and percentages and inferentially using Pearson's Product Moment Correlation Analysis in Statistical Packages for Social Sciences (SPSS 23) and presented using tables.

Results and Discussions

The study sought to:

- i. Assess levels of socio-emotional development among pre-primary school learners in Ganze Sub-county
- ii. Examine the influence of blended family structures on socio-emotional development of pre-primary school learners in Ganze Sub-county.

Response Rate

In this study, 100 questionnaires were administered to pre-primary school teachers out of which 98 questionnaires were filled and returned. At the same time, the researcher also interviewed 13 headteachers, 14 parents' representatives and conducted observation schedules among 200 pre-primary school learners. This yielded response rates shown in Table 1;

Table 1: Response Rates

Respondents	Sampled Respondents	Those Who Participated	Achieved Return Rate (%)
Headteachers	16	13	81.3
Pre-primary School Teachers	100	98	98.0
Parents' Representatives	16	14	87.5
Pre-primary School Learners	237	200	84.4
Total	369	325	88.1

Source: Field Data (2020)

Table 1 shows that headteachers, pre-primary school teachers, parents' representatives and pre-primary school learners registered a response rate of 88.1%. This confirmed the findings of Creswell (2014) that a response rate above 75.0% is adequate and of suitable levels to allow for generalization of the outcomes to the target population.

Levels of Socio-Emotional Development among Pre-primary School Learners

The study assessed the levels of socio-emotional development among pre-primary school learners. Collected data are shown in Table 2.

Table 2: Levels of Socio-Emotional Development among Pre-primary School Learners

Indicators of Socio-emotional Development	High		Low	
	f	%	f	%
Self-esteem, e.g. not isolated, not hot-tempered, not quiet, not withdrawn and not emotional	30	30.6	68	69.4
Self-confidence, e.g. not talking very little, not fearful, make decisions and feel motivated	36	36.7	63	63.3
Self-efficacy, e.g. not afraid of attempting issues and express themselves	29	29.6	69	70.4

Source: Field Data (2020)

Table 2 shows that only 30.6% of the pre-primary school teachers indicated that self-esteem levels of their learners is high whereas majority (69.4%) indicated low. In the same token, only 36.7% of the pre-primary school teachers indicated that the levels of self-confidence of their learners is high whereas majority (63.3%) indicated that their learners manifest low self-confidence levels. On the question of self-efficacy, only 29.6% of the pre-primary school teachers indicated that their learners manifest high levels of self-efficacy whereas majority (70.4%) indicated low. These views were shared by the headteachers and parents' representatives during the interviews. They also indicated that the self-esteem, self-confidence and self-efficacy levels of pre-primary school learners are low. Headteacher, H1, noted;

In my school, socio-emotional development of pre-primary school learners is low with many learners manifesting instances of low self-esteem, low self-confidence and low self-efficacy levels. Most of these learners are often isolated, hot-tempered, quiet, withdrawn and very emotional"

The researcher also observed pre-primary school learners manifested low self-esteem, low self-confidence and low self-efficacy levels. These findings lend credence to the observations of Benokraitis (2012) that children from different families manifest negative socio-emotional development such as behavioral adjustment, attachment security, parent-reported academic difficulties, emotional well-being, self-esteem and sociability. In summary, these findings affirm the fact that when one combines the internal struggles that a pre-primary school learner goes through with the physical struggles of mood swings, feelings of inadequacy and general awkwardness, it becomes clear that, although aggravating, why it is that pre-primary school learners have such a strong desire to set themselves apart from their parents and other adults and achieve some type of independence.

Blended Family Structures and Socio-emotional Development among Pre-primary School Learners

The study sought to establish how blended family structures influence socio-emotional development among pre-primary school learners. Descriptive data were collected from pre-primary school teachers and results are shown in Table 3:

Table 3: Views of Pre-primary School Teachers on the Influence of Blended Family Structures on Socio-Emotional Development among Pre-primary School Learners

Test Items	SA %	A %	U %	D %	SD %
No-kid husband with kid-wife blended family structures lower pre-primary school learners' self-esteem, self-confidence and self-efficacy	71.1	12.2	1.3	10.1	5.3
No-kid wife with kid-husband blended family structures lower pre-primary school learners' self-esteem, self-confidence and self-efficacy	66.9	13.2	2.4	12.7	4.8
Kid-husband with kid-wife blended family structures have negative pre-primary school learners' self-esteem, e.g. isolated, hot-tempered, quiet, withdrawn, emotional	80.5	12.4	1.6	3.3	2.2
Kid-husband with kid-wife blended family structures lower pre-primary school learners' self-confidence, e.g. talk very little, fearful, inability to make decisions and feel unmotivated	67.4	19.7	3.5	5.3	4.1
Kid-husband with kid-wife blended family structures lower pre-primary school learners' self-efficacy, e.g. afraid of attempting issues, inability to express themselves, withdrawn, disorganized	69.6	13.8	1.6	10.6	4.4

Source: Field Data (2020)

Table 3 shows that 70(71.1%) of the pre-primary school teachers strongly agreed with the view that no-kid husband with kid-wife blended family structures lower pre-primary school learners' self-esteem, self-confidence and self-efficacy. 12(12.3%) agreed. Only a paltry 1(1.3%) were undecided, 10(10.1%)

disagreed whereas 5(5.3%) strongly disagreed. The study also revealed that 66(66.9%) of the pre-primary school teachers strongly agreed with the view that no-kid wife with kid-husband blended family structures lower pre-primary school learners' self-esteem, self-confidence and self-efficacy as did 13(13.2%) who agreed. 2(2.4%) were undecided, 12(12.7%) disagreed whereas 5(4.8%) strongly disagreed. These findings corroborate the findings of a study carried out in the Netherlands in which Ermisch and Marco (2010) established that pre-primary school learners from such family arrangements suffer deleterious consequences. That is, they manifest low self-esteem, low self-confidence and put little effort in their academic studies.

Thus, these findings are indicative of the fact that blended families have extremely different outcomes, it all depends on the people involved and have detrimental effects on the child. In other words, when a second family and a second marriage dissolve, the children internalize the lessons that marriage is not permanent, that a home is never stable, and that they cannot trust the people they love. This formation affects their socio-emotional development and is a possible outcome when the children form strong attachments to the new parent and the new family. The study revealed that 79(80.5%) of the pre-primary school teachers strongly agreed with the view that kid-husband with kid-wife blended family structures have negative pre-primary school learners' self-esteem, e.g. isolated, hot-tempered, quiet, withdrawn and emotional as did 12(12.4%) who agreed. 2(1.6%) were undecided, 3(3.3%) disagreed whereas 2(2.2%) strongly disagreed. Slightly than two-thirds, 66(67.4%) of the pre-primary school teachers strongly agreed with the view that kid-husband with kid-wife blended family structures lower pre-primary school learners' self-confidence, e.g. talk very little, fearful, inability to make decisions and feel unmotivated. 19(19.7%) agreed. 3(3.5%) were undecided, 5(5.3%) disagreed whereas 4(4.1%) strongly disagreed. These findings lend credence to the findings of a study carried out amongst households in Lesotho in which Evans et al (2013) established that blended families go through difficult periods of adjustment, particularly during the first two years of living together. According to Evans et al (2013), jealousies and rivalries develop over everything from school performance to birthday parties and presents.

These findings imply that, when one of the partners has an only child, there is a perceived loss of attention and love, which, in turn, lead to poor socio-emotional development among school-going children. The study also revealed that 68(69.6%) of the pre-primary school teachers strongly agreed with the view that kid-husband with kid-wife blended family structures lower pre-primary school learners' self-efficacy, e.g. afraid of attempting issues, inability to express themselves, withdrawn and disorganized as did 14(13.8%) who agreed. 2(1.6%) of were undecided, 10(10.6%) disagreed whereas 4(4.4%) strongly disagreed. These findings are consistent with the findings of a study conducted in Nairobi County in which Wachira (2011) established that pre-primary school learners from such families find it hard to adjust to the changes. They may be confused about where they belong and worry about things such as moving house or schools, or losing touch with friends (Wachira, 2011).

Wachira (2011) suggests that, while new step-parents may want to jump right in and to establish a close relationship with stepchildren, they should consider the child's emotional status and gender first. These findings also corroborate the assertions of Musyoka and Kimani (2012) that blended families are a common phenomenon in Ganze Sub-county and has occasioned most pre-primary school learners to manifest diminished self-esteem, self-confidence, self-efficacy and motivation to work hard. Thus, these findings

point to the fact that different forms and dimensions of blended families influence socio-emotional development amongst learners in pre-primary schools.

Inferential Findings on the Influence of Blended family Structures on Socio-Emotional Development among Pre-primary School Learners

To verify the relationship between blended family structures and socio-emotional development among pre-primary school learners, data were collected on the number of learners from blended family structures and those who manifest diminished socio-emotional development such as low self-esteem. The results are shown in Table 4:

Table 4: Number of Pre-primary School Learners from Blended Family Structures and Number of Pre-primary School Learners with Cases of Low Self-esteem in Public Pre-primary Schools

Number of Learners from Blended Family Structures	Number of Learners with Cases of Low Self-esteem
3	1
7	3
7	3
7	3
8	5
8	6
9	6
10	6
10	6
11	7
12	7
13	8
15	9

Source: Field Data (2020)

Table 4 shows that many pre-primary school learners who come from blended families manifest instances of low self-esteem. These findings further corroborate the assertions of Musyoka and Kimani (2012) that blended families are a common phenomenon in Ganze Sub-county and has occasioned most pre-primary school learners to manifest diminished self-esteem, self-confidence, self-efficacy and motivation to work hard. These results were subjected to Pearson's Product Moment Correlation Analysis and results are shown in Table 5:

Table 5: Pearson's Product Moment Correlation Analysis Showing Relationship Between Number of Pre-primary School Learners from Blended Families and the Number of Pre-primary School Learners with Cases of Low Self-esteem

		Number of Pre- primary School Learners from Blended Families	Number of Pre- primary School Learners with Low Self- esteem
Number of Pre-primary School Learners from Blended Families	Pearson Correlation	1	.956**
	Sig. (2-tailed)		.000
	N	13	13
Number of Pre-primary School Learners with Low Self-esteem	Pearson Correlation	.956**	1
	Sig. (2-tailed)	.000	
	N	13	13

** . Correlation is significant at the 0.01 level (2-tailed).

Source: SPSS Generated (2020)

Table 5 shows Pearson's Product-Moment Correlation Analysis which was run to determine the relationship between the number of pre-primary school learners from blended families and the number of pre-primary school learners with cases of low self-esteem. The test generated a correlation coefficient of $r = 0.956$ with corresponding significant level (p-value) of 0.000 which was less than the predetermined level of significance, 0.05, that is, $p\text{-value} = 0.000 < 0.05$. These findings further affirm the fact there is significant relationship between blended family structures and socio-emotional development among pre-primary school learners. In summary, these findings are indicative of the fact that blended families are a common phenomenon with negative effects on socio-emotional development among pre-primary school learners. Pre-primary school learners from blended family structures manifest diminished self-esteem, self-confidence, self-efficacy and motivation to work hard.

Thematic Analysis of Qualitative Findings on the Influence of Blended Family Structures on Socio-Emotional Development among Pre-primary School Learners

The researcher also interviewed headteachers and parents' representatives who also responded in favor of the view that there are different forms of blended family structures. Headteacher, H2, noted:

"Many pre-primary school learners come from different forms of blended structures. These include; no-kid husband with kid-wife blended family structures, no-kid wife with kid-husband blended family structures, kid-husband with kid-wife and kid-husband with kid-wife blended family structures with harmful effects on socio-emotional development among pre-primary school learners"

These views were supported by the parents' representatives who noted that many families have become blended depending on a multiplicity of factors. Parents' representatives, however, noted such family formations have affected socio-emotional development. These views further affirm the fact that learners from such family arrangements manifest low self-esteem, low self-confidence and put little effort in their academic studies. From these views, when one of the partners has an only child, there is a perceived loss of attention and love, which, in turn, lead to poor socio-emotional development among school-going children. In other words, different forms and dimensions of blended families influence socio-emotional development amongst learners in pre-primary schools.

SUMMARY OF FINDINGS

From the study findings, it is evident that there are different forms of blended family structures. These include; no-kid husband with kid-wife blended family structures, no-kid wife with kid-husband blended family structures, kid-husband with kid-wife and kid-husband with kid-wife blended family structures with harmful effects on socio-emotional development among pre-primary school learners. This affirms the fact that learners from such family arrangements manifest low self-esteem, low self-confidence and put little effort in their academic studies.

RECOMMENDATIONS

The study recommends that parents who are in blended family structures should adopt mechanism of enhancing the socio-emotional development of their children.

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The Mobility of Professors in Performing Distance Education Activities

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Abstract

The article investigates the strategies used by Distance Education (DE) tutors to mobilize students in carrying out the activities available in the Virtual Learning Environment. To reflect on the mobility of tutors, learning theories outlined for Distance Education were revisited. The methodology consisted of a study applied at a university in southern Brazil. As a data collection instrument, a questionnaire was developed and applied to a group of tutor professors who work in DE. The testimonies obtained were analyzed to show the strategies used to mobilize students in the perspective of meaningful learning. The analysis showed that the terms mobilization and motivation are used interchangeably; the dimensions of meaningful learning (active, authentic, cooperation, constructive and intentional) are used to mobilize students, but not all dimensions have been captured in digital reports. This can be indicative of prioritizing one dimension over another. It was concluded that further investigations should be carried out to demystify the tutors strategies regarding learning theories.

Keywords: Distance Education; Meaningful Learning; Mobility.

1. Introduction

Distance Education (DE) is a teaching modality where the actors are spatially and/or temporally separated and carry out their studies, either synchronously or asynchronously, through the resources available in the Virtual Learning Environment (VLE). The resources available at VLE, together with the support of Information and Communication Technologies (ICT), favor the construction of new knowledge, autonomous study and the network of cooperation and collaboration between human agents (student-professor, student-tutor, professor-tutor).

DE was introduced in Brazil in the mid-1990s and emerged from the demands of autonomous learning, allowing studies to be carried out in any location and at any time, thus providing an opportunity for a broad and continuous process of changes in the educational sector. The proliferation of DE has intensified due to

the existing difficulties in urban mobility, international mobility, needs for time optimization and autonomous study. Over the years, this type of teaching that revolutionized education, was mediated by different media resources, including writing by correspondence, television, printing technology, Internet and ICT.

As described in [1], the Distance Education in higher education began more than a century and a half ago in the United Kingdom, when the University of London created its External System in 1858, or correspondence courses.

As time went by, new forms of intermediation were adopted, such as television (*Telecurso*) and the Internet. Education started to be offered with different purposes: initial and continuing training, professional or pedagogical training. In this sense, over the years, several Higher Education Institutions (HEIs) in the country have joined this movement. In Brazil, according to information from the Ministry of Education Portal (e-MEC) system, in July 2018 there were 571 accredited HEIs, with higher education courses offered in the Distance Education modality.

Research data of [2] demonstrate that higher DE in Brazil had, in 2004, around 60 thousand students enrolled; it grew rapidly and reached the mark of 1.5 million enrollments in 2016, offering important collaboration for the development of the country.

With the expansion of the number of enrollments in DE, there are motivations to know how professors do network education from the experience of a permanent and continuous intertwining between the biological, the social and the cultural, as taught by Maturana for “[...] individuals in their interactions constitute the social, but the social is the medium in which these individuals are realized as individuals, [...] there is no contradiction between the individual and the social, because they are mutually generative” [3]. Here stating that the autonomous, self-producing living being, which was not created to receive information passively. The concept of Network used in this article refers to the symbol of science for our century because it represents “The only organization capable of growth without prejudice and learning without guides [...] No other scheme - chain, pyramid, tree, circle, axis - can contain true diversity functioning as a whole” [4].

The Network metaphor does not presuppose previous structures, plastered, ready to imprison reality. We are dealing here with networks of relationships produced by the relationships themselves, these helpers and helpers, as Morin reports [5]. Perceived as threads that emerge and that are self-organizing at each moment subject, therefore, to unpredictability.

Despite contributions and experimentation with other processes from different researches in DE, we are still looking for ways to understand and intervene in the dynamics of network learning. Today, the creation of a more organized and systematic interactive space, conducive to the articulation of different activities, still makes us question the possibilities of networked education and its *hominization* potential.

For Lévy [6], the *hominization*, the process of the emergence of mankind has not ended, but it is accelerating in a brutal way. However, contrary to what happened at the time of the birth of our species, or at the time of the first great anthropological mutation (that of the Neolithic, which saw livestock, agriculture, the city, the State and writing), we now have the possibility to collectively think about this adventure and influence it [7].

The purpose of this article is to reflect on the professor's mobility in a VLE, with learning as the central focus. The research methodology consisted of a case study [8] held at an accredited University to offer

courses in the DE modality. As a data collection instrument, a questionnaire was developed and applied to a group of tutor professors who work in DE. The testimonies obtained, in the form of digital reports, were analyzed to show which strategies were used to mobilize students. To reflect on the professor's mobility, that is, what does it perform a certain action; that moves it in a VLE, the theories of learning have been revisited, in particular, the meaningful learning outlined for DE.

It is important to note that the author Charlot [9] distinguishes the idea of “mobilization” from the idea of “motivation”. For him to mobilize implies getting involved (“from the inside out”), while the motivation depends on the stimulus provoked (“from the outside in”). Thus, mobilization is more directed to the dynamics of the subject/educator's own movement. For the author “to mobilize is to” put resources in motion “to assume an” activity originated by mobilities”, because there are good reasons to do so” [9]. The mobility is the desire that will trigger the activity.

In the perspective described above, the author Morin [10] highlights the fifth knowledge for the education of the future, the need to “Face Uncertainties”. The certainty of historical progress, the idea that prevailed in modern civilization, destroyed the myth of the right, giving rise to the awareness of uncertainty considering “the speed and the acceleration of the complex and random processes of our planetary [...]”. Although the sciences have guaranteed many certainties, they have also revealed many uncertainties, showing the importance of education to teach the uncertainties present in the physical, biological and historical sciences.

When feeling mobilized, both the professor and the student seek to innovate their practices. According to Morin [5], based on complex thinking, from a systemic perspective, we cannot dissociate internal mobilities from external ones. There is a process of interdependence between them. The professor's knowledge is mobilized in the midst of the school's daily interactions, “the knowledge that comes from it, in one way or another, and serves to solve the problems of professors in practice, giving meaning to their own work situations” [11].

But what about the student? How can the professor and / or tutor mobilize the student participating in a distance education course to carry out certain learning activities? These questions are the guiding principles of this research.

Meaningful Education to Mobilize Students

Based on the assumption that the learning theories adopted for the design of the pedagogical model are essential to activate mobility resources, as they will provide all the conceptual and practical basis for the construction of a flexible pedagogical architecture (regarding the contents, strategies, methodologies and resources technological), adaptive and oriented to the context of the student. For the design of architecture, with such characteristics, the pedagogical team works with a hybrid approach, looking for devices in different learning theories.

Resende [12] highlights the existence of several learning theories applicable to DE and argues that those based on constructivist principles with interactionist conceptions are the most significant, since learning is largely carried out in VLE. Meeting with the author [12], we consider that the combination of both theories (constructivist and interactionist) are relevant to DE, since access to VLE resources occurs through

interactions with the virtual learning objects themselves and with human agents and these interactions collaborate to activate internal mobilities and external.

For Ausubel [13], learning from a cognitive perspective includes a diversity of theories, including the theory of form; theories of information processing; cognitive-structuralist theories; Piaget's theory that brings structuralist and organicist roots despite emphasizing more development at the expense of learning processes. The cognitive theory proposed by Piaget, treated in an interactionist perspective, explains human cognitive development, where man and the world are analyzed collectively [13].

For Pozo [14], Piaget and Vygotsky were the main proponents of contemporary constructivism. For Andrade [15] the concepts of knowledge construction proposed by Piaget can be applied in different aspects of human learning and for Rezende [12] the socio-interactionist conception proposed by Vygotsky highlights the importance of social interaction in the educational process, through the subject's exchanges with the other and with the social object.

Constructivism is a learning philosophy that describes what it means to know something and what is reality. Traditional conceptions of learning admit that knowledge is an object, something that can be transmitted from the professor. Constructivists, on the other hand, believe that knowledge is a human construction of meanings that seeks to make sense of their world [16].

The human construction of meanings is emphasized in meaningful learning, a theory based on the cognitivist conception, proposed by Ausubel [13]. This theory, also called the assimilation theory, seeks support in Piaget and Vygotsky's cognitive conceptions to explain the internal mechanisms that occur in the human mind in relation to learning and the structuring of knowledge. For the authors [17], Ausubel's theory of learning values the participation of mental processes in learning and emphasizes the importance of considering students' prior knowledge to build mental structures in order to seek new knowledge.

In the author's view [16], DE must emphasize in its teaching-learning process the relationships between the multiple dimensions that collaborate for meaningful learning, illustrated in Figure 1.

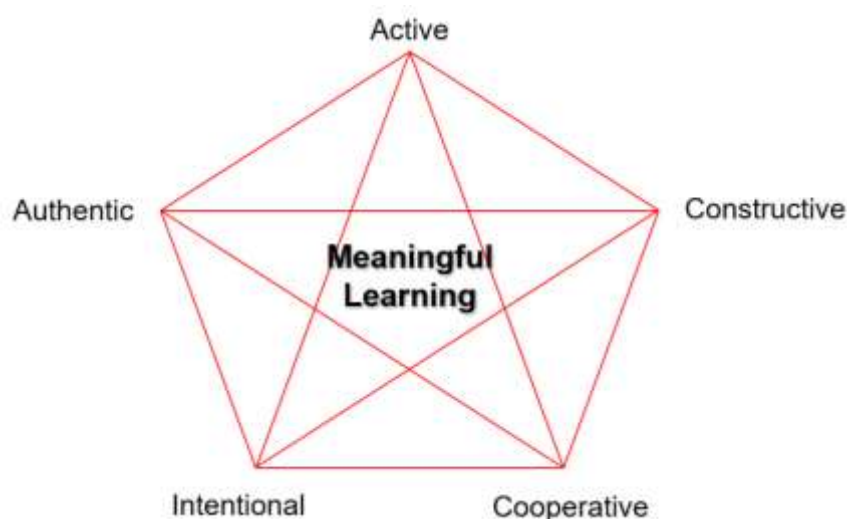


Figure 1 - Dimensions of Meaningful Learning [16].

For Salles [18], some authors dealing with the theme of multiple dimensions of meaningful learning, such as Ausubel [13], Jonassen [16] and Santos [19], claim that when the student learns something new, he

incorporates all of his previous baggage into that experience. The new information assimilated is processed forming a growing network of data that will assist the student in the interpretation of a given situation and application of the knowledge acquired in similar situations.

Chart 1, built on the basis of research carried out by Salles [18] presented the multiple dimensions of meaningful learning, its characteristics and how the construction of knowledge occurs in the view of different authors.

Chart 1 - Systematization of the multiple dimensions of meaningful learning.

Dimension	Characteristics	Meaningful Learning	Author
Active	Manipulative and observable	- Active manipulation of information from knowledge objects in the VLE.	[20][16]
		- Genuine experiences from interactivity.	[21]
		- Reflection on the information processed, from the manipulation and interaction with the tools made available in the VLE.	[22]
		- Relationship of processed information with previous knowledge and experience.	
Constructive	Articulatory and reflective	- Interpretation and meaning of information, generating new knowledge.	[23]
		- Active subject in the knowledge process.	
		- Constructive, reflective, collaborative, interactive relationship in autonomous moments of learning.	
		- Confrontation of previous knowledge with new historical and cultural contexts.	[16]
		- Construction of interpretations of the phenomenon manipulated through observations.	
Intentional	Reflective and regulatory	- Acquired knowledge is produced internally as a mental and individual construction involving the relationship between existing knowledge and new knowledge.	[14]
		- Interactivity involving relationships between virtual learning objects, subjects with diverse experiences and pedagogically organized activities.	[24]
		- Autonomy through shared relationships.	
		- Appropriation and reconstruction of knowledge through interactivity, sharing and reflection of experiences.	
		- Learning oriented to students' objectives and goals.	[20]
Intentional	Reflective and regulatory	- Learning favored through investigation, analysis of information and the exchange of knowledge and experiences aimed at expectations and goals.	
		- Permanent learning process that points to education as a source of knowledge and an object of transformation.	[25]
		- Intentional practices that encourage the student to analyze the acts practiced in daily life.	
Intentional	Reflective and regulatory	- Diversified practices, methodologies and tools provide behavioral changes based on the acquisition of new skills, knowledge, concepts and attitudes.	[25]

Dimension	Characteristics	Meaningful Learning	Author
		- Reflective skills exercised in problem solving contribute to the construction, reconstruction and reframing of knowledge applicable in practice, causing behavioral changes according to the situations that occur in daily life.	
Authentic	Complex and contextual	<ul style="list-style-type: none"> - Development of contextualized educational processes, which present complex and real problems, stimulating the student's ability to use thinking to work on poorly structured problems. - Presentation of actions that simulate significant real-world situations, with useful, new and different contexts, helping the student to apply these concepts. - Learning and problem solving must provide social activities linked to the student's context. - Appropriation of different views of the world and with other complexities, provided by the communities of the VLE, composed of members from different cultures and with different perceptions of reality. 	[20][16]
		- Relationship of knowledge with the reality of the student allows the improvement and construction of new knowledge from the information raised and problematized in their daily lives.	[19]
Cooperation	Collaborative and conversational	<ul style="list-style-type: none"> - Collaborative work with social negotiation, common expectation, understanding of the activity and methods adopted for its realization. - Collaboration between peers through the exchange of experiences. - Reflective thinking in the constructivist environment allows the rescue of individual experiences and the sharing of experiences with the group. - Relationship groups provide knowledge of different interpretations and perceptions between peers. 	[16]
		<ul style="list-style-type: none"> - Knowledge sharing through VLE's technological resources. - Construction of a horizontal social space rich in information sources, which, when making sense, can produce new knowledge and, consequently, new actions. - Application of collaborative activities in VLE collaborates with autonomous and collaborative, critical and creative study. - Establishing relationships between information received from social interactions and VLE resources. 	[25]

Source: Adapted from [18].

The communication network provided by the VLE must foster cooperation and collaboration between peers, so that new knowledge can be built based on the experiences lived, in this way the interactions provide the social construction of knowledge.

The virtual environment must be provided with mechanisms capable of capturing the students' prior knowledge, their interests and objectives, because thus, the VLE resources can be adapted to the context,

providing the student with intentional and authentic activities, tools and methods, appropriate with the your reality. In addition, the mechanisms must be able to follow the evolution and progress of the student, in view of the proposed activities. This functionality allows the alternation/adaptation of the proposed contents and activities aimed at meaningful learning.

In DE, caution is needed regarding authenticity in the teaching and learning process, as according to Jonassen [20] "Instruction, very often, tends to oversimplify ideas in order to make them easier to convey to students. This process assumes that the world is a simple and reliable place". According to Salles [18] complexity, a component of learning addressed by the author represents the need for the professor to develop educational processes that present complex and real problems, in order to stimulate the student's ability to use thinking to work on poorly structured problems". This dimension of meaningful learning must be carefully evaluated in the design of the DE system, as there may be a natural tendency in the simplification of educational processes so that the student can proceed with the autonomous study and achieve their goals.

According to Charlot's proposal, "teaching with meaning to mobilize students" is the most appropriate way for emancipatory education, because "the more significant what is being taught, the more the student starts to move, mobilizes to relate to that content" [26].

Significant Learning for the Mobilization of DE Students: With Tutors Speaking

The case study was used as a research strategy, with the application of the following guiding question: "What are the mobilization strategies used to carry out the activities proposed in the VLE (Virtual Learning Environment)?"

The question was sent to the group, composed of eleven tutoring professors from a University located in the interior of the state of Santa Catarina, in southern Brazil. Only five professors returned to the invitation and participated in the research, and the respective answers were provided via digital reports. The reports of professors 1, 2 and 3, presented below, have similarities in terms of mobilization and motivation.

Professor 1 reports that the messages in the chat and in some cases through information/requests made on the murals of the rooms (in the case of courses offered as semi-face-to-face) are the strategies adopted to mobilize the students.

For Professor 2, mobilization occurs by sending messages via VLE, e-mail and through sporadic visits in classrooms (courses offered in the semi-face-to-face modality). He complements saying that the student is congratulated for the dedication and participation, sending messages of self-motivation and stimulation to create a participation routine, not only of the activities, but of forums and the "talk to the tutor" channel. Professor 2 concludes that there is an incentive in organizing meetings with students to exchange experiences in the development of the discipline.

Professor 3 says that the strategies consist of the development of activities so that they seek to solve them collaboratively, thus seeking to exchange information with colleagues. Sending e-mails alerting you to deaDEines and face-to-face conversation helps with mobilization. A brief explanation of the contents covered facilitates learning a lot, for students who come to us in the physical space of DE at the Higher Education Institution.

Figure 2 summarizes the accounts of professors 1, 2 and 3, as well as the dimensions of significant learning adopted to mobilize DE students.



Figure 2 - Perception of Professors 1, 2 and 3 regarding the mobilization strategies.

Through Figure 2, it can be seen that some “motivation” strategies were classified by professors 1, 2 and 3 as being mobilization strategies, thus showing that there is still some confusion between the concepts of motivation and mobilization, seen as synonyms. This evidence needs an in-depth investigation with the entire team of tutors from the Higher Education Institution's DE, because although in a systemic perspective, we cannot dissociate internal and external mobilities, the concepts are specializations and not generalizations.

It is not too much to resume here the concepts mentioned above to distinguish them. Charlot [27] clarifies that “to mobilize, however, is also to engage in an activity originated by mobilities, because there are good reasons to do so”. Concerning the desire to do something. Motivation, on the other hand, is as if the professor had to present (something) as a reason, to provoke learning. This is because “many times, this act of motivating is the same as involving the students so that they do something they are not in the mood to do” [28]. On the other hand, the concept of mobilization suggests a relationship for the subject to start moving.

Through reports 1, 2 and 3, it was evident that professors use the constructive, intentional and cooperation dimensions as meaningful learning strategies to mobilize students in carrying out VLE activities.

The use of messages (encouragement, congratulations and self-motivation) are strategies to create the routine of participation and motivation in the VLE and according to Jonassen [20] we believe that such strategies are intentional practices oriented to the objectives and goals of learning.

Cooperation appears in the formation of groups to exchange experiences between peers. For Jonnassen [16] this strategy provides knowledge of the different interpretations and perceptions between peers. And in these discussions between the groups, meaningful constructive learning can occur when there is a confrontation of previous knowledge with new historical and cultural contexts [23].

The report of professor 4 (summarized in Figure 3) describes that the mobilization strategies consist of keeping them in constant performance of exercises and assessments, with different formats, in order to set them up so that they engage in different modalities of assessment and digital tools, because there are good reasons. For him, DE goes far beyond simply motivating the academic, as it is necessary to mobilize them

so that the activities take place, being instigated by contact with the tutor, solving their doubts, as well as guidance on the use of proposed digital tools and, thus, allow the activities and the learning and knowledge of digital tools to be effective.

The professor adds by saying that the diversification of the proposed activities collaborate for the mobilization, including, participation in discussion forums, making videos, written productions, use of various digital tools, such as infographics, the use of Google Forms for conducting research, as well as Google Slides, to expose your data, among others.

In the report, from one of the teachers, strategies are used based on the dimensions of cooperation, active, intentional and constructive (Figure 3). Through the report it was observed that there is an intentional diversification of practices, methodologies and tools, this diversification causes changes in behaviors from the reach of new skills, knowledge, concepts and attitudes [25]. The occurrence of the active dimension is identified with the student's instrumentalization for the active manipulation of information from the virtual learning objects of the VLE [20] and [16].

The constructive dimension and cooperation are observed in the report when the student acts as an active subject in the creation and production of learning objects, because in these constructions there is a reflexive, collaborative and interactive relationship in autonomous moments of learning [23]. Cooperation is strengthened when the student shares knowledge and performs activities collaboratively with VLE resources [25].

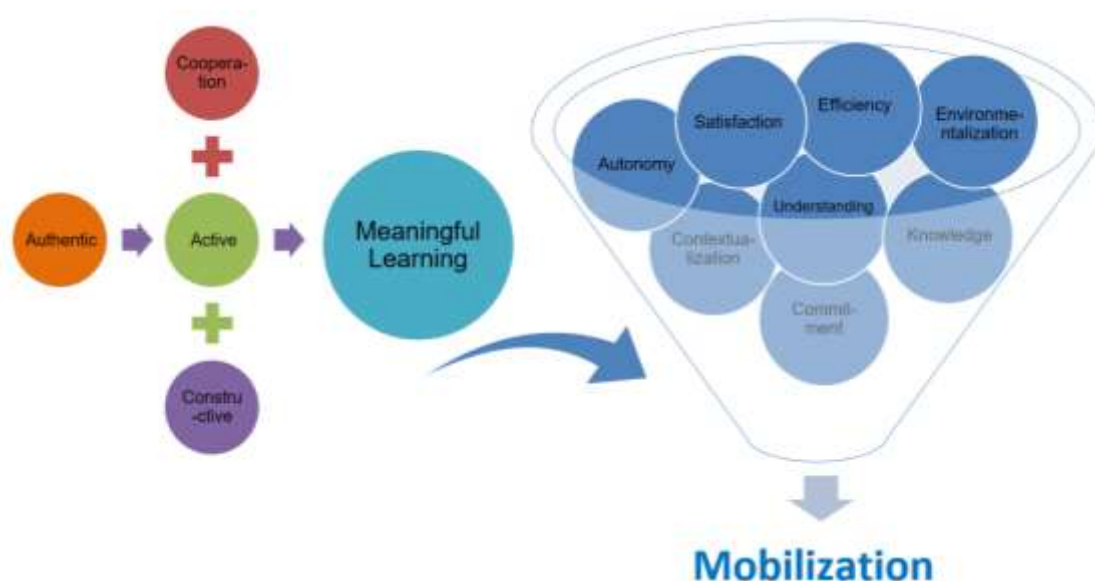


Figure 3 - Professor 4's perception of mobilization strategies.

Professor 5 reports that initially the motivation is required for the virtual student understands why the discipline and content proposed are interesting to him. After the student understands the importance of the content, the proposed activities are directed so that they can relate it and apply it in their day to day or in their future profession. Once this context is understood, the student has an interest in learning, discovering new things and keeping up with his classes. At the beginning of the journey this student is getting used to the content, the environment and learning to organize. After the period of knowledge of the learning

environment, the student is interested in keeping his activities up to date, as he learns the importance of completing classes on time and doing the work in a more efficient way.

Here the question of the internal dynamics (from within) of each student can be perceived, which starts to move by its own resources [9]. This movement is caused by different mobilities, the main one being the desire to move forward, the engine of mobilization.

He learns that the learning process depends 85% on him alone, on his ability to self-manage time and set aside quality time to build his knowledge. The professor concludes by saying that the satisfaction of the virtual student, once he puts the discipline as a goal, is indescribable. Having the feeling of reaching the goals, completing the activities and being able to maintain the line of reasoning is satisfactory and gives even more encouragement to study.

In Figure 4, strategies from the intentional, active, constructive and authentic dimensions are used. Self-organization of time, achievement of goals and objectives are characteristics of autonomy that contribute to the student becoming the active subject in the knowledge process [22]. These characteristics are intertwined in the active and constructive dimensions of meaningful learning.

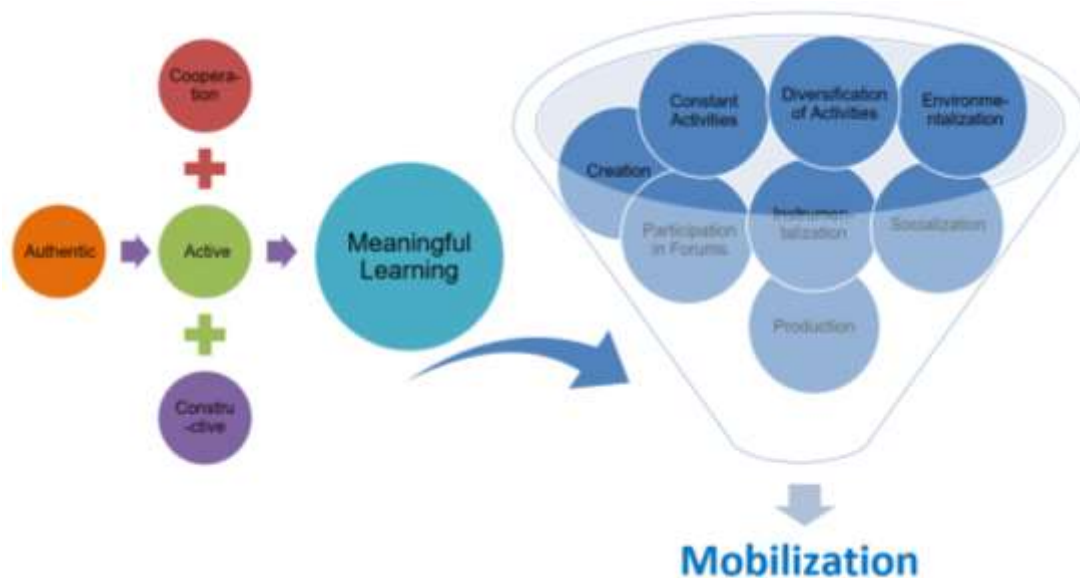


Figure 4 - Professor 5's perception of mobilization strategies.

In this sense, the subject performs reflections and associations of the contents and activities, since the intentional practices stimulate the student in the analysis of the acts practiced in their daily life [25]. In a complex and contextual approach to authentic meaningful learning, the relationship of knowledge with the reality of the student allows the appropriation and construction of new knowledge from the information raised and problematized in the student's daily life [19].

Charlot [27] highlights that in the relationship with knowledge there is an inseparability between meaning and learning effectiveness, that is, the subject only learns if it makes sense to him. In short, meaning is produced by establishing a relationship, within a system, or in relationships with the world or with others [9].

Final Considerations and Perspectives for Research Continuity

The study carried out here consisted of highlighting the mobility of a team of tutoring professors with a focus on learning at VLE. The results obtained were analyzed from the dimensions of significant learning. If, on the one hand, the analysis of the reports allowed to show that the concepts - "motivation" and "mobilization" are used as if they were synonyms, by some of the tutoring professors, on the other hand, it was possible to show that the construction of activities and the mobilization strategies are based on meaningful learning. However, two aspects deserve reflection for further research:

- 1) Reflection on the use and application of terms (mobilization and motivation), through an exploratory study with the instructional design team and professors from the University DE under study.
- 2) The analysis of digital reports allowed us to highlight the five dimensions of meaningful learning: active, authentic, cooperation, constructive and intentional. However, not all dimensions could be captured in all digital reports. This can be indicative of valuing or prioritizing one dimension over another. We therefore have evidence that research must continue to demystify the practices and strategies of tutors and/or instructional design staff regarding learning theories.

It is also important to remember that the concept of meaning presented by Charlot [9] involves ways for the subject to relate appropriate knowledge to relations with the world, with the other and with himself. In this perspective, the knowledge that enables us to understand life itself makes sense.

Thus, the mobility of professors in carrying out distance education activities will always be the discovery of relationships built with meaning during the learning process. The professor as a mobilizer of activities will be the mediator of networks of meanings that the subject is appropriating to make sense of what he is learning.

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Judicial Marxism: a sociological essay on ideology in Brazilian Courts¹

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Abstract

This article discusses the “judicial marxism”, which was characterized by the actuation of judges who have learned their ideology among student movements and labor unions. Brazilian Labor Justice was created in the 40s, but the true Labor Law charismatic founders were the hyper politicized generation of labor judges, stood out in the 80s and the 90s, when Marxist labor judges held their position, in the field, against the traditional view of a neutral and impartial judge in the Montesquieu style. It’s known that judges who are politically oriented to Marxism produce “garantist” discourses (in Ferrajoli’s sense) when they utter a speech in legal terms (in their opinions), referring to the fundamental labor rights doctrine – which is based on the concept of dignity of work. However, sometimes “labor garantism” and “Marxism” don’t coincide in attitudes of the same labor judges because it’s not necessary that garantist judges have both the humanistic education and the political initiation in their backgrounds. The truth is that Marxism and garantism can live together, once we recognize that the prior is a political and philosophical doctrine, effective only in the political field, but never into the legal field, while the later is a major philosophical theory especially applied to law issues. By the 2000s, elder Marxist judges were challenged by a younger generation of hyper technicist magistrates formed at the benches of the career preparatory courses. By asserting the autonomy of the juridical discourse, rather than the political ideology, these legal positivist

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judges (in Kelsen's sense), so called "professional jurists", partially delegitimized the judicial activism, particularly relevant in Brazilian Labor Courts. Nowadays, Judicial Marxism faces a crisis, losing space to pure garantist and legal positivist judges, although it still holds a formidable aura of legitimacy because it's the only labor law tradition that deeply justifies the "protective principle", by assuming the class struggle theory as a main postulate.

Keywords: Legal Sociology; Labor Courts; Ideology; Marxism; Legal Field.

1. Introduction. The first generation and the myth of the robe.

This sociological essay discusses the "Judicial Marxism", the most important political ideology held by professional judges in Brazilian Labor Courts. (Due to ethical commitments, we are referring the names by pseudonyms). In this essay, we will analyze the ideological attitudes of Brazilian Marxist labor judges in sociological terms.

First, some brief considerations about Brazilian laboral courts... Labor Courts is part of the Brazilian judicial system. Initially, by the late 30s, it was an organ of the executive branch, but the Federal Constitution of 1946 changed Labor Courts officially into a Judicial organization.

In Brazil, these Federal Courts, specialized in trial and judgement of laboral cases, are hierarchically structured, from the district courts (the so called "varas"), in the trial level, to the appellate higher courts: the Regional Labor Courts (TRTs), with full competence to review the matters of law and of fact discussed in the trials; the Superior Labor Court (TST), competent to examine issues concerning federal labor law; and, finally, the Supreme Federal Court (STF), competent to examine constitutional issues.

Until 1999, the laboral trial courts have had a paritary composition, with a main professional State judge and two "classist" lay judges, respectively representatives of the workers and the employers. Nowadays, local courts have only one professional judge.

The *enjeu*, in the field of the labor judicature, is the problem of defining and imposing, to the pairs within the profession, the definition of "being a good labor judge". According to spirit of times, the attitudes of judges, in the 40s, made them to think that a "good judge", a really fair one, was the one identified with the values of neutrality and impartiality. The power of this conception was so strong that even the Labor Justice assumed it for itself in the first decades. Then, the members of the first generation of labor judges believed that they should not be engaged in the class struggle arguments, thus being favorable to workers or employers. Rather, they believed that they would behave better, as judges, being fully impartial and applying the labor law itself (maybe literally) to the concrete cases brought before them. This attitude is known in literature as the "myth of the robe": the belief that neutrality is possible for a well trained and professional judge.

Therefore, this type of judge is considered similar to that ones described by Montesquieu as the "mouth of the Law" (*la bouche de la loi*). In this sense, when interviewed, the retired judge J.R. Ludke answered: *"I don't believe that I was a judge of employees or of employers. I guess that a judge must be a judge".* He also said: *"A judge must be a judge and apply the labor law and its principles. It's not the judge that protector [of the worker]. It's the [labor] Law, isn't it? It's the Law!"* Basically, this kind of attitude

before the Law is representative of the collective *habitus* of judges in the first generation of Brazilian Labor Courts.

2. The second generation: the Marxist founders.

Although Brazilian Labor Courts were created in the 40s, the true labor law charismatic founders were the judges of the hyper-politicized and ideological generation that stood out in the 80s and the 90s. We call “Marxist labor judges” those who held their ideological worldviews against the traditional idea that a judge should be neutral and impartial, before political issues, as in Montesquieu’s rhetoric.

It’s important make it clear that the term “Judicial Marxism” is a concept built in context of “our” research, in order to make theoretically meaningful our empirical intuition. In sum, Marxist judges are those labor magistrates ideologically identified with Marxism, and related beliefs and values, which means, militants in the left and the far left part in the political ideological spectrum.

The career of a Marxist judge in Brazil - the path in which he learns and absorbs a “Marxist set of values and attitudes” - typically encompasses the experience of being and living among judges, but also (and more important) the early political initiation: normally, a political leftist militant experience, such as, being part of student movements, labor unions and left-wing parties, particularly at a young age. Such a perspective, concerned about the trajectories (paths) of the judges in and out (after and before they join) the magistrate career (SILVEIRA, 2011), intends to be critical to approaches that intent to explain the judicial ideologies only by the internal socialization in the bench, such as Junqueira (1997) and Bonelli (2002).

3. A qualitative path analysis: two ways of being a Marxist judge

Two great examples of Marxist judges are M.Castilhos and B.Cavallieri, which are our case study:

Castilhos, the first case, daughter of a humble railroad worker, had a poor childhood. She studied in a public high school and took “classical studies” courses, because she preferred it better than the sciences. She joined the student movement in an early age, in late 50s; and so she soon had problems with the Military rule. The military regime arrested her for the first time, in 1968, during the Congress of the National Union of Students (UNE) in Ibiúna.

She was also militant of the Catholic Action movement (*ação católica* in Portuguese); and, most important yet, she joined the reorganized Communist Party of Brazil (PCdoB). Throughout her militant career, she was arrested again twice again by the Military. As a communist, she was probably seen by the regime as a revolutionary.

She was already a lawyer when she was finally approved in the exams for judgeship. Castilhos considers herself to be a Marxist and stated, in our interview, that she follows the Historical Materialism “as a religion”. Now retired, she very often tells this joke: “*I was a labor judge, not a capitalist judge*” - Coherently!

Differently, our second case, B.Cavallieri, was the child of an elite family, and she was grown in relatively privileged circumstances. Granddaughter of aristocratic landowners, politically and economically influent, and daughter of the town doctor. Her family had close relationships with important

politicians, among them the State President Júlio de Castilhos's grandnephew, the National President Getúlio Vargas's son, and the National João Goulart himself.

Because João Goulart got little B.Cavallieri's father started in the cooperative movement, which was considered subversive at that time, the family had to exile to Europe during the 1964 Military Coup d'État. Cavallieri's mother was also an unconventional woman: she ran away from traditional familial standards, which expected her to be a housewife; she used to smoke cigarettes and ride horses ("male attitudes"); and she also got a position in the Red Cross, in order to work, and finally became an Arts teacher.

When Cavallieri was 15 years old, her father decided that she was supposed to study abroad, sending her to a high school in the United States. So, she had to skip sciences courses because of the difficulties with a foreign language. That's why - she explained - she took only Humanities courses, such as: History, English, Arts and Sociology. As an young adult, back in Brazil, she realized she wasn't able to attend the Architecture Faculty, as she wanted. Then, almost by chance, she ended up studying Law and becoming a judge: with such a background it's not a surprise that she would become a leftist judge – *a fortiori*, a Marxist judge.

Differently from Castilhos, born in a proletarian environment, who came to be a typical left-wing political militant, Cavallieri naturally turned out to be a leftist intellectual. Not only she was a labor judge, but also she became a Law School professor, but teaching especially the most "philosophical" subjects (such as "Labor Law Principles") and even got a postdoctoral degree in Economics. She says: *"In contrast to what people suppose, they [the Marxist historians] – Marx included – don't believe in inexorable laws. No! They contextualize and put reasoning, inside History; and time, which I think it's fundamental. Therefore, if this is being a Marxist, you may consider myself one"*.

4. The rise of the Social Law: Why only in late 80s?

From the 80s to the 90s, Marxist judges made a true symbolic revolution in the field of the laboral judicature, breaking the current tradition of neutral and impartial judges. Their motto was the "protective principle," which establishes that it's the role of the Labor Law to rebalance the social injustices originated from the malfunctioning of the capitalist society. We realize that this principle of Law is grounded in the Marxist theory postulate of class struggle, and the social inequalities it produces, as a given and incontestable truth.

But such a level of ideological engagement was not the mainstream among labor judges in decades. Notice that, although Brazilian Labor Law is dated to the 30s, it was only in the late 80s that its *raison d'être* could be enough legitimized in the legal field. As well stated by Professor Angela Castro Gomes: the new democratic Brazilian Constitution (1988) gave to social rights a "special consideration". The constitutional framers put Social and Labor Rights in a bold position, within the legal system, thus legitimizing Labor Courts as guardians of these new fundamental labor rights.

5. Magistrates and revolutionaries: an apparent paradox

By coining the term "Judicial Marxism" maybe we are creating a contradiction in terms; which is an important theoretical problem to be faced: Isn't it contradictory to say the one is simultaneously a State

officer (a magistrate) and a revolutionary (a Marxist)?

Marx (2008) affirmed that the function of the State and of the Law, in a capitalist society, is to maintain the *status quo*, which means, the regime of property in which social exploitation is based, the bourgeois property. In this sense, Marx held that the State is the “committee of the bourgeois class”. Marx’s “theory of revolution” still proposes that the internal contradictions of the capitalist economic system will create the social conditions for its collapse.

This way, most kinds of Marxist ideologues and activists have considered that the “historical mission” of the proletariat is to take control over the State (dictatorship of the proletariat), in order to destroy it later. So, logically, since judges are State officers, they could never be Marxists. As it was said, a “Marxist judge” is apparently a contradiction in terms. So, how to solve this apparent paradox?

It’s important to define how a “Marxist legal professional” works in practice. To do so, we need to distinguish the dynamics of “Marxism” in two different realms: the *political field* and the *legal field*.

In the one hand, Marxism is (said to be) a critical theory, which means, among other things, that - different from philosophical positivism (COMTE, 1978) - it does not detach the objective scientific analyses and the down-to-earth engaged action. This is exactly what the Marxist thinkers call “*práxis*”. So, it’s completely coherent that anyone who is a self-declared Marxist person should be (logically) also considered an engaged player, politically or ideologically - say, some kind of “revolutionary”.

Thus, Marxism works out efficiently *in the political field*, explaining the relative position of some of its players, and the “possible discourses” (besides attitudes, values and worldviews) to be held by a left-wing engaged player. However, it is logically complicated, to one who has a legal profession, and “represents” the State, to hold such a discourse while interacting *in the legal world*, “in the name of the State”. That’s why understanding “Marxist judgeship” may seem so complicated...

Our fieldwork unveiled the *practical ambivalence* of such players, called Marxist State magistrates, according to the field (legal or political) where they are acting and speaking. None of the judges – being Marxists or not – produce “Marxist speeches” while acting, as legal players, within the legal field, say, when dealing with strictly legal and technical issues; for example, while proffering judicial sentences or other legal opinions and documents.

However, the empirical evidence of the “Marxist ideology” of our judges can be only found, empirically, in their public discourses and non-technical publications or (like in this research) in their personal interviews. That is to say: ideology only appears in the political field; although it seems to hide behind legal forms, in official documents. Thus, you’ll never find it if you only analyze official documents and written judicial opinions. That’s why we teach to our students that it is a methodological error to consider data, in a research on judicial attitudes, only from official documents (judicial opinions).

If it’s true that judges politically oriented towards Marxism do not produce Marxist discourses when dealing with *strict Law* (juridical forms), we could formulate a further and necessary question: *what is the specificity of Marxist judges’ legal discourses?* We found that these justices produce sentences in which they widely adopt the *fundamental labor rights doctrine*, which is based on the concept of *dignity of work* (a laboral variation of Kant’s concept of the dignity of the human being). Hereafter, We propose that we should brand the ideology of these legal discourses, concerned about the fundamental labor guarantees, by the term “laboral garantism” (in reference and by analogy to the Ferrajoli’s theory of “criminal

garantism”⁷) (FERRAJOLI, 2010).

6. Laboral Garantism

In the 80s and the 90s, garantist legal decisions were produced by the overwhelming majority of labor judges - not only by those with a political initiation in their sociological backgrounds. At that time, many judges didn't have a background with an important political socialization, neither in the left nor in the right, but, on the contrary, they often had backgrounds of Humanistic learning from college. The humanistic worldviews included the philosophy of Kant, the theories of Ronald Dworkin and Robert Alexy, human rights theories, new constitutionalism, humanistic criminal theories and etcetera. This was a remarkable feature in the education of an important generation of Brazilian Law professionals, especially in the very south of the country.

In this context we had, for example, the Alternative Law movement. This trend began in the Court of Justice of the State of Rio Grande do Sul (*Tribunal de Justiça do Estado do Rio Grande do Sul* in Portuguese), the Appellate Court for common civil and criminal cases. The fact is that the garantist legal ideology in Brazil was contemporary to the consolidation of the democratic Constitution. It fed the content (the rationale) of the non-positivist legal speeches for every kind of judge: alternative judges, criminal and laboral garantists and even, strange as it may seem, to Marxist judges.

Both laboral garantist judges and Marxist judges have lived together, sharing a convergent legal rational, in Brazilian Labor Courts in a relatively peaceful atmosphere for almost two decades. Notice that, many times, “laboral garantism” and “Marxism” are professional and political ideologies not not shared necessarily, at the same time, by every labor judge, because it's not necessary that garantist judges have both the humanistic education and the political initiation. The truth is that Marxism and garantism can live together, once the prior is a political and philosophical doctrine, which responds only in the political world, but makes little sense in the legal field; while the later is a major philosophical theory especially applied to legal issues. Let us give you some examples...

The already mentioned appellate judge Cavallieri used to hold philosophical and political opinions easily classifiable as “Marxist” – and that's why we called her a “Marxist judge” in the context of this research. However, she used to face very technical legal issues, in the trials, expressing a true “garantist” rationale, in order to undermine the strict *ipsis litteris* interpretation of the law, this way creating a new and “alternative law”.

In 2004, the 45th Constitutional Amendment determined, among other things, that the Labor Justice had legal trial and judgement competence for cases about civil compensation for moral and patrimonial damages derived from the labor relations². After several discussions, it was found the consensus that the new competence of the Laboral Courts included the trials of civil compensations derived from occupational accidents. Thus, emerged the controversy about the statute of limitation (*prescrição* in Portuguese) fixing the time limit in which the worker must take file a lawsuit to enforce the intended compensation. The literal reading of the Civil Law suggests clearly that the deadline was 03 years or 20 years from the damage date,

² See Article 114, item VI, of the Brazilian current Constitution.

depending on the case³. Nevertheless, Cavallieri decided audaciously - say, alternatively, against the judicial common sense -, that the claims to repair moral damages derived from work accidents don't have any statute of limitation. She wrote antithetical opinions, holding a thesis based on a "garantist rationale", according to which, whatever the subject matter of the legal issue may be, there are no statutes of limitation when the dignity of human being is at stake. In this sense she said to us:

"Well, now, what is the right statute of limitation to be applied? I think that this is another order of comprehension. I think that, if we are dealing with demands for compensation of moral damages derived from a work accident, it touches the right to live (...). These are fundamental rights... I believe that the discussion we should start now is about knowing if are there (or not) statutes of limitations, but not about what's the statute of limitation to be applied. I wonder if the right to live has any statutes of limitation... I wonder if there is any statute of limitation to the right to have a dignified life. This is the doctrine of the inexistence of statutes of limitations to any rights derived from the fundamental rights: fundamental rights don't have such statutes, especially the right to live. Don't you agree?"

This is a typical example of a laboral garantist thought, shared by both kinds of laboral judges, the "pure garantist" and the "Marxist": both of them write judicial sentences this way.

7. Conclusion: New (technocrat) kids on the block

By the 2000s, Marxist veteran judges were challenged by a younger generation of hyper-technicist magistrates, with an important background of years of education in the benches of "preparatory courses". In contrast to the last strong judicial generation, whose main feature is the belief that laboral judges' role is to protect the workers, counterbalancing social and economic injustices, the new technocrats believe that the Labor Law is protective enough and it's not their job to be active in favor of the employees.

As "pure professionals" and technicians, the new technocrats hold a position openly against all kinds of judicial activism. In this sense, a young judge of a district trial court, J. Hoff, said to us: *"(...) I'm against the idea of applying the protective principle to any hypothesis. I guess the principle of equality has to drive the trial. (...) He [the judge] doesn't need, I believe, to conduct the trial by holding a point of view in support of the employee party"*.

Another young substitute judge, R.E.Müller, stated something similar:

"I think that the Law already protects the employee. The Law does it already! If the judge intends to protect him even more than the Law does, he will create an inequality to the other party [to the employer party]. Here is what I think: there is the protective principle, isn't there? There is the economic inequality. Here comes the legal protection to balance the poles. So, I'd say: the Law already balances the relationship. I believe that it's not the judge's task to protect them even more! By applying the Law the way it is, searching for its fairest sense, he [the judge] will be assuring that it's not going to occur a legal inequality between the parties in the trial".

Now it's clear that the current relations of forces in the field put the *old veterans, politically devoted,*

³ Please, read Article 205, paragraph 3, item V, and Article 2.028, in the Brazilian Civil Code of 2002.

in direct struggle against the *new technocrats*, oriented only by their ideals of *professionalism*. The eloquent theory of the opposition between grand old man and new technocrats was created by Dezalay and Garth (1994), although in a quite different context.

Another remarkable difference between the old Marxists and the current legal positivist judges is built by analogy to the Max Weber's political theory of the "two types of political life": Weber (2002) used to say that one can live *for* the politics or *off* politics. The first one takes politics as a mission or a cause in the name of which it's worth to live and to die. The second one considers politics as a job, a source of income. In the same sense, we can say that the veteran Marxists have "lived for the judgeship", while the new technocrats are "living off the judgeship". That's the difference of considering judgeship as a vocation, in its religious sense, or as a profession, in a strict economic sense.

By asserting the autonomy of the juridical discourse, rather than the political ideology, these new legal positivist judges - in Kelsen's sense (KELSEN, 1998) -, so called "professional jurists", partially delegitimized the judicial activism of the charismatic founders of the social justice ideals in Brazilian judicial tradition. Today, some young technocrats call their veterans "dinosaurs" or "jurassic". Judicial Marxism faces a crisis, nowadays, losing space to "pure garantist" and "legal positivist" judges; even though it still carries a little aura of legitimacy (because it's the only labor law tradition that deeply justifies the "protective principle", dear to many legal professionals, by assuming the class struggle theory as a main postulate). The protective principle (social justice) is still (although its everyday less true) the very heart of Labor Law in Brazil.

Finally, our contribution was to give a name and to discern the specificity and the main relations involved in this social phenomenon, now called "Judicial Marxism".

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Inverse Affective Abandonment and the Judicialization of Affection

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Abstract

This article aims to analyze the Institute of Inverse affective abandonment and the effectiveness of the judicialization of the demands resulting from the lack of affection with older people. To this end, it shows the analysis of the aspects related to the increasing population aging, the elements, and criteria used in the characterization of the older person, as well as the challenges arising from aging in the person who touches Family, society and the public power. It will also be analyzed the objective and subjective aspects related to legal protection and care for the elderly who suffer the affective abandonment, with a view to the debate about the possibility of compensation for moral damages in case of immaterial neglect. Finally, to verify whether the legal protection sought by the judicialization of the demands arising from it is capable of producing a sentence able to generate or make reestablish the affection. The work is conceived according to the inductive method, using the technique of bibliographic research, Doctrinaria and jurisprudential.

Keywords: Abandonment; Affection; Indemnity; Elderly; Judicialization.

1. Introdução

Envelhecer é o mais natural de todos os processos da vida humana. A condição de estar vivo pressupõe o envelhecimento, e este traz consigo diversos desafios, não só às pessoas que se encontram em avançado estágio da vida, mas também à família, sociedade e ao Poder Público.

Diante desta realidade é que a Constituição da República Federativa do Brasil, o Código Civil e o Estatuto do Idoso estabelecem a responsabilidade de cuidado ao idoso à família precipuaemente, mas também à sociedade e ao Poder Público de forma conjunta.

Embora o cuidado seja um dever legal compartilhado, a população idosa ainda sofre com o desrespeito ao dever de cuidado material, e, de sobremaneira, com a falta do amparo afetivo da prole, o chamado abandono imaterial paterno filial, ou ainda, abandono afetivo inverso, que por, muitas vezes, leva a quadros depressivos e conseqüentemente ao desinteresse pela vida, que pode ser fatal.

Diante da gravidade e crescente número de casos de abandono afetivo de idosos é que os Projetos de Lei nº 4.294-A de 2008 e nº 4.562/2016 buscam a legitimação por meio da disposição expressa do que é o abandono afetivo inverso, e que este é capaz de gerar o direito à indenização por danos morais.

Contudo, não há ainda, no ordenamento pátrio, dispositivo legal expresso hábil a coibir ou amenizar, na esfera Cível, os danos causados pelo abandono imaterial paterno filial, mesmo com o notável avanço das garantias específicas estabelecidas na Política Nacional do Idoso (Lei nº 8842/1994) e no Estatuto do Idoso (Lei nº 10.741/2003), com reflexos nos entendimentos doutrinários e jurisprudenciais.

Por outro lado, no que tange à tutela jurídica, com vistas aos avanços proporcionados pelas normas específicas e aquelas estabelecidas na Constituição da República, há reflexos positivos nos entendimentos doutrinários e jurisprudenciais, onde tal instituto vem sendo reconhecido cada vez mais como uma violação do dever de cuidado e também como uma violação de direitos humanos.

Tais demandas judicializam o afeto, levando ao Poder Judiciário o desafio de julgar a violação do dever de cuidado, do desrespeito à dignidade da pessoa humana, com vista a necessidade maior do ser humano, que vai além da indenização ou compensação pela falta de amor.

Com isso se questiona se a judicialização das demandas referentes ao abandono afetivo inverso pode produzir uma sentença capaz de gerar ou reestabelecer os laços de afeto entre pais e filho, e como o Poder Judiciário a partir das experiências com as garantias e procedimentos utilizados nos processos referentes à criança e adolescente pode oferecer ao idoso uma tutela afetiva satisfativa, com cunho de tentar o reestabelecimento e ou a manutenção dos laços e deveres afetivos.

2. Envelhecimento e o Abandono afetivo Inverso

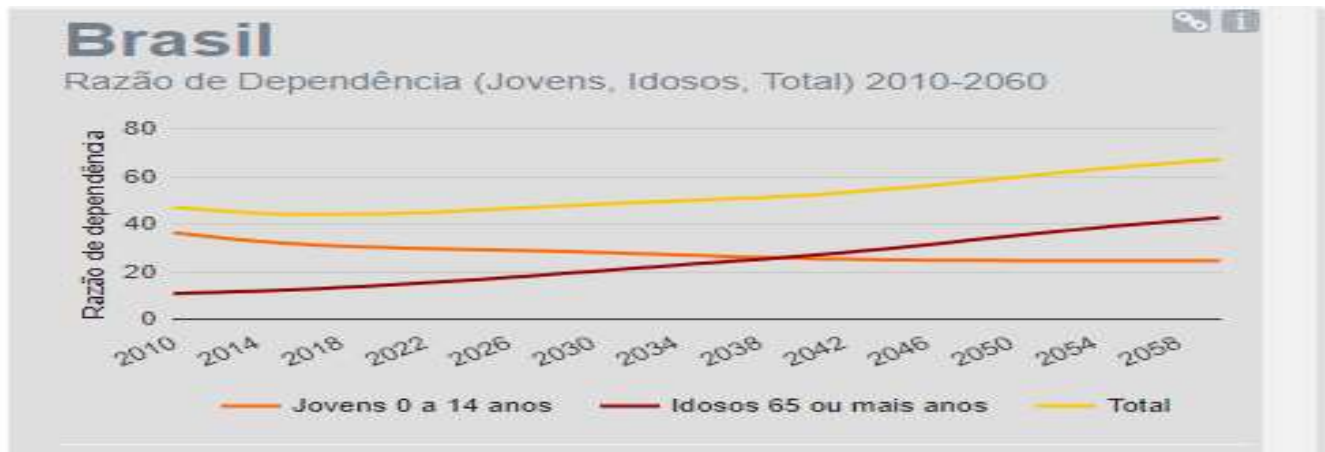
O mundo como um todo está envelhecendo “a faixa etária que mais cresce é a da população idosa acima de sessenta anos. Tanto no Brasil quanto na maior parte do planeta (particularmente nos países desenvolvidos), esse é o grupo humano que mais aumenta” (Paula, 2016, p. 263).

A expectativa de vida mundial aumentou substancialmente. Entre 2010-2015, a expectativa de vida ao nascer era de 78 anos nos países desenvolvidos e 68 nos nas regiões em desenvolvimento, hoje as projeções para 2045-2050, é de que os recém nascidos possam viver até os 83 anos nas regiões desenvolvidas e 74 naquelas em desenvolvimento. (ORGANIZAÇÃO DAS NAÇÕES UNIDAS, 2012), sendo este um dos fatores que mais influenciam o envelhecimento mundial.

Entretanto, para que haja o envelhecimento de determinada população, é necessário um processo dinâmico que exige primeiro o nascimento de muitas crianças em determinado período, e que estas sobrevivam até idades avançadas, e que simultaneamente o número de nascimentos diminua durante o período de envelhecimento. Com isso o número de jovens na população fica reduzido, em proporção com aquelas pessoas que sobreviveram até idades mais avançadas (Kalache, Veras, & Ramos, 1987).

No Brasil, segundo informações publicadas nas Projeções e Estimativas da População e das Unidades da Federação realizadas pelo Instituto Brasileiro de Geografia e Estatística (2018), a população brasileira segue a realidade das populações mundiais e em menos 20 anos a população idosa ultrapassará a população de jovens de 0 a 14 anos, conforme gráfico da figura 1.

Figura 1: Estimativa Populacional



Fonte: IBGE/Diretoria de Pesquisas. Coordenação de População e Indicadores Sociais. Gerência de Estudos e Análises da Dinâmica Demográfica. Projeções e Estimativas da População e das Unidades da Federação (IBGE, 2018)

O gráfico da figura 1 demonstra a urgência e necessidade de se pensar e planejar, como a sociedade atual pode se tornar mais justa e digna com as pessoas em idade avançada, tendo em vista a realidade referente aos problemas enfrentados pela população idosa, com vista a mudanças fundamentais para que esta tenha uma vida mais feliz, restando clara a maior necessidade de atenção, proteção e amor neste estágio da vida. Deste modo, vale ressaltar que:

no contexto brasileiro, o acelerado crescimento da população idosa faz surgir um grande desafio: como garantir uma sobrevivência digna a todos aqueles que tiveram suas vidas prolongadas em anos? A busca de soluções adequadas exige a inclusão do envelhecimento da população brasileira como um elemento fundamental na elaboração das novas políticas e na agenda de investigações científicas do novo milênio. (Minayo & Júnior, 2002, p. 25)

Outro desafio decorrente desta realidade, é estabelecer quem deve-se considerar uma pessoa idosa ou não, tendo em vista a natureza singular que cada pessoa estabelece com relação ao seu próprio envelhecimento, posto que a definição etária não leva em conta que “envelhecer é uma característica individual de cada pessoa, condições biológicas estão interligadas à idade cronológica, existindo, portanto, outros fatores que contribuem para a velhice” (VIEGAS & BARROS, 2016, p. 172).

Na complexa tarefa de conceituar quem seria considerada uma pessoa idosa, a Lei nº 8.842/1994, que implementou a Política Nacional do Idoso, adotou o critério puramente etário, estipulando em seu artigo 2º que: “Considera-se idoso, para os efeitos desta Lei, as pessoas maiores de sessenta anos de idade”. Alguns anos depois, o Estatuto do Idoso (Lei nº 10.741/2003) também adotou o mesmo critério com a diferença de se considerar idoso “toda pessoa com idade igual ou superior a 60 (sessenta) anos”.

Adotando o mesmo critério, a Organização Mundial da Saúde OMS (2002) faz uma pequena distinção ao determinar que pessoa idosa é aquela com 60 anos ou mais em países em desenvolvimento, e com 65 anos ou mais em países desenvolvidos.

A doutrina jurídica vem buscando estabelecer os critérios a partir dos vieses biológicos, econômicos, sociais e psicológicos para a delimitação do conceito de idoso no contexto jurídico contemporâneo do país (SILVA & LOI, 2016, p. 4).

Neste sentido, o conceito de capacidade funcional é particularmente útil no atual contexto do envelhecimento, pois envelhecer mantendo todas as funções não significa problema quer para o indivíduo ou para a comunidade; entretanto, quando as funções começam deteriorar é que os problemas começam a surgir” (Kalache et al., 1987, p. 208).

Apesar de o critério etário não considerar a amplitude e singularidade do envelhecimento individual, este foi adotado no Brasil tendo em vista principalmente a urgência na delimitação do grupo populacional para a formulação de políticas públicas e garantia de direitos.

O limite etário é necessário, tendo em vista as transformações no decorrer da trajetória de vida de um idoso, as quais demarcam obstáculos que antes pareciam corriqueiros, mas, infelizmente passaram a ser difíceis de se transpor. Sendo certo que, é nessa fase da vida, conforme apontam Viegas e Barros (2016), que o amparo familiar e o respeito das garantias impostas pela legislação são especialmente necessários.

Contudo, o utilitarismo implantado nas relações humanas aumenta os problemas enfrentados pela população idosa, não bastassem as dificuldades naturais do envelhecimento nas ordens físicas, biológicas, social, cultural, sexual e cognitiva, ainda é necessário enfrentar o estigma da inutilidade e o não planejamento familiar para lidar com os idosos após seu período econômico-produtivo.

Neste sentido, Maria Mesquita da Fonseca e Hebe Signorini Gonçalves argumentam que:

Assim, o idoso tem sua imagem associada à decadência, à perda de habilidades cognitivas e de controles físicos e emocionais, fundamentos importantes da autonomia dos sujeitos, e as várias doenças crônicas de que são portadores colocam-nos em estado de dependência que demandam cuidados para os quais a família nem sempre está disponível. (Fonseca & Gonçalves, 2003, p. 2).

Além das políticas públicas, a relação do idoso no ambiente familiar afeta diretamente a sua dignidade e qualidade de vida. A família é a primeira e mais importante fonte de interação e estabelecimento de laços humanos e sociais, e, por este motivo, o ambiente no qual a pessoa em idade avançada se encontra é crucial para o envelhecimento digno.

Deste modo, a família é o arcabouço psicológico do ser humano, a memória afetiva, o primeiro núcleo social de educação, por isso tem uma função socializadora para além da formação do ser humano, pois transmite conhecimento, valores e afetos, e a ausência dessa troca afetiva pode caracterizar o abandono (SILVA & LOI, 2016).

O abandono pela ausência de troca afetiva, também chamado de abandono imaterial, ocorre quando a família age com descaso, falta de cuidado, desamor nas relações e desrespeito aos direitos de personalidade, como o direito de se viver em família, atitudes estas que afetam diretamente a qualidade da existência emocional do idoso.

O desamparo ou abandono material, por outro lado, diz respeito ao não fornecimento de recursos necessários a garantia da subsistência da pessoa idosa, quando há omissão quanto aos deveres de assistência familiar, relacionadas a uma vida digna, os quais afetam diretamente a existência física da pessoa idosa, ou seja, sua sobrevivência.

A respeito desse delicado tema, o Instituto Brasileiro de Direito de Família (IBDFAM) informa que “o principal motivo do abandono aos idosos em asilos e casas de repouso é a dificuldade de relacionamento com filhos, netos, genros e noras” (IBDFAM, 2018).

O abandono é uma das formas relatadas de violência contra a pessoa idosa, que podem ocorrer de diversas formas como bem sistematiza Maria Elisa Gonzalez Manso (2019, p. 76):

A literatura mostra uma tipologia destes abusos, os quais incluem: (I) violência psicológica, caracterizada por agressão verbal ou gestual com finalidade de aterrorizar, humilhar ou restringir o idoso; (II) abuso sexual, homo ou heterossexual, mediante aliciamento, violência física ou ameaças com o objetivo de obter excitação à custa do idoso; (III) abandono, consistindo na deserção ou ausência dos familiares nos cuidados do idoso ou no não acionamento de órgãos responsáveis para tal; (IV) negligência, onde os cuidados que poderiam ser oferecidos ao idoso são omitidos; (V) abuso financeiro e econômico, quando há exploração dos recursos financeiros e patrimoniais do idoso. **Grifos nossos.**

Seja material ou imaterial, o abandono de pessoas idosas é uma dura realidade crescente e que ganha cada vez mais notoriedade, devido ao crescimento do número de idosos e do protagonismo social dessa parcela da população.

3. Proteção Jurídica do Idoso Frente ao Abandono Inverso

Com vista ao protagonismo e aos problemas enfrentados pelos idosos com o abandono afetivo inverso é que tramita o Projeto de Lei 4.562-B de 2016 e tramitava na Câmara dos Deputados o Projeto de Lei nº 4.294-A de 2008, ambos destinados a estabelecer de forma expressa a indenização por dano moral em razão do abandono afetivo inverso, constando nas suas justificativas do primeiro projeto que:

No caso dos idosos, o abandono gera um sentimento de tristeza e solidão, que se reflete basicamente em deficiências funcionais e no agravamento de uma situação de isolamento social mais comum nessa fase da vida. A falta de intimidade compartilhada e a pobreza de afetos e de comunicação tendem a mudar estímulos de interação social do idoso e de seu interesse com a própria vida. (BRASIL, PROJETO DE LEI Nº 4.294-A, BRASÍLIA, 2008).

Tal justificativa coaduna com os dados coletados e apresentados na pesquisa de Maria Cecília de Souza Minayo e Fátima Gonçalves Cavalcante (2010), que informa sobre as alarmantes taxas de suicídio no que se referem à população na faixa etária acima de 60 anos, que são o dobro das que a população em geral apresenta, posto que, conforme as autoras da pesquisa:

no processo de envelhecimento a vivência de situações altamente desvitalizantes, com frequente comprometimento subjacente da saúde mental, podendo conduzir a quadros depressivos, o que pode muitas vezes determinar a ocorrência de pensamentos suicidas e/ou a execução do ato. Acredita-se que dois terços dos suicídios na população idosa estão relacionados à depressão. O grande número

de ocorrências de suicídios na população idosa destaca-se dentre as causas de mortes nesse grupo populacional, sendo considerado um problema de saúde pública mundial (Minayo & Cavalcante, 2010, p. 855).

Próximo dessa realidade, o constituinte originário de 1988 previu na Constituição da República Federativa do Brasil, mais especificamente na segunda parte do art. 229, que: “Os filhos maiores têm o dever de ajudar e amparar os pais na velhice, carência ou enfermidade”, amparo tal que, à luz da irradiação dos efeitos do princípio da dignidade da pessoa humana, não se limita ao âmbito material, mas também à esfera imaterial, na qual se inclui a necessidade humana de afeto.

Além do dever de amparo dos filhos, a Carta Maior em seu art. 230 assevera também que: “A família, a sociedade e o Estado têm o dever de amparar as pessoas idosas, assegurando sua participação na comunidade, defendendo sua dignidade e bem-estar e garantindo-lhes o direito à vida” (BRASIL, 1988).

Como se vê, o texto constitucional prevê o dever do Estado e da sociedade no amparo à pessoa idosa. Contudo, atribui a família de forma precípua o dever de cuidado aos pais idosos podendo se extrair que esse cuidado deve advir primeiramente de seus descendentes, não se podendo esquecer que embora exista uma “ordem de preferência”, muitos filhos não estão preparados para receber seus pais idosos (VIEGAS & BARROS, 2016).

Tais comandos constitucionais já seriam suficientes para legitimar a obrigação familiar de amparar ao idoso em prol de sua dignidade e bem-estar. Entretanto, em âmbito infraconstitucional, o legislador ordinário instituiu, por meio da Lei nº 10.741/2003, o chamado Estatuto do Idoso, com a finalidade de regular os direitos assegurados às pessoas com idade igual ou superior a 60 (sessenta) anos, e que em paralelo ao texto constitucional reforça tais deveres de cuidado em seu artigo 3º, ao asseverar que:

Art. 3º. É obrigação da família, da comunidade, da sociedade e do Poder Público assegurar ao idoso, com absoluta prioridade, a efetivação do direito à vida, à saúde, à alimentação, à educação, à cultura, ao esporte, ao lazer, ao trabalho, à cidadania, à liberdade, à dignidade, ao respeito e à convivência familiar e comunitária. (BRASIL, 2003).

Não bastassem as normas de proteção explícitas na Constituição e no Estatuto do Idoso, decorre deles o princípio da afetividade das relações familiares, o qual segundo Calderon (2011) viabiliza respostas mais adequadas a plural e instável realidade das relações familiares, pois apresenta duas vertentes, a primeira se apresenta em forma de dever jurídico voltada às pessoas que possuam algum vínculo de parentalidade ou conjugalidade de forma a estabelecer o dever de reciprocidade afetiva nessas relações. Na segunda, será gerado o vínculo familiar àqueles que não possuam este vínculo reconhecido pelo sistema (parentalidade e ou conjugalidade), de modo a trazer a percepção exata da importância do afeto nas relações familiares. Dessa maneira, “o afeto deixou de ser algo presumido em núcleos familiares e passou a ser norteador para a formação de uma estrutura familiar sólida, merecedor de abrigo no Direito de Família, pautado no respeito, e, principalmente, no amor” (VIEGAS & BARROS, 2016, p. 185).

Logo, não há dúvidas que a proteção do afeto decorre da própria dignidade da pessoa humana e da proteção constitucional do direito de família, incidindo sobremaneira na tutela da pessoa idosa, notadamente diante de suas vulnerabilidades peculiares.

De acordo com Maria Elisa Gonzales Manso:

Apesar de inúmeros esforços e da existência de legislação e políticas públicas, ainda há muito que avançar para que os idosos possam se considerar cidadãos e sujeitos de direito. As dificuldades que se impõem à efetivação destas políticas perpassam não apenas pela mobilização social dos idosos. A atual conjuntura política brasileira dificulta a implementação e propõe retrocessos em várias políticas públicas arduamente conquistadas (Manso, 2019, p. 76).

Além disso, apesar de a família ter responsabilidade e dever legal de cuidado com os idosos, o crescente número de casos de abandono por parte dos filhos e familiares acarretou o surgimento de demandas judiciais relacionadas aos abandonos, tanto na esfera criminal quanto cível (material e moral) pelo chamado abandono inverso.

4. Judicialização do afeto

No que se refere a esfera criminal, o abandono do idoso é tipificado como crime no Estatuto do Idoso em seu artigo Art. 98, que diz: “Abandonar o idoso em hospitais, casas de saúde, entidades de longa permanência, ou congêneres, ou não prover suas necessidades básicas, quando obrigado por lei ou mandado: Pena – detenção de 6 (seis) meses a 3 (três) anos e multa” (BRASIL, 2002) e no Código Penal em seu Art. 244, in verbis:

Art. 244 - Deixar, sem justa causa, de prover a subsistência do cônjuge, ou de filho menor de 18 (dezoito) anos ou inapto para o trabalho, ou de ascendente inválido ou maior de 60 (sessenta) anos, não lhes proporcionando os recursos necessários ou faltando ao pagamento de pensão alimentícia judicialmente acordada, fixada ou majorada deixar, sem justa causa, de socorrer descendente ou ascendente, gravemente enfermo: (Alterado pela L-010.741-2003) Pena - detenção, de 1 (um) a 4 (quatro) anos e multa, de uma a dez vezes o maior salário mínimo vigente no País. (BRASIL, 1941).

Assim, tendo em vista a clara tipificação do crime de abandono referente a pessoa idosa, seja no Estatuto do Idoso ou no Código Penal, a tutela criminal não apresenta divergência doutrinária ou jurisprudencial quanto a possibilidade de sanção.

Contudo, no âmbito da tutela cível, seja nos tribunais pátrios ou na doutrina existem polêmicas relacionadas a possibilidade de indenização pelos danos morais e materiais advindos do abandono inverso.

No que tange ao abandono material paterno filial, as divergências existem, mas quanto a possibilidade de prestação de alimentos dos filhos para os pais, não há muita discussão, posto que se infere diretamente do texto legal inserto na primeira parte do artigo 1.696 do Código Civil de 2002 que: “O direito à prestação de alimentos é recíproco entre pais e filhos [...]”.

Por outro lado, quando se fala da reparação por abandono inverso imaterial, também chamado de abandono afetivo inverso, ou ainda, de teoria do desamor, está tem sido alvo de muita discussão e reflexão na doutrina, nas pesquisas e principalmente na jurisprudência. Percebe-se, também, uma grande preocupação no que se refere à comercialização do afeto; a finalidade é vedar exageros e por esse motivo tem-se utilizado pelos tribunais muita cautela nas ações de indenização por danos morais por abandono afetivo (MARCO & MARCO, 2012).

Por não haver uma previsão expressa, os tribunais têm adotado via de regra uma interpretação axiológica, posto que o bem jurídico violado no caso do abandono afetivo dos pais por seus filhos, guarda íntima similitude com o abandono afetivo dos filhos pelos seus pais.

Para a Ministra Nancy Andrighi do Superior Tribunal de Justiça, o não cuidado afetivo, o comportamento de desamor e a ausência familiar geram os sentimentos de impotência e a sensação de ser traído por aqueles que deveriam dele cuidar, assim, para ela, na indenização por abandono afetivo: não se fala ou se discute o amar e, sim, a imposição biológica e legal de cuidar, que é dever jurídico (ANDRIGHI, 2012).

Outro exemplo interessante de entendimento, diz respeito a decisão proferida pelo Juízo da Comarca de Brasileia (AC), onde em sede de sentença, apontou que em decorrência do visível abandono moral e afetivo inverso, restou demonstrada a ingratidão, despreço e ausência de sentimento afetivo para com pai ainda em vida pela filha, o qual foi submetido ao desamparo e a solidão até sua morte em casa de acolhimento. Assim, diante do inequívoco abandono afetivo paterno filial, nada mais justo que o deferimento do pleito de herança em somente 50% do valor existente em conta bancária em favor da filha, proporção garantida no direito sucessório e a outra metade em favor do Lar dos Vicentinos, onde o idoso passou seus últimos dias, ressaltou o Juiz de Direito Gustavo Sirena (TRIBUNAL DE JUSTIÇA DO ESTADO DO ACRE, 2018).

Tais entendimentos demonstram que, apesar de a temática ser abordada somente de forma expressa no projeto de Lei n.º 4.294-A de 2008 e não haver determinação da mesma natureza na Constituição Federal 1988, no Código Civil Brasileira e nas leis específicas nº 10.741/2003 e nº 8.842/1994, a reparação civil por abandono afetivo inverso tem seus pressupostos presentes nestas normas e, caso venha a ser aprovado o projeto de lei mencionado, também terá legitimidade expressa no Código Civil e no Estatuto do Idoso. Contudo, conforme lecionam Cristhian Magnus De Marco e Charlotte Nagel De Marco (2012, p. 37):

É óbvio que não se pode cobrar amor de ninguém. Não se pode obrigar os pais a amarem seus filhos, tampouco os filhos a amarem e honrarem seus pais, porém, deve-se ao menos permitir que o prejudicado receba a devida indenização pelo dano que lhe foi causado. Disso decorre o caráter pedagógico do instituto da responsabilização civil por abandono afetivo praticado, pois, além de uma forma de sanção para aqueles que abandonam afetivamente, também serviria como um desestímulo àqueles que, porventura, possam causar tal tipo de dano.

A judicialização do afeto revela que a busca de “indenização pelo abandono afetivo dos familiares será uma forma de coibi-los de tal atitude, servindo como punição, já para o idoso trará, de certa forma, um acalanto para a alma ou quem sabe o alcance para o próprio alimento” (Machado & Toaldo, 2012)

Entretanto, “a judicialização das lides que envolvem no seu núcleo material a falta de afeto, não traz de volta o principal objeto da demanda, qual seja, a falta do sentimento afetivo recíproco, ao contrário, poderá distanciar mais os dois polos da ação, uma vez que não se pode obrigar uma pessoa a manter o vínculo afetivo com outra” (Scheinvar & Aguiar, 2017, p. 5).

Diante desse quadro, tais demandas também evidenciam a falta de efetividade das políticas públicas, a ausência de conscientização da sociedade quanto às necessidades da pessoa idosa e demonstram, de sobremaneira, a fragilidade na construção e manutenção das relações familiares.

Dessa forma, forçoso se torna questionar se a judicialização usual é uma opção viável ao reestabelecimento de laços afetivos, tendo em vista que uma sentença fundada apenas em reparações morais e materiais não é capaz de resguardar, garantir ou fazer desabrochar afeto.

Um processo que não se digna a analisar os desafios reais enfrentados pelos idosos em casos de abandono, não levando em conta todo o sofrimento e solidão causado, faz aumentar casos como o da Dona Laurinda, que em depoimento a pesquisa realizada por Fabiana Souza de Almeida deixa clara a urgência da viabilização de mecanismos judiciais e extrajudiciais de restabelecimento e promoção das relações afetivas:

Eu não lembro quem me trouxe para cá, mas queria morar com meus filhos só que eles não me querem. Eu morava com o caçula, mas depois que ele casou a mulher dele e nem ele me querem mais. Ele diz que eu sou doente e ele não tem tempo de zelar de mim, foi isso que ele falou”. Minha filha eu não sei. Meus filhos não me querem, um vive bebendo, outro casou e outro também não me quer. Tenho um neto que é o único que me visita. Eu sinto tanta falta dos meus filhos, às vezes quando eu acordo parece que eu to vendo eles. Tem vezes que eu choro, faz falta demais deles comigo. Eles nem ligam mais, só o mais novo que vem aqui. Eu não tenho nenhuma foto deles (VIEGAS & BARROS, 2016, p. 23 apud. ALMEIDA).

Em um país como o Brasil, com limitações de recursos às políticas sociais de atenção ao idoso, onde a judicialização tem se tornado a última investida e pedido de socorro, impõe ao Judiciário o dever de expansão de seus mecanismos de fortalecimento à família já utilizados nas demandas relacionadas à criança e ao adolescente.

Dessa forma, urgente e possível é a viabilização à população idosa dos mesmos meios alternativos de resolução e mediação de conflitos já utilizados com os processos de abandono afetivo dos filhos pelos pais, tendo em vista que com o crescimento da população idosa e sua projeção referente às pessoas com idade entre 0 e 14 anos, resta demonstrar que na simetria entre o aparato disponível para resguardar os direitos das crianças e adolescentes e o disponível à população idosa é um dos caminhos que o Judiciário pode abrir, para gerar sentenças que realmente promovam ou ao menos tentem reestabelecer o afeto familiar.

Tal simetria passa pela viabilização de varas especializadas em violência contra a pessoa idosa, a expansão das oficinas de parentalidade para aproximação da família com a pessoa idosa como ocorrem com as violações a direitos afetos as crianças e adolescentes.

Posto que, apesar de os recursos materiais serem imprescindíveis para a sobrevivência do idoso e a indenização por danos morais ser um avanço para coibir o abandono imaterial, o ser humano precisa de mais do que isso. O afeto ou a falta dele na vida de uma pessoa gera efeitos positivos ou negativos, e,

claramente um idoso que vive em um ambiente afetivo e fraternal dispõe mais força e ânimo para vencer os impasses da vida (SILVA & LOI, 2016).

Neste sentido, aponta Ricardo Lucas Calderon (2011, p.24), em sua dissertação de mestrado defendida na UFPR, “o direito deve laborar com a afetividade e sua atual consistência indica que se constitui em princípio no sistema jurídico brasileiro. A solidificação da afetividade nas relações sociais é forte indicativo de que a análise jurídica não pode restar alheia a este relevante aspecto dos relacionamentos”.

A saúde mental, especialmente quando se trata de abandono ou violência intrafamiliar, parece estar cada vez mais conectada aos direitos humanos. Pois, “onde não houver respeito pela vida e pela integridade do ser humano, onde as condições para a dignidade não estiverem asseguradas, onde a intimidade e a identidade do indivíduo forem objeto de ingerência indevida, e onde sua igualdade não for garantida, não haverá espaço para a dignidade da pessoa humana” (Baltes, 1993, p. 581).

O judiciário precisa se reinventar. E tal reinvenção passa pela ampliação e disponibilização dos mecanismos e aparatos existentes às demandas relacionadas as crianças e adolescentes, de tal forma que os idosos possam dispor de um processo que disponibiliza uma oportunidade de reestabelecimento do afeto pretendido.

5. Considerações Finais

Os obstáculos a serem superados pela população idosa são muitos e de diversas ordens. Além do envelhecimento físico e biológico, o idoso também enfrenta o estigma da inutilidade, decorrente da cultura das sociedades utilitaristas, que valorizam o ser humano a partir do parâmetro econômico-produtivo.

Mesmo com o crescimento numérico e o protagonismo que a população idosa vem estabelecendo na sociedade atual, a cultura do descarte às pessoas em idade avançada continua, e estas não recebem a atenção que lhes é compatível.

A família não foi educada para compreender a vital responsabilidade que os filhos têm para com seus genitores, o que gera grande fragilidade nas relações familiares e por diversas vezes rompimento dos laços afetivos. Fato social que tem causado diversos transtornos psicológicos, abalo moral e, por muitas vezes, a perda do interesse em viver.

Diante de tal quadro, é que surge a figura do abandono afetivo inverso e a relevância da discussão quanto a judicialização do afeto, com a possibilidade de indenização em danos morais decorrentes de tal abandono e, mais afundo, a efetividade da indenização mediante o bem jurídico tutelado.

Tendo em vista que, conforme bem assevera a Ministra Nançy Andrigui (2012, n.p.), “amar é faculdade, cuidar é dever”, evidencia-se a ineficiência das sentenças que apenas promovem a condenação em indenização por danos morais, a qual não é capaz de resguardar e garantir o bem jurídico tutelado.

Assim, devido à urgência e dentro do que é possível hoje, o avanço na proteção aos idosos passa pelas possibilidades de ampliação dos mecanismos judiciais e extrajudiciais já utilizados pelo Poder Judiciário na proteção à família da criança e do adolescente, sendo urgente que sejam disponibilizadas tais ferramentas às demandas pela busca de afeto pelos idosos, posto que como bem defende o Ministro do Supremo Tribunal Federal brasileiro Luís Roberto Barroso (2016, p. 22) “a vida é feita das circunstâncias e do possível e não do ideal”, já que o ideal seria a não necessidade das demandas judiciais de afeto. 4

Acknowledgement

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Application of BYOD In Digital Inclusion in The Elderly Municipal Park - Doctor Thomas

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Abstract

One of the biggest challenges today faced by people over 60 years of age is technological news, these people nowadays feel more alone than in the past, family members seem more distant and less attentive to their elderly, because most of the day they stay connected even at meals at home, meanwhile, their elderly are without communication or even without attention. The idea is not only to introduce the elderly to technologies, but also how to make this transition from the real world to the digital one, in a way that does not cause even a trauma, as most of them are unable to keep up with these technological changes. The elderly inclusion project using the BYOD methodology in the Municipal Park for the Elderly was motivated due to having the highest concentration of elderly people in the state practicing some activity in order to fill this time gap, working mind and body. The idea of using the BYOD methodology, is that today the Park's technological equipment is mostly gone and the few that exist are broken or outdated, and the institution does not have more funds to renovate its computer lab, with that, the main objective of our article is to make digital inclusion using the personal technological equipment of the elderly in a place with comfort and tranquility.

Keywords: BYOD; Elderly Park; Digital inclusion; City Hall.

1. INTRODUCTION

This article aims to address the relationship between seniors and new technologies and the positive results brought about by this relationship between them. When the human being gets older, he faces different situations, it is necessary that he is always improving, evolving and adapting. The need to be included in the digital world today is indispensable for any age group, no one can live without knowing this fantastic tool that enables thousands of opportunities and growth. People are in a constant process of learning to adapt to the changing world. Information is something that spreads quickly and intensely through different sources, so the benefits that information technology offers has been observed in an increasing number, both globally and nationally and regionally, of the elderly who are more deeply interested in the technological world. However, the limitation is very big for the elderly, the constant change of technology is something that hinders their learning a lot, studying in one equipment and coming home to find another equipment is very difficult, the idea of learning in your own equipment is something new is different. With the explosion of new technologies: the idea is to give freedom to the elderly so that they can use their own equipment and devices to streamline their learning. In this convenience of dealing with computers and mobile devices that suit you, we hope at the end of the study to reach a satisfactory conclusion in the use of BYOD, as a tool to help better technological learning for the elderly.

2. THEORETICAL REFERENCE

2.1 What is B.Y.O.D?

B.Y.O.D. is the acronym for "Bring Your Own Device", in translation it means "Bring your own device", in practice the company or any other body allows you to use your own electronic devices to access corporate information or in this case a training at an institute of teaching, most common examples are smartphones and notebooks, in other cases we can think of your personal electronic equipment, which is in your home the same that you can use either in the company or in a corporate or educational training.

Knowing how to use your equipment outside the home will be essential for the success of a BYOD program, either at the company or at the training center. Not much is said about BYOD, being very absent in many works, but its importance today is extremely important to control software licenses so that these devices do not access the corporate network using unlicensed software. See BYOD as an innovative strategic project that involves the entire management of the company.

2.2 LAW No 10.741, OF OCTOBER, 2003

Art. 2 The elderly person enjoys all the fundamental rights inherent to the human person, without prejudice to the full protection referred to in this Law, assuring him, by law or by other means, all the opportunities and facilities, for the preservation of his physical and mental health and their moral, intellectual, spiritual and social improvement, under conditions of freedom and dignity.

Art. 3 It is the obligation of the family, the community, society and the Government to ensure the elderly, with absolute priority, the realization of the right to life, health, food, education, culture, sport, leisure, to

work, citizenship, freedom, dignity, respect and family and community coexistence.

2.3 Social Engagements - personal motivation factor.

Today, there are several actions aimed at the inclusion of the elderly, with successful results. The Browsing the Internet in the Best Age Program is a program carried out by the Institute of Information and Communication Technology of the State of Espírito Santo (Prodest) in partnership with the Secretary of State (Seger).

The goal is to include elderly people in the large world wide web (INTERNET), an initiative that has already trained more than 4,500 elderly people.

Encouraging digital inclusion for the elderly is a way to promote citizenship and improve the quality of life.

3. MATERIALS AND METHODS

In this article the method of bibliographic review and quantitative research was used, when we are referring to the bibliography it is with reference to the material in hand acquired, regularly, by books, official web sites, publications of periodicals. These, together with scientific articles, enable a blanket of broader and more varied content compared to explicit research, so there is an advantage in this method for a greater collectivity of information on the chosen theme. Thus, there is a bibliographic disposition in total relevance for the knowledge and acquisition of new information, considering that, many times, it is one of the essential means of study for an explorer. Knowing this, bibliographic research is a driver in the area of data collection and something that has often been tested, enabling the acquisition of new knowledge and the construction of critical freedom and methodology about what was shown in the study. On-the-spot research was also carried out, through the creation of a questionnaire and an interview with the park's visitors, which became graphics that, in the course of our article, illustrated in order to enrich our project.

4. RESULTS AND DISCUSSION

Our country has an advanced law to guarantee the rights of those who have passed the age of 60, but few administrations have implemented specific policies and practices for the elderly as in the state of Amazonas. The law that deals with the integral protection of this public was approved in 1994. It was drafted in order to provide health and well-being in the aging process and to build a social protection network that contemplates all spheres of life of the elderly. The PNI, regulated in 1994, also proposes to encourage the autonomy and independence of people in this age group. The main objective, within guidelines adopted internationally during two world meetings on aging, is to build a more just society for all ages. As the focus of our study on Digital Inclusion, it was conceived on the premises of the Parque Municipal do Idoso, in Manaus, which serves more than 3 thousand people over the age of 60 and offers leisure, health care, handicrafts and education. Some data were collected with 30 elderly people interviewed on the spot on 03/04/2020.



Figure 1 – Municipal Park of Source: Manaus City Hall website.

Average age of visitors to Parque Municipal do Idoso - Dr. Thomas Foundation. In the year 2019.

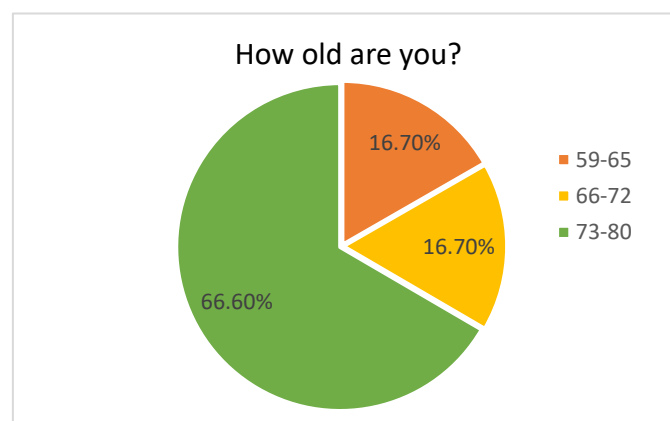


Figure 2 – Average Age of Attendants. Source: own authorship.

The participants of the Parque Municipal do Idoso - Fundação Dr. Thomas were asked. If they have cell phones.

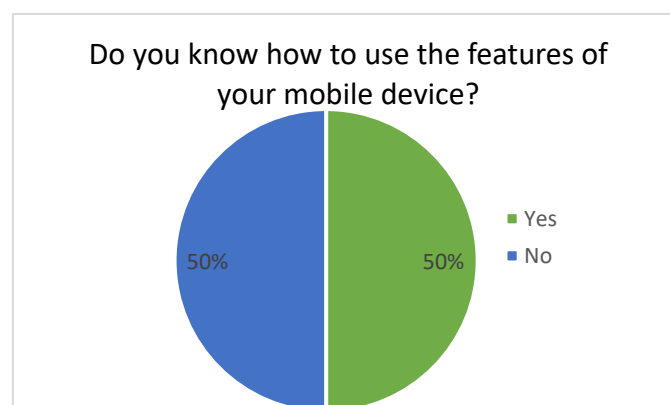


Figure 3 – Goers who own cell phones. Source: own authorship.

It was asked if the visitors of the Municipal Park of the Elderly - Fundação Dr. Thomas. They know how to use the resources of their mobile device.

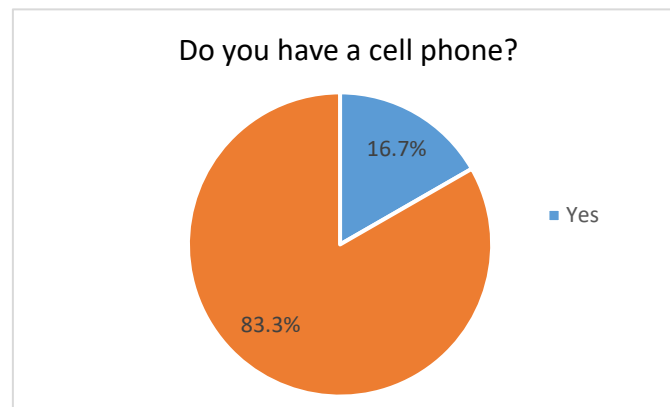


Figure 4 – Goers who know how to use technology. Source: own authorship.

The table below shows the number of senior citizens who can find something on their cell phones and computers.

Table 1: Can search information easily

<i>Information search</i>	<i>N</i>	<i>%</i>
<i>Yes</i>	24%	8
<i>No</i>	47%	16
<i>Sometimes</i>	29%	10
<i>Total</i>	100%	34

Source: Digital inclusion for the elderly: the importance of access to information.

5. CONCLUSION

It is observed that there are laws that are guarantees for the insertion of the elderly with the new existing technologies are indicative that offer several perspectives to this honorable generation, often misinterpreted by some government officials. The lack of commitment of some family members to enable greater engagement of their elderly is remarkable. It is not easy to keep up with the changes in this technological world, every day more modern devices are created, new computers appear, systems keep appearing, for younger people it is already very difficult to follow imagine for the elderly, with the idea of leaving the technology most common to them was introduced to the BYOD idea, where the entire study was performed on the elderly's equipment.

Encouraging the elderly to continue studying even though they have limitations and their family is not contributing as they should is a challenge. However, the world changes and minds change, - everyone is able to learn, even if I try some obstacle, with dedication and patience we can improve the daily lives of these people.

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VITAMIN D, IN THE BEST CLINIC IN AUTOIMMUNE, INFLAMMATORY INFECTIOUS AND DEMELINIZING DISEASES: A CRITICAL ANALYSIS

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Abstract

The term demyelination is used to characterize any inflammatory changes that occur in the medullary or cephalic region. Multiple sclerosis (MS) is a chronic inflammatory disease of the central nervous system and in general, besides being inflammatory [08, 25], demyelinating and with significant neuronal degeneration, it is considered an important cause of permanent disability in young adults [02-05]. The inflammatory process occurs by an irregular immune response usually mediated by T cells and acts as autoantigens and leads to destruction of the myelin sheath with genetic predispositions [21]. Thus, these chronic and disabling characteristics place a high cost on public health coffers by temporarily or permanently restricting the economic and social activities of their holders and also impacting the lives of their families in a financial and emotional way [15-18]. Still regarding the high cost treatment to inflammatory-infectious processes, primary and autoimmune demyelinating agents, such as sepsis in the adult and child population is considered a critical disease as the main cause of death in children intensive care in Brazil. In recent years in Brazil [24], the high rate of death from sepsis in Brazilian intensive care units has surpassed deaths from stroke and infarction and approximately 230.000 adult patients undergoing intensive care unit treatment have sepsis and estimated 55.7% of hospitalized patients with sepsis died [24]. It is recognized that Vitamin D deficiency is common in both children and adults hospitalized in severe clinical conditions in intensive care [06-12].

And high vitamin D exposure can protect against the development and progression of multiple sclerosis and sepsis and autoimmune diseases [04-10], such as lupus, possibly through of the immunomodulatory properties of its biologically active metabolite is [1,25-dihydroxyvitamin D] [10-13]. And the improved survival of children and adults infected with viruses or bacteria in the immune system during hospitalization has focused attention on the benefit of adjunctive therapies such as Vitamin D [15-17].

Thus, Vitamin D is a potent immune system activator [07-11], being an absolute and protective component of the natural defense mechanisms against microbial invasion and the neural demyelination process [18-21]. Vitamin D is a fat-soluble steroidal hormone with endocrine, paracrine and autocrine functions [24-25].

For humans, the main source of Vitamin D is exposure of the skin to sunlight, which can produce around 10,000 IU (250 µg) of Vitamin D₃ per day [24].

Vitamin D biogenesis occurs in the skin [12], specifically in Malpighi cells [03-05], through a chemical reaction known as photolysis [20-25], where Ultraviolet rays mainly B induces breakage of B nucleus of precursor steroids [02-04] and the individual receiving solar ultraviolet rays [21-22], specifically, ultraviolet B radiation with The presence of [7-DHC] absorbs the UVB photon which results in the carbon bond breakage and as a response occurs the disruption of ring B with the pre-formation of Vitamin D [22-25]. And through heat, an isomerization reaction gives rise to Vitamin D [13]. The genetic predisposition in the pathogenesis of autoimmune diseases is constructed as a mosaic, aggregated to hormonal and environmental factors [18].

Vitamin D blood level and VDR polymorphism have highlighted an important environmental risk factor in the development of autoimmune diseases [24].

Scientific evidence links VDR polymorphism [24], specifically linked to BsmI, Apal, TaqI, and FokI polymorphism genotypes to the increased frequency of autoimmune diseases, and has highlighted that the interaction between VDR and their biomolecular bonds produce an anti-inflammatory effect on innate cells of the immune system and also [20-24], performs a regulatory and immunosuppressive action on adaptive immunity [21-25].

Decreased blood levels of Vitamin D are usually defined in autoimmune diseases [21], such as Diabetes Mellitus, SLE, rheumatoid arthritis, inflammatory bowel disease, thyroiditis, and autoimmune gastritis [21-24]. In the last ten years in northern Europe the prevalence of Multiple Sclerosis has been strongly correlated with Vitamin D deficiency and risk of disease development [24]. It is noteworthy that Vitamin D has immunomodulatory and suppressive functions in Multiple Sclerosis [19-24].

Vitamin D may interfere with the pathophysiology of Multiple Sclerosis [18] by altering inflamed tissues [22].

This interference is due to Vitamin D binding protein (DBP) and Vitamin D receptor (VDR) protein [19-21], as well as the presence of metabolite enzymes (CYP27B1) [19] which is present in the central nervous system [24] and VDR, CYP27B1 are expressed in a cell variety that includes invasive neurons, glial cells and lymphocytes [21-24], as Vitamin D plays a modulating action in various pathophysiological processes of the disease. Multiple Sclerosis [24] and includes the inflammatory, demyelinating process, axon damage repair and remyelination [25].

Vitamin D has the function of regulating the system in innate and adaptive immunity [24], because the innate immune response is characterized by activation of monocytes and macrophages capable of recognizing molecular patterns. pathogen-associated pathogens and [19-21] thus provide a first line of defense against external agents and increase the antimicrobial activity of macrophages and the enhancement of phagocytic chemotactic and capacity [22-24]. Conversely, Vitamin D deficiency impairs the ability of macrophages to mature [24-25] to produce specific surface antigens and macrophages and

acid lysosomal phosphatase enzymes and to secretion of hydrogen peroxide which is essential for their function antimicrobial [25].

Also, in the process of up-regulation of VDR in the Toll-like receptor activation of monocytes and macrophages leads to induction of catelicidins; a family of polypeptides found in macrophage lysosomes and polymorph-nuclear leukocytes that have a critical function in innate immune defense [23-25].

Catelicidin production is increased after bacterial and macrophage infection by recognizing bacterial invasion regulates VDR expression by activating the catelicidine gene, thereby destroying the bacterial invader [21-24]. Monocytes are activated in the presence of [1,25 (OH) 2 D] by showing decreased TNF- α , IL-1 α and IL-6 production and an increase in IL-10 production [24]. Thus, Vitamin D can modulate the immune response in a more anti-inflammatory way and exert a regulatory function [19-24]. Active immunity is also influenced by Vitamin D in many ways [24]. Vitamin D acts on monocyte-macrophage cells by developing a cell line capable of preventing differentiation into dendritic cells and reduces the expression of CD80 and CD86 surface co-stimulatory molecules [25], thus affecting T-cell stimulating capacity [21].

In addition, [1,25 (OH) 2D] can supply maturing dendritic cells by decreasing T and B antigen presentation and cellular activity [24]. Following vitamin D stimulation [20-24], dendritic cells have the ability to reduce and trigger T cell proliferation [17-19]. Also, in [1,25 (OH) 2D] dendritic cells has a direct action on T lymphocytes and alters the cytokine profile of T cells by inhibiting pro-inflammatory action in the production of cytokines such as IL-2, INF- γ , IL-17 and IL-21 [19-22]. Vitamin D also influences B cell population production (RAMOS et al., 2019), because exposure of B cells to [1,25 (OH) 2D] inhibits their proliferation (LEE, 2011), cell differentiation. Plasma and immunoglobulin secretion (IgG and IgM) and memory B cell generation also induce cellular apoptosis [06-10].

Currently there has been strict control by health professionals in requesting serum vitamin D dosing related to the steady increase in vitamin D deficiency in Brazil and some countries around the world [02] and to perform the determination of Vitamin D metabolites there is a difficulty because they are lipophilic molecules that circulate in reduced concentrations [25 (OH) D equivalent to 8 - 60 ng / ML-1] and [1,25 (OH) 2D [02-04] equivalent at 20 - 60 pg / ML-1] and are strongly adherent to proteins (DBP and Albumin) [02,24]. Generally Vitamin D deficiency is a result of PTH secretion which induces production [1,25 (OH) 2D] (BIKLE, 2011), high levels of [1,25 (OH) 2D] or normal may be presented in patients with Vitamin D deficiency [02].

In Brazil the “Endocrine Society” (2011) and the “Brazilian Society of Endocrinology and Neurology” (2017) defined Vitamin D deficiency below 20 ng / ML-1 [24], insufficiency with [25 (OH) D] of 21 - 29 ng / ML-1 and [25 (OH) D] sufficiency greater than or equal to 30 ng / ML-1 [02, 24]. These cohort patterns are the most commonly used today to define blood Vitamin D level [25].

There is a consensus that daily intake of 50.000 IU/day (100 ng/ml in the blood) of Vitamin D by patients has no toxic effects on the body [17] which would not cause adverse health effects [14].

Based on immunological health [24], bone and neurological recommendations of the “Brazilian Society of Endocrinology and Neurology” (2017) for adequate daily intake of Vitamin D in patients without pre-existing diseases are: 400 IU/day for infants up to one year old, 600 IU/day for children, adolescents

and the elderly up to 70 years old and 800 IU/day for elderly over 70 which should correspond to the ideal blood dose level of 20 ng/day. ML^{-1} [24].

For patients at risk and with pre-existing autoimmune, inflammatory, infectious and demyelinating diseases, the recommended guideline is (B: 400 - 1000 IU/day for infants up to one year of age, 600 - 1000 IU/day for infants up to 18 years and 2000 IU/day for persons over 18 years of age and should have a blood level of at least 30 ng / ML^{-1} of at least [25 (OH) D] [02,24].

In addition, the result reinforces that the problematization of sepsis in critically ill patients with vitamin D deficiency [24] occurs according to changes in glucose metabolism and especially calcium or immune and endothelial cell related disorders Vitamin D deficiency [03].

However, the points of this study are related to serum vitamin D (VENKATRAM et al., 2011), which proposes a relationship between infection rate and vitamin D deficiency [04], a trend reinforced by the increase in hospital intensive care infection people with hypovitaminosis D [16]. This study confirms that the high prevalence of low Vitamin D levels in critically ill patients triggers immune system changes that may result in sepsis [17-19]. Therefore, there is a need for blood serum analysis at the beginning of the hospitalization period for Vitamin D dosing [14], since there is an easy probability of avoiding complications during hospitalization [17]. Vitamin D deficiency can lead to imbalance of the immune system [13], Vitamin D has a primary role in defense against bacterial and viral agents and this defense occurs by stimulation of antimicrobial peptides which [12] can intensify the reduction of catelicidine and therefore the Vitamin D concentration level get a better significance (NAIR et al., 2015), for example, in the samples of intensive care patients with sepsis in reference to non-sepsis patients [17]. In this context, it is emphasized that the role of Vitamin D is to function as an immunomodulators [02-04], as Vitamin D identifies and nullifies the action of inflammatory cytokines mainly interleukins 6 (IL-6) which induces the systemic inflammatory response syndromes [20-24].

When comparing the serum vitamin D level during the intensive care admission process of the sepsis patient, there is an increased likelihood of developing organic disease when the patient has a vitamin D deficit [14].

In view of the above evidence, the protective role of vitamin D is biologically plausible [24], since [1,25 dihydroxyvitamin-D] is present in various immune cells [21] such as macrophages, activated T cells and B, IL-04, IL-06, IL-08, IL-10 and myelin specific [22]. Thus, this study highlighted that the increase in immune system cells occurs by stimulating receptors in the production of inflammatory cytokines [22-24].

This study highlights that Vitamin D supplementation above 50.000 IU/week is safe and protective against acute respiratory tract infections. It is emphasized that Vitamin D has several immunomodulatory functions including the regulation of antiviral peptides that are part of human innate immunity and may, for example, inactivate influenza virus [18-24].

The synthesis of the evidence showed that Vitamin D deficiency is high in patients with sepsis. There is a direct relationship with clinical improvement in patients with sepsis supplemented with Vitamin D [24], which shows a greater reduction in the indicators of the intensity of organic dysfunction and Vitamin D is increasingly recognized as an important agent with immune function and may be a preventive factor in the development of sepsis in intensive care patients [19-24].

Vitamin D supplementation (equal to or greater than 50 IU/week) has been shown to be more effective compared to lower supplementation doses [24]. These findings highlight the urgent need for further research and guidance for health professionals regarding the dose and duration of the intervention to be administered in the treatment associated with autoimmune, inflammatory-infectious and demyelinating diseases [18-21].

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Evolution of COVID19 new cases in 16 countries and Scenarios for Brazil using metaphorical analysis of Board, Inverted Pyramid and Papyri

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Abstract

Since the end of 2019, the world has become aware of a new virus that has emerged in China, which in February 2020 was called by the World Health Organization (WHO, 2019) as Coronavirus disease (COVID19). Due to its fast transmission, at 18:32 (GMT) on March 29, 2020, the world has officially accounted for about 710,950 new confirmed cases with 33,553 deaths and 150,734 recovered cases (Worldometers, 2020). The pandemic has become the newest challenge for several nations, especially the USA, Italy, China, Spain, Germany, Iran, for being the most affected, and since Brazil is a continental country with disabilities in its Unified Health System, it could be in the next two months among the five most affected. Thus, the main objective of the research is analyze the evolution of new cases of COVID19 in 16 countries to present short-term scenarios and recommendations for Brazil to face the pandemic. The research is applied, as its results and recommendations can be applied with adaptation by government authorities, business managers and citizens. The research is descriptive, with a qualitative and quantitative approach, based on bibliographic and documentary research, involving the study of articles, reports, manuals and other technical documents related to the subject. For the creation of scenarios, data collection focused on the number of new cases registered in 16 countries, including Brazil, as well as in the development of an approach using metaphorical analysis of the Board, the Inverted Pyramid and Papyri. The main conclusion is that even though no country is prepared to face epidemics and pandemics (NTI, JHU and EIU, 2019), among the 16 countries investigated, Thailand, Finland, Australia, South Korea, Denmark and Sweden are benchmarks that Brazil could study in order not to repeat the scenarios of China, USA, Italy and Spain. At the end, ten recommendations are made for future research and also to public and private managers.

Keywords: COVID19; New cases; WHO; Board; Inverted Pyramid; Papyri; Transparency; Scenarios.

1. Introduction

The world is not the same since the end of 2019, when a new virus spread in China that later came to be called by the World Health Organization (WHO, 2020a) the Coronavirus disease, popularly known as COVID19.

It is still unclear who the zero patient was. Although the World Health Organization (WHO, 2019) Office located in China reported on December 31, 2019, the occurrence of people suffering from unknown pneumonia in the city of Wuhan in China's Hubei Province, Huang et al (2020 p 500) states that the first case was identified on December 1, 2019, a man working in the Seeuan market in Huanan, in the Wuhan district. In an article published by the South China Morning Post, on March 13, 2020, author Ma (2020) argues based on access to government data from China, that patient zero was registered much earlier, on November 17, 2019, a 55-year-old from Hubei province. Although the Chinese government did not release the facts until the end of December 2019, there were about 266 contagions, increasing the number of new cases to 381 on January 1, 2020.

Regardless of who was patient zero, the fact is that then-unknown pneumonia crossed the borders of several cities in China, getting out of control and reaching not only nearby countries but other continents.

Currently, there are several websites for monitoring the evolution of covid19 in the world, containing statistics on new cases and also the number of daily deaths. Among these sites, there is the World Health Organization <<https://bit.ly/2QW5LAh>>, but the most dynamic are worldometers <<https://www.worldometers.info/coronavirus/>>, Covid19 Tracker <<https://www.bing.com/covid>> developed by Microsoft and John Hopkins University & Medicine Coronavirus Resource Center <<https://coronavirus.jhu.edu/map.html>>.

To measure the size of the challenge facing humanity, at 18:32 (GMT) on March 29, 2020, the Worldometers pointed out 710,950 confirmed cases with 33,553 deaths and 150,734 recovered cases. At the same time, with the last update made at 2:37 pm, Covid Crawler19 pointed to 710,290 new confirmed cases, 33,550 deaths and 150,734 recovered cases (Figure 1). At the same time, but with the last update made at 1:30 pm, the John Hopkins University & Medicine Coronavirus Resource Center pointed to 704,095 confirmed cases with 33,509 deaths and 148,824 recovered (Figure 2).

The results in Figure 3 show the twenty-five most affected countries, of which the ten most critical registered at 18:32 (BMT) on March 29, 2020, are: 1st) the USA; 2nd) Italy; 3rd) China; 4th) Spain; 5th) Germany; 6th) France; 7th) Iran; 8th) the United Kingdom; 9th) Switzerland and 10th) the Netherlands.

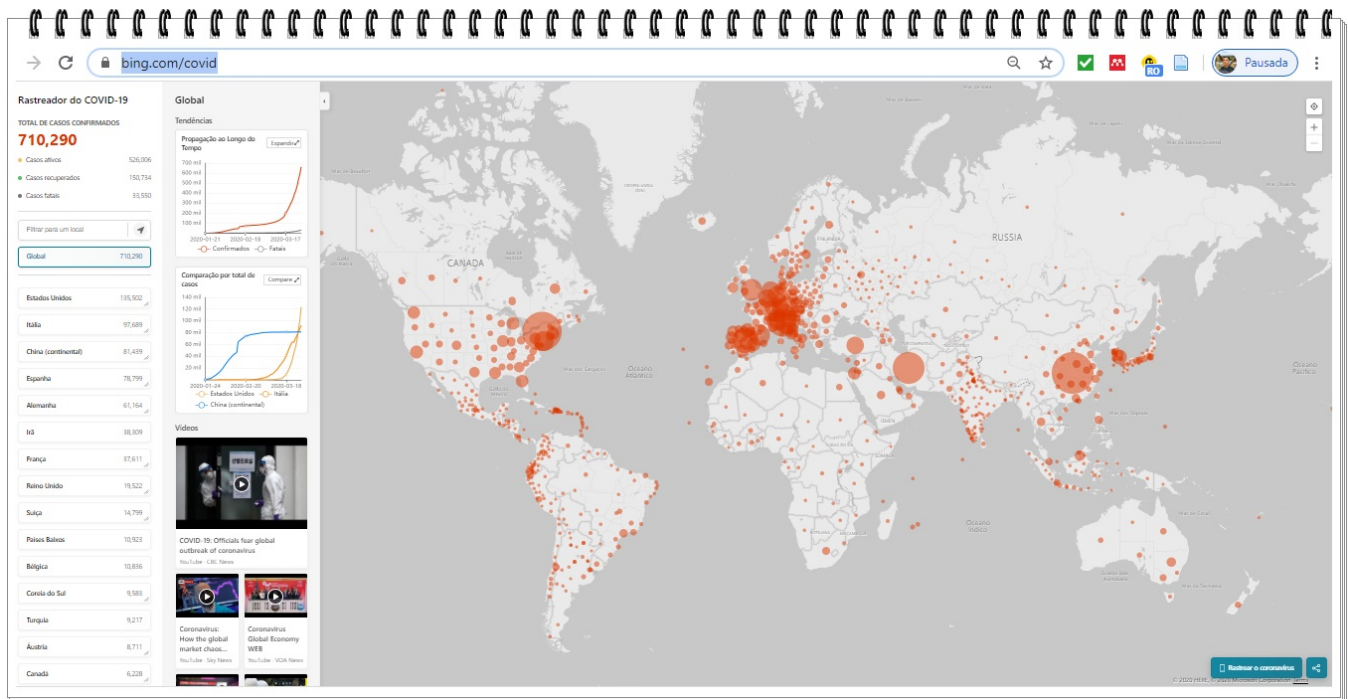


Figure 1: Statistics about COVID19 on 03/29/20

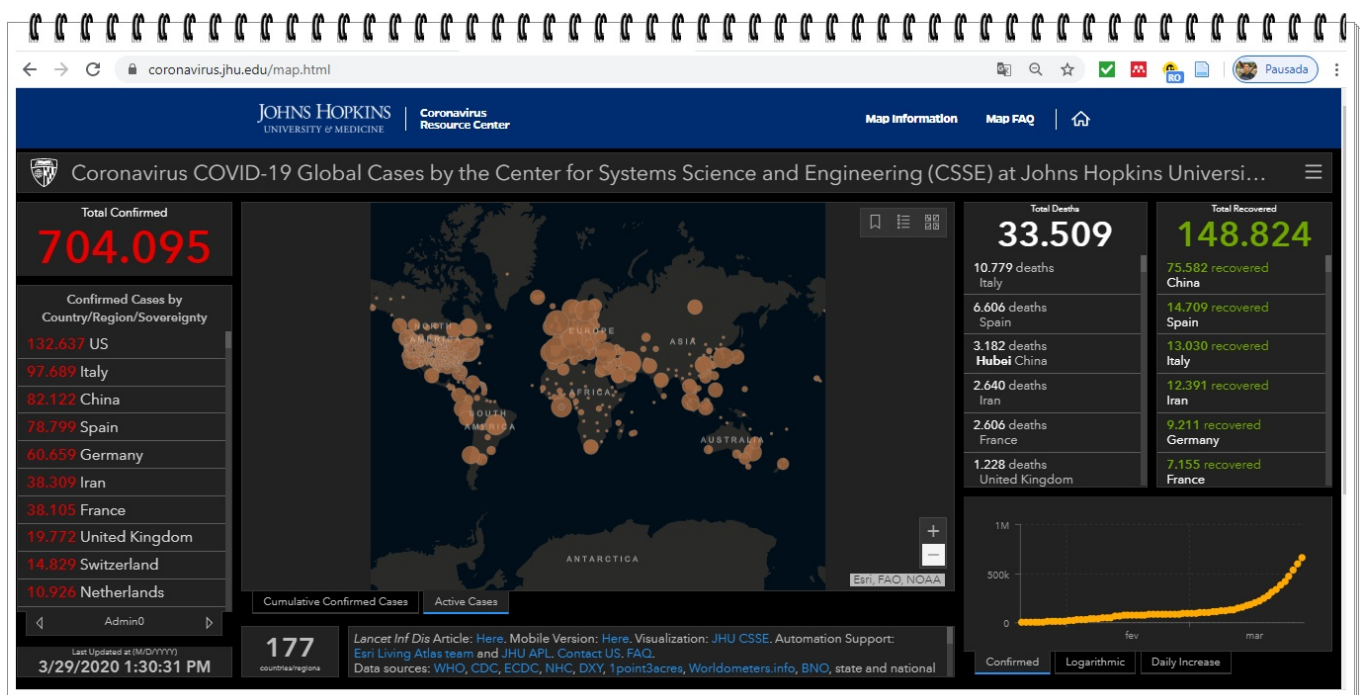
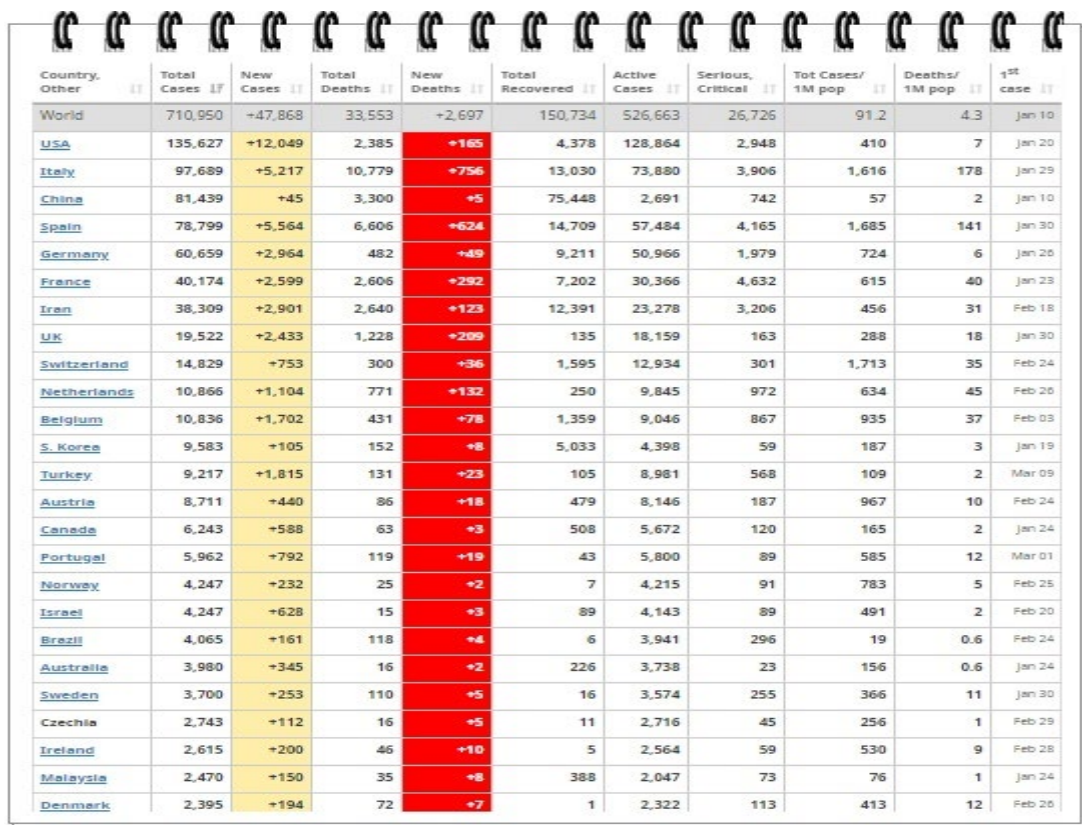
Source: COVID-19 Tracker <<https://www.bing.com/covid>>

Figure 2: Statistics about COVID19 on 03/29/20

Source: John Hopkins Coronavirus Resource Center <<https://coronavirus.jhu.edu/map.html>>



Country, Other	Total Cases	New Cases	Total Deaths	New Deaths	Total Recovered	Active Cases	Serious, Critical	Tot Cases/ 1M pop	Deaths/ 1M pop	1st case
World	710,950	+47,868	33,553	+2,697	150,734	526,663	26,726	91.2	4.3	Jan 10
USA	135,627	+12,049	2,385	+165	4,378	128,864	2,948	410	7	Jan 20
Italy	97,689	+5,217	10,779	+756	13,030	73,880	3,906	1,616	178	Jan 29
China	81,439	+45	3,300	+5	75,448	2,691	742	57	2	Jan 10
Spain	78,799	+5,564	6,606	+624	14,709	57,484	4,165	1,685	141	Jan 30
Germany	60,659	+2,964	482	+49	9,211	50,966	1,979	724	6	Jan 20
France	40,174	+2,599	2,606	+292	7,202	30,366	4,632	615	40	Jan 23
Iran	38,309	+2,901	2,640	+123	12,391	23,278	3,206	456	31	Feb 18
UK	19,522	+2,433	1,228	+209	135	18,159	163	288	18	Jan 30
Switzerland	14,829	+753	300	+36	1,595	12,934	301	1,713	35	Feb 24
Netherlands	10,866	+1,104	771	+132	250	9,845	972	634	45	Feb 26
Belgium	10,836	+1,702	431	+78	1,359	9,046	867	935	37	Feb 03
S. Korea	9,583	+105	152	+6	5,033	4,398	59	187	3	Jan 19
Turkey	9,217	+1,815	131	+23	105	8,981	568	109	2	Mar 09
Austria	8,711	+440	86	+18	479	8,146	187	967	10	Feb 24
Canada	6,243	+588	63	+3	508	5,672	120	165	2	Jan 24
Portugal	5,962	+792	119	+19	43	5,800	89	585	12	Mar 01
Norway	4,247	+232	25	+2	7	4,215	91	783	5	Feb 25
Israel	4,247	+628	15	+3	89	4,143	89	491	2	Feb 20
Brazil	4,065	+161	118	+4	6	3,941	296	19	0.6	Feb 24
Australia	3,980	+345	16	+2	226	3,738	23	156	0.6	Jan 24
Sweden	3,700	+253	110	+5	16	3,574	255	366	11	Jan 30
Czechia	2,743	+112	16	+5	11	2,716	45	256	1	Feb 29
Ireland	2,615	+200	46	+10	5	2,564	59	530	9	Feb 28
Malaysia	2,470	+150	35	+6	388	2,047	73	76	1	Jan 24
Denmark	2,395	+194	72	+7	1	2,322	113	413	12	Feb 26

Figure 3: The twenty-five most critical countries affected by COVID199

Source: Worldometer <<https://www.worldometers.info/coronavirus/>>

In this list of 25 most critical countries, Brazil was in 19th place, with 4,065 new cases and 118 deaths, but there is strong evidence that it may move the world in the coming months, due the 10 reasons bellow:

- 1) its continental dimension with an estimated population of approximately 212.4 million inhabitants (UNPFA, 2020a);
- 2) for not having an efficient national public health system, for many years not being considered an international reference in various rankings (WHO, 2000; ERIC et al, 2017; NUMBEO, 2019);
- 3) billion dollar freezes and/or cuts in the health budget, carried out by several governments in recent years;
- 4) number of hospital beds has decreased in recent years (IBGE, 2010; WORLD BANK, 2020; MONTANEZ, 2019), only 10% one Intensive Care Unit (ICU) for every 10000 inhabitants within Public Health System, while WHO recommends that countries must have 1 to 3 beds per 10000 inhabitants. If the private health hospitals are included, around 12,6% of cities attend WHO recommendation, and the most critical regions are North and Northeast (AMIB, 2020; BRIGHT CITIES, 2020; FOLHA, 2020a);
- 5) excessive bureaucracy in the public sphere;
- 6) delay in carrying out tests in laboratories;
- 7) constant lack of medicines and personal protective equipment of Brazilian cities have at least for health professionals in public hospitals;
- 8) excessive delay by the federal government in recognizing the seriousness of the pandemic, with the President not obeying WHO guidelines, not protecting himself or his team, to the point that 23 close people

who accompanied him on a trip to the United States last March were infected by COVID19, in addition there is no harmony between the President and the Minister of Health, Governors and Mayors;

9) managerial inability of the current federal government to prepare the country to face the pandemic;

10) inefficient transparency and communication between government officials and the population, especially about information from the WHO and the real state of COVID19 in the country.

Given the above, the main research problem is “From the history of the most critical countries, what scenarios can Brazil have in the short term about the evolution of COVID19?”

Thus, the main objective of the research is to analyze the evolution of new cases of COVID19 in 16 countries to present short-term scenarios and recommendations for Brazil to face the pandemic.

The specific objectives are: a) to collaborate in the process of disseminating useful WHO information to protect the population and prepare any country to face the pandemic; b) to analyze the evolution of the pandemic in 16 countries (including Brazil); c) identify the countries with the lowest rates of new cases and deaths, for future studies of the good management practices adopted; d) present possible short-term scenarios for Brazil by using metaphorical analysis of the Tablet, the Inverted Pyramid and Papyri.

The research is not intended to use complex mathematical or statistical models but hopes to be relevant to: a) the population has access to basic information from the WHO on COVID19; b) the academy because it can serve as a reflection and point out new research opportunities, especially on the good management practices adopted by countries with the best performance in coping with the disease; c) public and private managers understand the guidelines recommended by WHO to plan and prepare the health system to face the pandemic, in addition for the understanding of the pandemic evolution and for the creation of indicators to better monitor the disease; d) presidents, ministries, governors, secretaries responsible for Health Systems, since they will have to access a simple approach that permits to compares their countries against the 16 countries investigated, as well as to forecast new scenarios of covid19 in short-term.

2. Theoretical Referential

2.1 World Health Organization (WHO)

The WHO headquarters is located in Geneva, Switzerland, is part of the United Nations and was founded on the seventh day of April 1948.

Its history started from a meeting of diplomats held in San Francisco (USA) in 1945 to form the United Nations, at the time one of the points of discussion was the creation of a global health organization, is then officially created on the aforementioned date. At that time, the 53 delegates held the first Assembly in June 1948, placing the health of women and children, malaria, tuberculosis, venereal diseases, nutrition, and environmental sanitation as a priority (WHO, 2006 p. 4).

Currently, WHO is recognized as the Global Guardian of Public Health, has helped to eradicate or face diseases, as well as helping to face humanitarian crises, thanks to its 7000 professionals working in more than 150 countries: scientists, epidemiologists, aid specialists emergency, medical doctors, public health specialists, administrative managers, economists, financial specialists, information systems specialists, specialists in health statistics, etc.

In its seventeenth general program (WHO, 2018) covering the period from 2019 to 2023, WHO defined as its mission “Promoting health, keeping the world safe and serving the vulnerable”, also based on Article 1 of its constitution, defined as a vision "A world in which all people meet the maximum possible standard of well-being and health".

To this end, they developed three strategic goals to help improve public health in each member country, as can be seen in Figure 4. Strategies range from political dialogue, strategic support, technical assistance to service delivery during emergencies.

The WHO recognizes the importance of Research and Innovation, which is why it will use several approaches to find and disseminate innovative solutions on a global scale. Also, WHO is redesigning its key processes to adopt a new structure capable of accomplishing the program's mission, vision and goals. WHO is an internationally respected organization, especially by those who have been related to it over time (WHO, 2015), being recognized as an indispensable and essential leader to improve global health results, as a provider of reliable, accurate and useful information, etc.

There are several working groups at WHO, but for this research, it is worth highlighting the work of the Strategic and Technical Advisory Group for Infectious Hazard (STAG-IH) that was created on the recommendation of the review committee dealing with Ebola in 2005. This committee has between 10 and 15 temporary advisers with 5 functions, three of which are: assessing the global context of infectious diseases, providing analysis and advice on priorities for WHO to formulate their strategies and activities, providing analysis and advice on innovative collaborations and partnerships, etc. It is recommended in the current situation to follow the work developed by them through the link <<https://bit.ly/3bCPI2c>>.

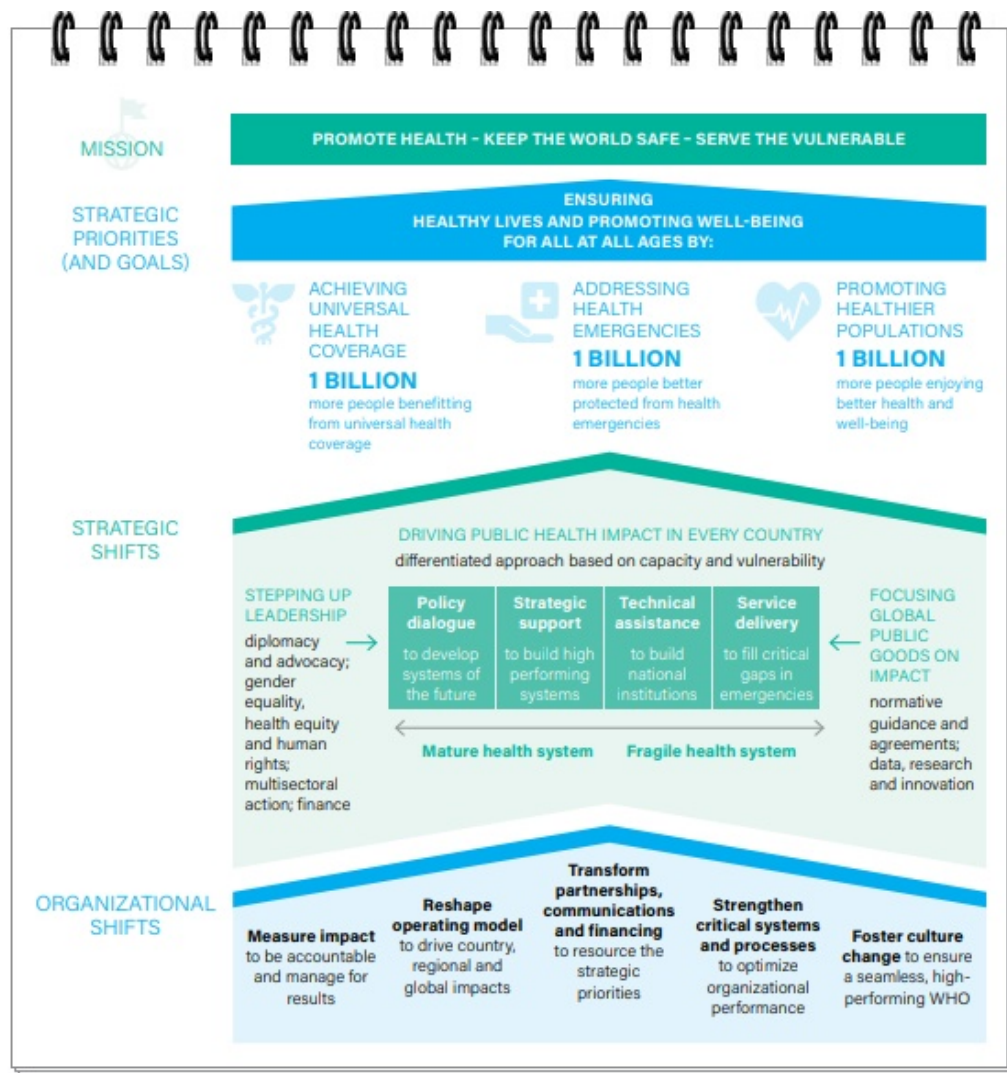


Figure 4: Overview of the 17th WHO Program for the period from 2019 to 2023.

Source: WHO (2018)

Finally, there are just over 300 topics covered by WHO, ranging from abortion, air pollution, asthma, biological weapons, cancer, covid19, to zoonosis, but the most popular are Ebola, Nutrition, Hepatitis, the ten causes of death and COVID19, the latter will be dealt with in the next section.

2.2 COVID19

2.2.1 The technical name and zero patient

In the last 3 months, a new disease challenges humanity again, it is COVID19 or coronavirus disease. It is caused by a virus whose technical name was released by WHO on 11/02/20 as “Severe acute respiratory syndrome coronavirus2 (SARS-CoV-2) because the virus is genetically related to the coronavirus that caused the outbreak of SARS (Severe Acute Respiratory Syndrome) occurred in 2003, although both are different.

It is still difficult to prove who the zero patient was. Although the WHO Office (WHO, 2019), located in China, reported on December 31, 2019, the occurrence of people suffering from unknown pneumonia in the city of Wuhan in China's Hubei Province, Huang et al (2020 p 500) argue that the first case was identified on 12/1/19, a man who worked at the Seeuan market in Huanan, in the Wuhan district.

In an article published by the South China Morning Post, on March 13, 2020, author Ma (2020) argues based on access to government data in China, that patient zero was registered much earlier, on November 17, 2019, a 55-year-old from Hubei province. Although the Chinese government did not release the facts until the end of December 2019, there were about 266 contagions, increasing the number of new cases to 381 on January 1, 2020.

Regardless of who was the zero patient, the fact is that then-unknown pneumonia crossed the borders of several cities in China, getting out of control and reaching not only nearby countries but other continents. Besides, from a data series involving 72314 COVID19 cases in China, published on February 11, 2020, by the Chinese Center for Disease Control and Prevention (China CDC Weekly, 2020), it is possible to observe that of the 44672 (62%) confirmed cases: a) the majority (38680; 86.6%) were between 30 and 79 years old; b) there is no distinction between those infected concerning gender since 51.4% were men and 48.6% women; about the degree of severity, most (36160; 81%) had mild symptoms, 6168 cases (14%) had severe symptoms and 2087 cases (5%) were considered critical; c) the percentage of death was 2.3% (1023 deaths), no fatality occurred as people in the light or severe groups, but reached 49% of the critical cases. Another interesting point is that of the 1023 fatal cases, most are male (63.8%).

Wu and McGoogan (2020), analyzing the data series above to identify the lessons learned, pointed out that given that there were no drugs and vaccines available to tackle COVID19, China focused on traditional public health tactics to tackle the disease, such as community restraint, quarantine, isolation and social detachment.

2.2.2 Symptoms and ways of preventing the public

According to WHO, COVID19 is a respiratory disease, the majority of infected people will develop symptoms between mild and moderate levels, and can recover without the need for special treatment. However, WHO warns that elderly people over 60 years old and those with medical problems (cardiovascular disease, diabetes, chronic respiratory diseases, and cancer) are the most vulnerable to having the situation aggravated by the new disease and dying. The common symptoms are fever, tiredness and dry cough. Other symptoms are shortness of breath, pain, sore throat, and few people have reported runny nose, nausea or diarrhea. Healthy people who experience mild symptoms should isolate themselves and communicate with the doctor and/or the local organization responsible for monitoring, testing, and results. For those who experience fever, cough or difficulty breathing, seek medical advice.

On this page <<https://bit.ly/2JotvZk>> WHO presents protective measures to the public to prevent infection and reduce the transmission of COVID19, the page is constantly updated according to new scientific findings. The recommendations are:

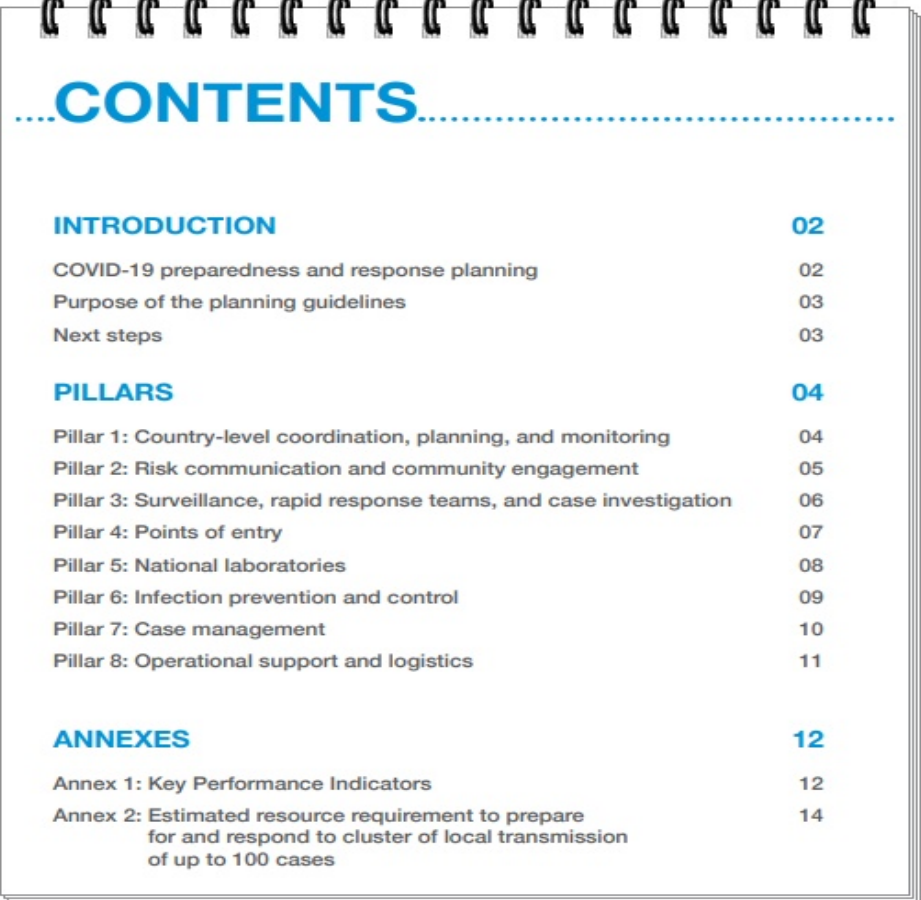
- a) wash your hands frequently with soap and water or rub your hands with alcohol;
- b) maintain a social distance of one meter (1m) between you and the person with a cough or sneeze;
- c) avoid touching eyes, nose and mouth;
- d) practice respiratory hygiene, covering your mouth and nose with your elbow or folded tissue when you cough or sneeze. Then dispose of the used fabric in the correct place immediately;
- e) stay home if you don't feel well. If you have a fever, cough or difficulty breathing, see a doctor. Follow the guidelines of your local health authority;

- f) avoid smoking or performing any other activity that weakens the lungs;
- g) avoid unnecessary travel and stay away from groups of people;
- h) stay informed and follow the advice of health authorities.

2.2.3 Preparedness and Response Plan to COVID19

On February 12, 2020, WHO launched a draft (Figure 5) called “COVID19 Strategic Preparedness and Response Plan” aimed at helping local United Nations teams and partners work to develop the Country Preparedness and Response Plan (CPRP) to immediately support the national government to prepare and respond to COVID10. The guidance was given so that the plan was for 3 months, between 2/1/20 and 4/30/20, which can be changed over time according to the evolution of the situation and needs.

The guide is available at <<https://bit.ly/2xzOW7n>>. In summary, it consists of 8 pillars (Figure 5) that represent the priority steps in the public health preparedness and response process: P1 (Country-level coordination, planning, and monitoring) containing 3 steps and 12 actions; P2 (Risk communication and community engagement) containing 3 steps and 11 actions; P3 (Surveillance, rapid response teams, and case investigation) with 3 steps and 10 actions; P4 (Points of entry) with 3 steps and 5 actions; P5 (National Laboratories) with 3 steps and 10 actions; P6 (Infection prevention and control) with 3 steps and 13 actions; P7 (Case Management) with 3 steps and 11 actions; P8 (Operational support and logistics) with 3 steps and 6 actions to be performed.



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Figure 5: Contents of the Preparedness and Response Guide to COVID19

Source: WHO (2020b)

In addition to the pillars, there are two annexes; the first contains a list of several key indicators for each of the pillars. The second has the resources estimated in US \$ for a cluster to prepare and respond to the transmission of covid19 for up to 100 cases.

This guide model was then complemented with another document <<https://bit.ly/3awqORp>> released on March 25, 2020 (WHO, 2020c), aimed at helping countries to reorganize and maintain the population's access to a good quality of service. Both documents are excellent guides for ministers, governors, health secretaries and hospital managers.

2.2.4 WHO updates about COVID19

This site is recommended <<https://bit.ly/2QWpy2m>> to follow the latest official WHO information on COVID19, to avoid being a victim of fake news on the subject.

As an example, on 03/27/20, WHO launched Health Alert, a messaging service in partnership with Whatsapp and Facebook to keep people safe from the coronavirus.

The service can be accessed through a link that initiates conversation via WhatsApp, simply by typing:

In Spanish “hola” to +41 22 501 76 90 on WhatsApp <wa.me/41225017690?text=hola>

In French “salut” to +41 22 501 72 98 on WhatsApp <wa.me/41225017298?text=salut>

In English “hi” to +41 79 893 18 92 on WhatsApp <wa.me/41798931892?text=hi>

In Arabic “مرحبا” to +41 22 501 70 23 on WhatsApp <wa.me/41225017023?text=مرحبا>

At this link <<https://bit.ly/3avHGYK>> WHO has technical material for public, private and other professionals interested in the subject. Finally, at this link <<https://bit.ly/34h70zq>> the WHO presents the “Draft landscape of COVID19 candidate vaccine – 20 March 2020”, as well as some important notes written in the document footer.

2.3 Health system and national performance of countries

2.3.1 Health System from the perspective and assessment of WHO

A technical report with 215 pages was published 20 years ago by OMS about “Health Systems: Improving Performance”. In short, the report (OMS, 2000):

- a) conceptualizes a Health System as being the composition of all organizations, institutions, and resources destined to produce health actions. A health action was defined as any effort, whether in personal health care, public health services or intersectoral initiatives to improve health;
- b) the objectives of a Health System are: b1) to improve people's health; b2) meeting people's expectations; b3) protect them against the financial costs of the disease, treating them with dignity;
- c) three elements are important when entering a Health System: Human Resources; Physical Capital and Consumables, the performance of the system ultimately depends on the knowledge, skills, and motivation of the people responsible for delivering the services;
- d) without functional facilities, diagnostic equipment and medicines, it will not do to have qualified employees with a high level of knowledge and skills, service delivery will continue to below;
- e) failures in the health system are because ministries are concentrated in the public sector, paying little attention to the private sector;

f) to evaluate a health system, 5 things are necessary: the general level of health (the overall level of health); the distribution of health in the population (the distribution of health in the population); the general level of responsiveness (the overall level of responsiveness); the distribution of responsiveness (the distribution of responsiveness); and the distribution of the financial contribution (distribution of financial contribution); g) based on the methodology adopted, the ten member countries at the time with the best general health levels were: 1) France; 2) Italy; 3) San Marino; 4) Andorra; 5) Malta; 6) Singapore; 7) Spain; 8) Oman; 9) Austria; 10) Japan. Brazil ranked 125th among the 191 countries analyzed.

Due to the complexity of the theme, this was the first and last study carried out by WHO, and over time other new methodologies were developed to assess the performance of the National Health System, among them Eric et al. (2017), Numbeo (2019) and NTI, JHU and EIU (2019), the latter being an easily accessible report containing more complete information than the previous ones.

2.3.2 Health System Assessment by the GHS Index (NTI, JHU and EIU, 2019)

The Global Health Security Index (GHS) is a project of the Nuclear Threat Initiative (NTI) together with the Johns Hopkins Center for Health Security (JHU) in partnership with The Economist Intelligence Unit (EIU).

The GHS Index 2019 is a report that presents the global assessment of the health security capacity of 191 countries, based on a questionnaire with 140 questions divided into 6 categories, 34 indicators, and 85 sub-indicators.

The project started in 2017 with a meeting in London in April to develop its structure, with the pilot test in October 2017 with 4 countries, panels and other activities in 2018, being completed in July 2019 and the GHS Index launched on October 24, 2019.

Figure 6 shows the six categories:

1. Prevention (emergency prevention or pathogen release);
2. Detection and Reporting (detection and early notification of epidemics of international interest);
3. Rapid Response (rapid response and mitigation of the spread of an epidemic);
4. Health System (robust health system to treat patients and protect health professionals);
5. Compliance with international standards (commitment to improving national capacity, finance plans to fill gaps and adhere to international standards);
6. Environmental Risk (risk of the general environment and the country's vulnerability to biological threats)



Figure 6: GHS Index 2019 categories

Source: NTI, JHU and EIU (2019)

In summary, the results of the report:

- a) **point out that health security is fundamentally weak on the planet, no country is fully prepared to face epidemics and pandemics, and each country has gaps that need to be resolved;**
- b) the overall average of the GHS Index 2019 of 195 countries is 40.2 points, on a scale of points that goes up to 100;
- c) points out 33 recommendations, among them, there is one related to the health security capacity of each country, needs to be transparent and regulated;
- d) the average score for the indicator “Health System” is 26.4, being considered the category with the lowest score;
- e) the ten countries (Figure 7) with the best overall scores were: 1) USA (83.5); 2) United Kingdom (77.9); 3) the Netherlands (75.6); 4) Australia (75.5); 5) Canada (75.3); 6) Thailand (73.2); 7) Sweden (72.1); 8) Denmark (70.4); 9) South Korea (70.2) and Finland (68.7);
- f) The ten countries with the lowest scores were: 195) Equatorial Guinea (16.2); 194) Somalia (16.6); 193) North Korea (17.5); 192) São Tomé and Príncipe (17.7); 191) Marshall Islands (18.2); 190) Yemen (18.5); 189) Kiribati (19.2); 188) Syria (19.9); 187) Guinea Bissau (20); and 186) Gabon (20);

OVERALL SCORE		1. PREVENTION OF THE EMERGENCE OR RELEASE OF PATHOGENS		2. EARLY DETECTION & REPORTING FOR EPIDEMICS OF POTENTIAL INTERNATIONAL CONCERN		3. RAPID RESPONSE TO AND MITIGATION OF THE SPREAD OF AN EPIDEMIC	
Rank	Score	Rank	Score	Rank	Score	Rank	Score
1	United States 83.5	1	United States 83.1	1	United States 98.2	1	United Kingdom 91.9
2	United Kingdom 77.9	2	Sweden 81.1	2	Australia 97.3	2	United States 79.7
3	Netherlands 75.6	3	Thailand 75.7	2	Latvia 97.3	3	Switzerland 79.3
4	Australia 75.5	4	Netherlands 73.7	4	Canada 96.4	4	Netherlands 79.1
5	Canada 75.3	5	Denmark 72.9	5	South Korea 92.1	5	Thailand 78.6
6	Thailand 73.2	6	France 71.2	6	United Kingdom 87.3	6	South Korea 71.5
7	Sweden 72.1	7	Canada 70.0	7	Denmark 86.0	7	Finland 69.2
8	Denmark 70.4	8	Australia 68.9	7	Netherlands 86.0	8	Portugal 67.7
9	South Korea 70.2	9	Finland 68.5	7	Sweden 86.0	9	Brazil 67.1
10	Finland 68.7	10	United Kingdom 68.3	10	Germany 84.6	10	Australia 65.9
11	France 68.2	11	Norway 68.2	11	Spain 83.0	11	Singapore 64.6
12	Slovenia 67.2	12	Slovenia 67.0	12	Brazil 82.4	12	Slovenia 63.3
13	Switzerland 67.0	13	Germany 66.5	13	Lithuania 81.5	13	France 62.9
14	Germany 66.0	14	Ireland 63.9	13	South Africa 81.5	14	Sweden 62.8
15	Spain 65.9	15	Belgium 63.5	15	Thailand 81.0	15	Spain 61.9
16	Norway 64.6	16	Brazil 59.2	16	Italy 78.5	16	Malaysia 61.3
17	Latvia 62.9	17	Kazakhstan 58.8	17	Greece 78.4	17	Canada 60.7
18	Malaysia 62.2	18	Austria 57.4	18	Ireland 78.0	18	Chile 60.2
19	Belgium 61.0	19	South Korea 57.3	19	Estonia 77.6	19	Denmark 58.4
20	Portugal 60.3	20	Turkey 56.9	20	Mongolia 77.3	20	Norway 58.2
21	Japan 59.8	21	Armenia 56.7	21	France 75.3	21	New Zealand 58.1
22	Brazil 59.7	22	Hungary 56.4	22	Georgia 75.0	22	Madagascar 57.8

Figure 7: The ten best countries in the GHS Index 2019

Source: NTI, JHU and EIU (2019)

g) Brazil was in 22nd place with 59.7 points, receiving low scores in indicator 6 (General environmental risk and vulnerability of the country with biological threats) being in 94th position with 56.1 points, as well as in indicator 4 (System of Robust health to treat patients and protect healthcare professionals) ranking 33rd with 45 points. The strongest scores were the indicators: 3 (Rapid Response) ranked 9th with 67.1 points; 2 (Detection and Reporting) ranked 12th with 82.4 points, and 1 (Prevention) ranked 16th with 59.2 points;

h) transparency and trust are vital elements in preparing for the pandemic.

2.4 The Most Transparent Countries in 2019

One of the recommendations of the GHS Index 2019 report for each country is that the health security capacity is transparent and regularly evaluated, and the results are published at least once every two years (NTI, JHU, and EIU, 2019 p. 13).

Also, one of the principles of the GHS Index 2019 is that transparency and trust are vital elements in preparing for the pandemic. Shared Transparency, data publicity is needed to draw a more comprehensive and reproducible picture of global gaps related to preparedness (NTI, JHU, and EIU, 2019 p. 34).

Given the above, each government must streamline its data collection and dissemination process involving COVID19. Governments must, therefore, act with integrity and transparency (E.V., T. I., 2020b).

The population needs to feel confident in the government and its public managers responsible for health and other essential areas, to act more correctly in the face of the pandemic.

One of the studies that assess the level of perception of a sample of the population with its leaders is carried out annually in 180 countries, called "Corruption Perceptions Index - CPI", published by Transparency International <<https://www.transparency.org/>>.

The last report was CPI 2019, it contains 34 pages and its methodology aggregates data from different sources that allow evaluating on a scale from 0 to 100, the perception of specialists and entrepreneurs with the level of corruption in the public sector, where 100 points mean that the country is very clean, while 0 points mean that the region is highly corrupt (EV, TI, 2020b p.4).

In summary, this report points out that:

- a) The average score for all countries was 43 points;
- b) Two-thirds of the countries had points below 50 points;
- c) The region with the highest score was the European Union and Western Europe with an average of 66 points;
- d) The region with the lowest score was sub-Saharan Africa with an average of 32 points;
- e) The ten most transparent countries were: Denmark (87 points), New Zealand (87 points), Finland (86 points), Singapore (85 points), Sweden (85 points), Switzerland (85 points), Norway (84 points), Germany (80 points) and Luxembourg (80 points);
- f) The ten least transparent countries were: Somalia (9 points), South Sudan (12 points), Syria (13 points), Yemen (15 points), Venezuela (16 points), Sudan (16 points), Equatorial Guinea (16 points), Afghanistan (16 points), North Korea (17 points) and Libya (18 points);
- g) recommendations were made to manage conflicts of interest, control political funding, strengthen electoral integrity, regulate lobbying activities, address special treatment, empower citizens and strengthen controls and balance sheets;

Regarding Brazil, it is worth noting that the country in 2019 had the worst score (35 points) since 2012, the 2019 report highlights that after the 2018 elections, the country underwent a series of anti-corruption setbacks in its legal framework and institutional. Among other things, he highlighted the growing political interference of President Bolsonaro in the so-called control bodies and the approval of legislation that threatens the independence of law enforcement officials and the accountability of political parties.

The use of this ranking is important to look more confidently at the data released by the countries considered most transparent, especially the top 20, on the other hand, it signals the need to maintain a more critical view regarding the reliability of the data released by the other countries, especially those considered less transparent, since the possibility of the data being underestimated is high.

3. Methodology

The research is applied, as its results and recommendations can be applied with adaptation by public managers and other people interested in the theme.

The research is descriptive, with a combined, qualitative and quantitative approach, based on bibliographic and documentary research, involving study articles, reports, manuals and other technical documents related to the subject. Descriptive statistics were also applied to the number of new confirmed cases collected daily on the Worldometers and John Hopkins Coronavirus Research Center sites.

The research has the following steps:

Stage 1) Bibliographic review with documentary and article research

Step 2) Definition of the 16 countries:

In addition to Brazil, the 15 countries were divided into two groups. Group 1 composed of the 5 most critical countries, affected in terms of the number of new cases confirmed by COVID19 until the first half of March 2020, that is, China, Italy, Iran, Spain, and Germany.

Group 2 was composed of 10 countries considered by the GHS Index 2019 with the best overall scores: USA (83.5); 2) United Kingdom (77.9); 3) the Netherlands (75.6); 4) Australia (75.5); 5) Canada (75.3); 6) Thailand (73.2); 7) Sweden (72.1); 8) Denmark (70.4); 9) South Korea (70.2) and Finland (68.7). It is worth mentioning that if by the end of the data collection (03/30/20) one of these countries evolves to the top of the 5 most critical on the planet, it will be transferred to Group 1 during the development of the scenarios.

Step 3) Data collection and analysis

Initially, it was sought to collect data from the ministries of health of each nation. However, in some countries, such as Brazil, it is difficult to collect updated data and in a more organized way, because of this, data released in real-time by the Worldometers <<https://bit.ly/3dpMERI>>, by COVID-19 tracker <<https://www.bing.com/covid>>, created by Microsoft, as well as data from the John Hopkins Coronavirus Resource Center <<https://coronavirus.jhu.edu/>>.

For each country, the number of new cases and confirmed deaths were entered in spreadsheets (Figure 8), with daily values since the day in each country officially announced its 1st case until 03/30/20. Columns were also created to insert the percentage of daily and accumulated evolution, aiming at analyzing the data.

Day	Week	China	WD	81518		DG(%)	DAG(%)	Death	Ac Death	Italy	WD	101739		DG(%)	DAG(%)	Death	Ac Death
1	1	31/12/19	T(3a)	27	27	-	-	0	0	31/01/20	F(6a)	2	2	-	-	0	0
2	1	01/01/20	W(4a)	0	27	-100	0,00	0	0	01/02/20	Sa	0	2	-100,00	0,00	0	0
3	1	02/01/20	Th(5a)	0	27	0,00	0,00	0	0	02/02/20	Sun(D)	0	2	0,00	0,00	0	0
4	1	03/01/20	F(6a)	17	44	.	62,96	0	0	03/02/20	M(2a)	0	2	0,00	0,00	0	0
5	1	04/01/20	Sa	0	44	-100,00	0,00	0	0	04/02/20	T(3a)	0	2	0,00	0,00	0	0
6	1	05/01/20	Sun(D)	15	59	.	34,09	0	0	05/02/20	W(4a)	0	2	0	0,00	0	0
7	1	06/01/20	M(2a)	0	59	-100,00	0,00	0	0	06/02/20	Th(5a)	1	3	.	50,00	0	0
8	2	07/01/20	T(3a)	0	59	0,00	0,00	0	0	07/02/20	F(6a)	0	3	-100	0,00	0	0
9	2	08/01/20	W(4a)	0	59	0,00	0,00	0	0	08/02/20	Sa	0	3	0	0,00	0	0
10	2	09/01/20	Th(5a)	0	59	0,00	0,00	0	0	09/02/20	Sun(D)	0	3	0	0,00	0	0
11	2	10/01/20	F(6a)	0	59	0,00	0,00	0	0	10/02/20	M(2a)	0	3	0	0,00	0	0
12	2	11/01/20	Sa	0	59	0,00	0,00	0	0	11/02/20	T(3a)	0	3	0	0,00	0	0
13	2	12/01/20	Sun(D)	0	59	0,00	0,00	0	0	12/02/20	W(4a)	0	3	0	0,00	0	0
14	2	13/01/20	M(2a)	0	59	0,00	0,00	0	0	13/02/20	Th(5a)	0	3	0	0,00	0	0
15	3	14/01/20	T(3a)	0	59	0,00	0,00	0	0	14/02/20	F(6a)	0	3	0	0,00	0	0
16	3	15/01/20	W(4a)	0	59	0,00	0,00	0	0	15/02/20	Sa	0	3	0	0,00	0	0

Figure 8: Daily launch of the number of new confirmed cases and deaths from COVID19

Source: Author

The daily and weekly evolution was compared with the same period in each country, using accumulated values, averages, medians, standard deviation and coefficient of variation.

With the analysis of the data, it was possible to identify the countries that are performing better against the increase in the confirmed cases of COVID19, which will be recommended for future benchmark studies on the best management practices adopted.

Step 4) Creation of scenarios

Also, the evolution of the new confirmed cases of COVID19 from the most critical countries was studied to compare with Brazil and outline short-term scenarios, as well as to propose recommendations to the public, private and start-up managers.

To simplify understanding and facilitate future applications of scenarios, a strategic metaphorical approach with the number 7, the Board, the Pyramid, the Papyri and was used, together with variables that will be explained during the discussion of the results.

Finally, Clipart Library and software from Edraw Max, Libre Office and PhotoScape packages were used to write the article, make the calculations, table and figures of this article.

4. Results

4.1 Basic profile of the 16 countries

Table 1 presents the profile of the 16 countries investigated, organized in ascending order of the GHS Index 2019. Regarding Group 1, the countries considered the most critical at the end of the first half of March 2020, it is observed that Italy, China, and Iran are respectively in the 31st, 51st and 97th positions of the GHS Index 2019.

Table 1: Information of the countries investigated (Global Health System, Transparency, Population)

RANK	GROUP	COUNTRIES	GHSI2019	CPI2019	* P (Mil)	** PD	* LEXP	* 0-14 (%)	* 10-24 (%)	* 15-64 (%)	* >=65 (%)
1TH	2	USA	01 (83.5)	023 (69)	329.1	36	80	19	20	65	16
2TH	2	UK	02 (77.9)	012 (77)	67	279.1	82	18	17	63	19
3TH	2	NETHERLANDS	03 (75.6)	008 (82)	17.1	507	82	16	18	64	20
4TH	2	AUSTRALIA	04 (75.5)	012 (77)	25.1	3.3	83	19	19	65	16
5TH	2	CANADA	05 (75.3)	012 (77)	37.3	4.1	83	16	17	66	18
6TH	2	THAILAND	06 (73.2)	101 (36)	69.3	136.3	76	17	19	71	12
7TH	2	SWEDEN	07 (72.1)	004 (85)	10.1	24.5	83	18	17	62	20
8TH	2	DENMARK	08 (70.4)	001 (87)	5.8	136	81	16	18	64	20
9TH	2	SOUTH KOREAN	09 (70.2)	039 (59)	51.3	526.8	83	13	16	72	15
10TH	2	FINLAND	10 (68.7)	003 (86)	5.6	18.2	82	17	17	62	22
11TH	1	GERMANY	14 (66.0)	009 (80)	82.4	239.6	82	13	14	65	22
12TH	1	SPAIN	15 (65.9)	030 (62)	46.4	93.7	84	14	15	66	20
13TH	NG	BRAZIL	22 (59.7)	106 (35)	212.4	25.3	76	21	23	70	9
14TH	1	ITALY	31 (56.2)	051 (53)	59.2	205.9	84	13	14	63	24
15TH	1	CHINA	51 (48.2)	080 (41)	1420.1	152.7	77	18	17	71	12
16TH	1	IRAN	97 (37.7)	146 (26)	82.8	50.9	77	24	21	70	6

Sources: NTI, JHU and EIU (2019); E.V., T. I. (2019); UNFPA (2019b); UNITED NATIONS (2019)

In terms of the perception of experts and entrepreneurs with the level of corruption in the countries in the year 2019 (EV, TI, 2019), the CPI2019 ranking (Corruption Perception Index) points out that the most transparent countries on the planet that were classified up to the 12th position are: 1st) Denmark (87 points); 3rd) Finland (86 points); 4th) Sweden (85 points); 8th) The Netherlands (82 points); 9th) Germany (80 points); 12th) United Kingdom, Australia, and Canada, all with 77 points.

The countries that were between the 20th and 40th global positions were: 23rd) USA (69 points); 30th) Spain (62 points) and South Korea (59 points).

The least transparent countries were: 146a) Iran (26 points); 106a) Brazil (106 points), worth noting that Brazil has been losing positions in recent years; 80a) China (41 points) and 51a) Italy (53 points). This information is relevant to analyze more carefully the data collected from countries whose perception of public transparency is considered low.

In terms of population, China, the USA, Brazil, Iran, and Germany are the five most populous countries, while Finland, Denmark, Sweden, the Netherlands, and Australia are the least populated regions respectively.

In terms of population density (number of people per Km²) the five most dense countries are respectively: South Korea (526.8), Netherlands (507), United Kingdom (279.10), Germany (239.6) and Italy (205.90), while the five least dense countries are in this order: Australia (3.3), Canada (4.1), Finland (18.2), Sweden (24.5), Brazil (25.3) and the USA (36). This information can be useful for future research aimed to analyze the increase in new cases due to the greater number of the population and its greater concentration in the affected region.

Finally, concerning the countries with the highest proportion of people aged 65 and over, the following decreasing order was observed: 1st) Italy (24%); 2nd) Germany and Finland (22%); 3rd) Netherlands, Denmark, Spain, Switzerland (20%); 4th) United Kingdom (19%); 5th) Canada (18%); 6th) USA and Australia (16%); 7th) South Korea (15%); 8th) China and Thailand (12%); 9th) Brazil (9th); 10th) Iran (6%).

4.2 Daily evolution of new confirmed cases from Covid19 in 16 countries

The first analysis was made observing the date of the first officially confirmed case (START), the Number of Days (ND) and Weeks (N WEEKS) in which the country faces the pandemic (ND) until the date of 03/30/20, Total new confirmed cases in this period (TOTNC), Average number of confirmed cases per day (TOTNC/ND), Total deaths in the period (TDEATHS) and Average number of confirmed deaths per day (TDEATHS/ND).

The results were organized in Table 2 in decreasing order of Total New Cases (TOTNC) confirmed in this period, which allows observing that:

- a) The total of new confirmed cases among the 16 countries is approximately 612,043, with approximately 32,226 deaths recorded, representing about 5.3% of the total of new cases;
- b) Among the five countries with the longest time to face COVID19, only China is in Group 1 with 91 days and 3 weeks, the other four are in Group 2: Thailand with 78 days and 11.14 weeks, South Korea with 71 days and 10.14 weeks, the USA with 70 days and 10 weeks, and Australia with 66 days and 9.43 weeks. On the other hand, the countries with the least time are Denmark and the Netherlands with 33 days and 4.71 weeks, Brazil with 35 days and 5 weeks, Iran with 41 days and 5.86 weeks, and Sweden with 45 days and 6.43 weeks. It is worth mentioning that among these five countries with less time to act against the pandemic, Iran registered an average of 67 deaths per day, ahead of the Netherlands (26), Brazil (5), Sweden (3) and Denmark (2);

Table 2: Classification of countries in decreasing order of new confirmed cases of COVID19

RANK	GROUP	COUNTRIES	GHSI2019	CPI2019	** PD	*15-64 (%)	* >=65 (%)	START	ND	NWEEKS	TOTNC	TOTNC/ND	TDEATHS	TDEATHS/ND
1TH	2	USA	01 (83.5)	023 (69)	36	65	16	21/01/20	70	10,00	162848	2326	3157	45.1
2TH	1	ITALY	31 (56.2)	051 (53)	205,90	63	24	31/01/20	60	8,57	101739	1696	11591	193
3TH	1	SPAIN	15 (65.9)	030 (62)	93,70	66	20	31/01/20	60	8,57	87956	1466	7716	129
4TH	1	CHINA	51 (48.2)	080 (41)	152,70	71	12	31/12/19	91	13,00	81518	896	3413	38
5TH	1	GERMANY	14 (66.0)	009 (80)	239,60	65	22	27/01/20	64	9,14	66885	1045	645	10
6TH	1	IRAN	97 (37.7)	146 (26)	50,90	70	6	19/02/20	41	5,86	41565	1014	2757	67
7TH	2	UK	02 (77.9)	012 (77)	279,10	63	19	31/01/20	60	8,57	22141	369	1408	23
8TH	2	NETHERLANDS	03 (75.6)	008 (82)	507	64	20	27/02/20	33	4,71	11750	356	864	26
9TH	2	SOUTH KOREAN	09 (70.2)	039 (59)	526,80	72	15	20/01/20	71	10,14	9661	136	158	2
10TH	2	CANADA	05 (75.3)	012 (77)	4,10	66	18	27/01/20	64	9,14	7448	116	89	1
11TH	NG	BRAZIL	22 (59.7)	106 (35)	25,30	70	9	25/02/20	35	5,00	4630	132	163	5
12TH	2	AUSTRALIA	04 (75.5)	012 (77)	3,30	65	16	25/01/20	66	9,43	4460	68	19	0
13TH	2	SWEDEN	07 (72.1)	004 (85)	24,50	62	20	15/02/20	45	6,43	4028	90	146	3
14TH	2	DENMARK	08 (70.4)	001 (87)	136	64	20	27/02/20	33	4,71	2577	78	77	2
15TH	2	THAILAND	06 (73.2)	101(36)	136,30	71	12	13/01/20	78	11,14	1524	20	10	0
16TH	2	FINLAND	10 (68.7)	003 (86)	18,20	62	22	29/01/20	62	8,86	1313	21	13	0

Sources: NTI, JHU and EIU (2019); E.V., T. I. (2019); UNFPA (2019b); Worldometers (2020)

c) Group 1 composed of Italy, Spain, China, Germany and Iran, the five countries with the most cases at the end of the first half of March/20, accounted for approximately 379,663 new cases with about 26,122 deaths, representing 6.9% new cases in this group. The total number of new cases in Group 1 represents about 62.03% of the total of the 16 countries, while the total number of deaths in Group 1 represents 81.06% of the total number of deaths in the 16 countries.

d) Most Group 1 countries, except for Germany, did not rank in 2019 among the 10 most transparent countries on the planet, which is why the data presented may have been or still be underestimated, especially in Iran (146th place with 26 points), China (80th place with 41 points), Italy (51st place with 53 points) and Spain (30th place with 62 points);

e) In Group 2 with the countries with the best global score in times of Health Security, about 227,750 people were infected and 5,941 fatal cases were registered, which represents about 26.08% of all cases registered in this group. The total number of new cases in Group II represents about 37.21% of the total of the 16 countries, while the total number of deaths in Group II represents 18.43% of the total number of deaths in the 16 countries;

f) The sum of the population of the 5 countries in Group 1 reaches 1,691 billion inhabitants, which is 2.74 times greater than the sum of the 10 countries in Group 2 (617.7 million). The number of new cases registered in Group 1 countries (379,663) is 1.67 times higher than Group II (227,750), while the number of deaths in Group 1 (26,122) is 4.4 times higher than in Group 2 (5,941). This last result draws attention because the countries considered to have the best health security systems are presenting a total amount of average deaths per day (59), which is much lower than the countries in Group 1 (437), with an emphasis on Finland, Thailand, Australia, Canada, Denmark, and South Korea. In Group 1 Germany is the only country with an average number of deaths per day (10) close to the majority of Group 1;

g) Among the Group 2 countries, the USA is the one that has presented the worst indicators, after 67 days it assumed the leadership in the world ranking on March 27, 2020, on March 30, 2020, accumulated 162,848 new cases, about 2,326 new cases per day. Altogether there are 3,157 deaths, representing an average of 45.1 deaths per day, behind only Italy (193 deaths/day), Spain (129 deaths/day) and Iran (67

deaths/day). Until the last day of data collection, only the UK (22141 new cases/day and 369 deaths), the Netherlands (11750 new cases/day and 356 deaths) and South Korea (9661 new cases per day and 136 deaths) had most worrying indicators;

h) Of the 16 countries, the majority (11; 68.75%) has several days equal to or greater than 60 (two months): China (91 days), Thailand (78), South Korea (71), USA (70 days), Australia (66 days), Canada and Germany (64 days), Finland (62 days), United Kingdom, Spain, and Italy with 60 days. Among these 11 countries with the longest pandemic time (Table 3), the five that had the lowest averages of new daily cases of COVID19 were Thailand (20), Finland (21), Australia (68), Canada (116) and South Korea (136), all with the best performances in terms of the average number of deaths per day overtime;

Besides, these five countries are in the top ten of the 2019 GHS Index, with Finland standing out for being the country with the best ranking in terms of transparency (3rd place in CPI 2019), as well as having a rate (22%) of people over 65 years old, considered to be the highest risk by WHO. Because of this, they are highly recommended for benchmark studies to identify the good practices adopted to face the virus, only highlighting the care with Thailand, even though it was considered the 6th country with the best Health Security System (GHSI2019), the country was considered by the GPI2019 the 101st country in terms of transparency;

Table 3: Classification of 11 countries in increasing order of the average new cases/day of COVID19

RANK	GROUP	COUNTRIES	GHSI2019	CPI2019	** PD	*15-64 (%)	* >=65 (%)	START	ND	NWEEKS	TOTNC	TOTNC/ND	TDEATHS	TDEATHS/ND
1TH	2	THAILAND	06 (73.2)	101(36)	136,30	71	12	13/01/20	78	11,14	1524	20	10	0
2TH	2	FINLAND	10 (68.7)	003 (86)	18,20	62	22	29/01/20	62	8,86	1313	21	13	0
3TH	2	AUSTRALIA	04 (75.5)	012 (77)	3,30	65	16	25/01/20	66	9,43	4460	68	19	0
4TH	2	CANADA	05 (75.3)	012 (77)	4,10	66	18	27/01/20	64	9,14	7448	116	89	1
5TH	2	SOUTH KOREAN	09 (70.2)	039 (59)	526,80	72	15	20/01/20	71	10,14	9661	136	158	2
6TH	2	UK	02 (77.9)	012 (77)	279,10	63	19	31/01/20	60	8,57	22141	369	1408	23
7TH	1	CHINA	51 (48.2)	080 (41)	152,70	71	12	31/12/19	91	13,00	81518	896	3413	38
8TH	1	GERMANY	14 (66.0)	009 (80)	239,60	65	22	27/01/20	64	9,14	66885	1045	645	10
9TH	1	SPAIN	15 (65.9)	030 (62)	93,70	66	20	31/01/20	60	8,57	87956	1466	7716	129
10TH	1	ITALY	31 (56.2)	051 (53)	205,90	63	24	31/01/20	60	8,57	101739	1696	11591	193
11TH	2	USA	01 (83.5)	023 (69)	36	65	16	21/01/20	70	10,00	162848	2326	3157	45.1

Sources: NTI, JHU and EIU (2019); E.V., T. I. (2019); UNFPA (2019b); Worldometers (2020)

I) In the ranking of the 16 countries, Brazil was in 11th place with 4630 new cases registered in 35 days and 9th place with 163 deaths.

Brazil is a worrying case for the reasons already mentioned in the introduction and for being the second country among the 16 investigated to have the worst performance in transparency (106th place on the planet with 35 points), behind only Iran (146th place on the planet with 26 points) points).

Given the importance of speed and transparency advocated by WHO in combating pandemics, Brazil is a worrying case, since there is evidence of slowness in the process of daily registration of new cases and deaths throughout the country, with several records published in newspapers (CAMPBELL, 2020; CORREIO BRAZILIENSE, 2020; LEMOS, 2020; CRUZ, 2020; DINIZ et al, 2020; FOLHA, 2000b) involving new unrecorded cases or burials in a record time of suspected victims of COVID19 who were not registered locally and nationally.

Figure 9 shows the evolution of the number of new cases and deaths registered in Brazil. When analyzing the behavior of the numbers until 03/30/20, a series of numbers with very close values is perceived, sometimes showing reduction, sometimes slow growth, such values have characteristics of the low ability of Brazil to record efficiently the COVID19 cases and/or bias.

Since the number of unregistered cases that are being disclosed in newspapers, as well as the experience of the most critical countries, especially Italy, Spain, and the USA, it will not be long before hundreds of cases appear around the country, and it is no longer possible to officially control the slow evolution of the numbers.

Day	Week	Brazil	WD	DV	DVAC	DG(%)	DAC(%)	DVTAC%	DEATH	DEATHAC
1	1	25/02/20	T(3a)	1	1	-	-	100	0	0
19	3	14/03/20	Sa	23	121	9,52	23,47	19,01	0	0
20	3	15/03/20	Sun(D)	79	200	243,48	65,29	39,50	0	0
21	3	16/03/20	M(2a)	34	234	-56,96	17,00	14,53	0	0
22	4	17/03/20	T(3a)	112	346	229,41	47,86	32,37	1	1
23	4	18/03/20	W(4a)	183	529	63,39	52,89	34,59	3	4
24	4	19/03/20	Th(5a)	111	640	-39,34	20,98	17,34	3	7
25	4	20/03/20	F(6a)	330	970	197,30	51,56	34,02	4	11
26	4	21/03/20	Sa	208	1178	-36,97	21,44	17,66	7	18
27	4	22/03/20	Sun(D)	368	1546	76,92	31,24	23,80	7	25
28	4	23/03/20	M(2a)	378	1924	2,72	24,45	19,65	9	34
29	5	24/03/20	T(3a)	323	2247	-14,55	16,79	14,37	12	46
30	5	25/03/20	W(4a)	307	2554	-4,95	13,66	12,02	13	59
31	5	26/03/20	Th(5a)	431	2985	40,39	16,88	14,44	18	77
32	5	27/03/20	F(6a)	432	3417	0,23	14,47	12,64	15	92
33	5	28/03/20	Sa	487	3904	12,73	14,25	12,47	22	114
34	5	29/03/20	Sun(D)	352	4256	-27,72	9,02	8,27	22	136
35	5	30/03/20	M(2a)	374	4630	6,25	8,79	8,08	27	163

Figure 9: Evolution of the numbers of new cases and deaths of COVID19 in Brazil

Source: Worldometers (02/25 to 03/30/20)

4.3 China's actions and critical periods of COVID19 in the first 91 days

This analysis took into account the daily and weekly values of new confirmed cases in each of the 16 countries, focusing primarily on the countries that were considered most critical in March 2020.

Daily growth in percentage (DG%) was also analyzed to identify the most critical weeks and days in each of the countries.

The results of Figure 10 show that until March 03/30/20, when 91 days have passed since the first case officially announced to WHO by China (December 31, 19), the most critical countries in terms of registering new cases are: USA, China, Italy, Spain, Germany, and Iran.

4.3.1 China

It seems that in November and December, China took a long time to communicate to the WHO about the new disease and the first people infected. The first official report only took place on 12/31/20. By the end of the 3rd week, 291 new cases had been announced, as of the 4th week, the number of new cases evolved rapidly, reaching a maximum value of 14108 on the 44th day (02/12/20) of the 7th week, the date from which registered the reduction over time, apparently being the only country that managed to control the pandemic for the number of cases in the order of dozens daily, starting from the 67th day (03/06/20) of the 10th week.

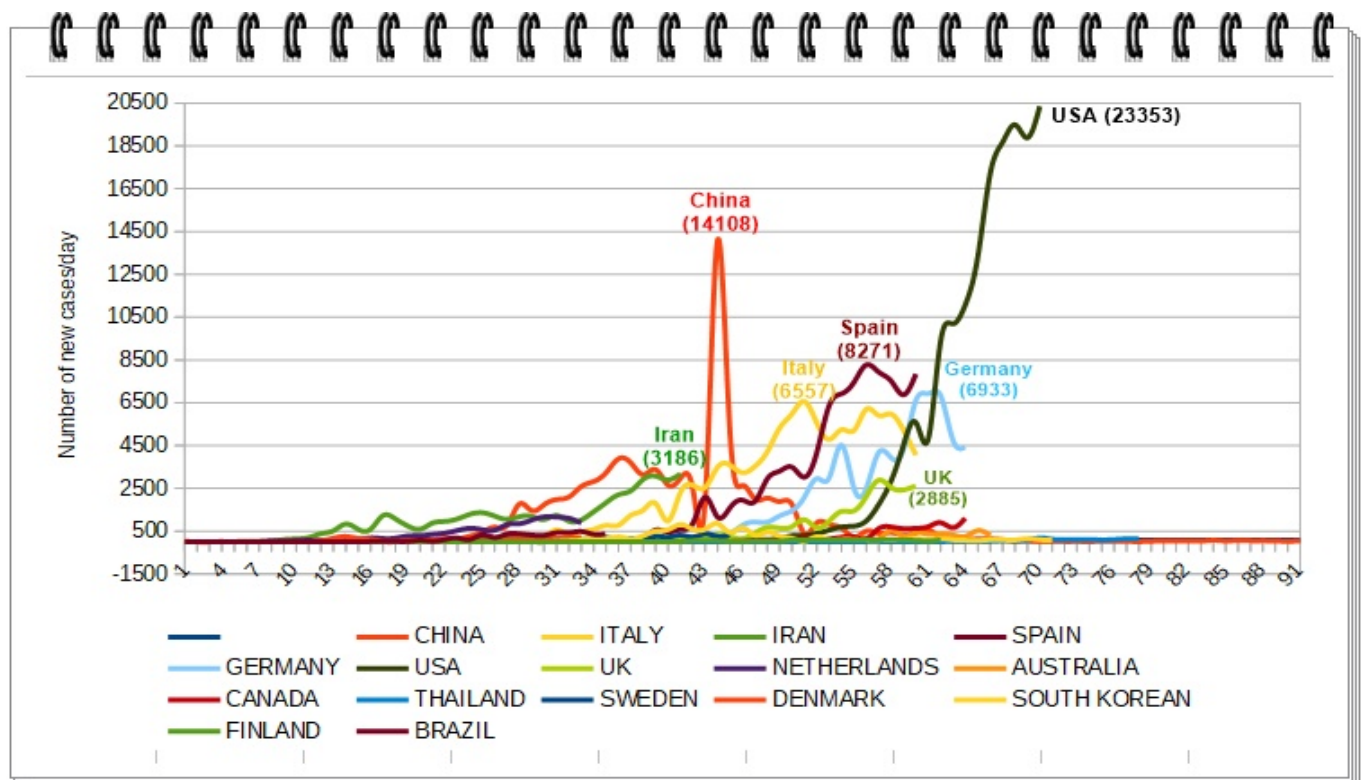


Figure 10: Number of new cases confirmed daily between 12/31/19 until 03/30/20

Source: Author (2020)

Table 6: Daily Growth (DG%) of the Number of COVID19 cases in China (12/31/19 to 03/30/20)

WEEK – CHINA	T(3a)	W(4a)	Th(5a)	F(6a)	Sa	Sun(D)	M(2a)	X - DG(%)	Med - DG(%)	S - DG(%)	CV - DG(%)
1	Start	-100,00	0,00	.	-100,00	.	-100,00	-75,00	-100,00	50,00	-66,67
2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
3	0,00	0,00	0,00	.	1350,00	32,76	20,78	233,92	10,39	546,93	233,81
4	60,22	-12,08	107,63	63,24	54,95	11,77	130,30	59,43	60,22	49,61	83,47
5	-17,62	19,05	14,05	5,96	23,39	9,07	14,51	9,77	14,05	13,40	137,11
6	20,06	-4,89	-14,92	7,70	-21,65	12,10	-17,02	-2,66	-4,89	16,14	-607,03
7	-18,32	600,15	-63,92	-48,11	-23,97	1,99	-7,81	62,86	-18,32	238,01	378,65
8	-7,36	-77,64	127,37	-7,42	-21,26	-66,98	137,38	12,01	-7,42	86,76	722,31
9	-20,08	6,65	-24,48	30,58	34,19	-64,75	-38,12	-10,86	-20,08	36,45	-335,70
10	-4,80	16,81	2,88	-30,77	-55,56	-9,09	-52,50	-19,00	-9,09	27,86	-146,61
11	26,32	-37,50	13,33	-23,53	53,85	-20,00	31,25	6,25	13,33	33,75	540,37
12	-38,10	161,54	14,71	5,13	12,20	-15,22	100,00	34,32	12,20	70,62	205,75
13	-39,74	42,55	-17,91	-1,82	-16,67	-31,11	54,84	-1,41	-16,67	36,41	-2585,29
X	-3,29	47,28	12,21	0,09	99,19	-11,62	21,05				
MED	-6,08	0,00	0,00	0,00	0,00	-4,55	14,51		X of all DG (%)	24,81	
S	28,20	177,32	51,39	29,88	378,29	30,43	70,28		Med of all DG (%)	0,00	
CV	-858,36	375,05	420,91	34747,67	381,38	-261,85	333,94				

Source: Author (2020)

Table 6 shows the daily growth (DG) as a percentage of new cases of COVID10 in China from 12/31/19 to 3/30/20, as well as the mean (X), the median (Med), the deviation standard (S), the coefficient of variation (CV), the general mean (X of all DV) and the general median (MED of all DG%) of all Daily Increases.

The results in Table 6 show that, in relative terms, weeks 3, 4, 7 and 12 were those with the highest daily growth percentages for Covid19 in China, while weeks 1, 8, 9 and 10 showed those that had the lowest growth rates. The most critical days of the week were Saturday (X = 99.19%), Wednesday (47.28%) and Monday (X = 21.5%) respectively, the least critical were Sunday (X = -11.62) and Tuesday (X = -3.29). Because China has been the focus of the pandemic, it will receive greater emphasis in this section, especially on some of the actions taken over time.

According to a report (WHO, 2020d) of an international mission carried out in China (25 experts from China, Germany, Japan, South Korea, Nigeria, Russia, Singapore, USA, and WHO), between 16 and 24 February 2020:

- implementation of control and prevention measures in the main areas of Hubei and Wuhan;
- closing public markets to identify the zoonotic source;
- formulation of the protocol to diagnose, treat, monitor, manage contacts of people close to patients, and perform tests in laboratories delivering the result on the same day;
- implementation of strategies to reduce the intensity of the pandemic in the priority regions of Wuhan and Hubei: other markets for the sale of wild animals have also been closed; temperature checks, quarantine; isolation of people close to patients and with medical monitoring; changes to the Spring Festival holiday dates; cancellation of mass activities; traffic control; control of the capacity of the transport system to reduce the movement of people; construction of new hospitals; use of reserve beds; coordination of the allocation of medical supplies; guarantee price stability and product distribution;
- reduce the clusters of cases: standardization of manuals; implementing measures to improve testing capacity, admission, and treatment of patients; adoption of technologies (big data, artificial intelligence, applications, bar codes, etc. to strengthen the tracking of people involved and the management of priority populations; promulgation of policies related to health insurance, involving payment and financial

compensation; popularization of knowledge about disease prevention, control of the gradual return of social activities, etc.

At the end of the report, the mission presents various technical information and recommendations deemed useful not only for the Chinese but for other countries.

4.3.2 USA, Italy and Spanish

Concerning the other countries considered critical in Group 1, none has yet managed to drastically reduce the number of new cases over time. The USA, despite being in Group 2, is currently the leader of new cases, which is why this country will be compared within Group 1.

Politicians and public officials in the USA, Italy and Spain ignored the warnings of scientists, control bodies and WHO, when prioritizing the economy, it took a long time to recognize the seriousness of the pandemic and to react since the first confirmed cases in the second half January 2020 (PISANO, SADUN and ZANINI, 2020; GLOBO, 2020; HALTIWANG, 2020; KEELEY, 2020).

The US officially registered the first case on 1/21/20 and only 100 new cases by the end of the 6th week. In the 7th week, 604 new cases were registered (average of 86 new cases/day), six times the value of the first six weeks. In the eighth week, more than 3959 new cases were recorded (average of 566 cases/day), with daily growth rising from 3 digits after the 9th week, with a peak of 20353 new cases recorded on the last day of data collection (03/30/20). The average growth rate in the USA in the last ten days is 16.54%, one of the highest indexes when compared against other countries, reason by which it may register continuous growth of new cases and it seems that it may remain at the top of the world for the next month. Table 7 points out that from the end of the 6th week onwards, the highest percentage of new cases of COVID19 increased in the USA, with Sunday (X = 42.90%) and Monday (17.83%) being the days most critical of the week.

Table 7: Daily Growth (DG%) of the New cases of COVID19 in USA (01/21-30/03/20)

WEEK - USA	T(3a)	W(4a)	Th(5a)	F(6a)	Sa	Sun(D)	M(2a)	X - DG(%)	Med - DG(%)	S - DG(%)	CV - DG(%)
1	Start	-100,00	0,00	.	0,00	100,00	-100,00	-20,00	0,00	83,67	-418,33
2	0,00	0,00		0,00	0,00	200,00	-100,00	16,67	0,00	98,32	589,92
3	0,00	.	-100,00	0,00	0,00	0,00	0,00	-16,67	0,00	40,82	-244,95
4	0,00	0,00	0,00	0,00	.	0,00	0,00	0,00	0,00	0,00	0,00
5	0,00	0,00	.	-100,00	0,00	0,00	.	-20,00	0,00	44,72	-223,61
6	-77,78	-25,00	-100,00	.	66,67	40,00	257,14	26,84	7,50	130,01	484,43
7	-4,00	41,67	85,29	55,56	18,37	-8,62	53,77	34,58	41,67	34,27	99,12
8	77,91	5,86	28,99	38,89	26,55	5,89	33,38	31,07	28,99	24,34	78,35
9	77,82	62,93	59,06	23,13	-13,50	94,82	8,39	44,67	59,06	39,41	88,23
10	8,94	20,14	29,16	8,46	4,34	-3,13	7,79	10,81	8,46	10,63	98,30
X	9,21	0,62	0,31	3,25	11,38	42,90	17,83				
MED	0,00	0,00	14,50	4,23	0,00	2,95	7,79		X of all DG (%)	13,05	
S	46,78	45,77	68,09	46,48	23,77	68,56	104,52		Med of all DG (%)	0,00	
CV	507,89	7364,82	21726,15	1427,96	208,92	159,84	586,18				

Source: Author

Italy has officially released only 3 new cases on the 21st (1/20/20) of the 3rd week since January 31, 2020, when the first case was confirmed. In the 4th week, 647 new cases were recorded (average of 92 new cases/day), hundreds of times the value of the first 3 weeks. In the 5th week more 3208 new cases registered (average of 458 cases/day), in the 6th week more 11255 new cases (average of 1608 new cases/day) with

daily growth with 4 digits, reaching the maximum value of 101739 new cases recorded on the last day of data collection (03/30/20). In the last ten days, the number of new cases has evolved more slowly with records of increases and decreases in cases, with an average rate of – 3.03%.

Table 8: Daily Growth (DG%) of the Number of COVID19 cases in Italy (01/31 - 03/26/20)

WEEK – CHINA	T(3a)	W(4a)	Th(5a)	F(6a)	Sa	Sun(D)	M(2a)	X - DG(%)	Med - DG(%)	S - DG(%)	CV - DG(%)
1	Start	-100,00	0,00	.	-100,00	.	-100,00	-75,00	-100,00	50,00	-66,67
2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
3	0,00	0,00	0,00	.	1350,00	32,76	20,78	233,92	10,39	546,93	233,81
4	60,22	-12,08	107,63	63,24	54,95	11,77	130,30	59,43	60,22	49,61	83,47
5	-17,62	19,05	14,05	5,96	23,39	9,07	14,51	9,77	14,05	13,40	137,11
6	20,06	-4,89	-14,92	7,70	-21,65	12,10	-17,02	-2,66	-4,89	16,14	-607,03
7	-18,32	600,15	-63,92	-48,11	-23,97	1,99	-7,81	62,86	-18,32	238,01	378,65
8	-7,36	-77,64	127,37	-7,42	-21,26	-66,98	137,38	12,01	-7,42	86,76	722,31
9	-20,08	6,65	-24,48	30,58	34,19	-64,75	-38,12	-10,86	-20,08	36,45	-335,70
10	-4,80	16,81	2,88	-30,77	-55,56	-9,09	-52,50	-19,00	-9,09	27,86	-146,61
11	26,32	-37,50	13,33	-23,53	53,85	-20,00	31,25	6,25	13,33	33,75	540,37
12	-38,10	161,54	14,71	5,13	12,20	-15,22	100,00	34,32	12,20	70,62	205,75
13	-39,74	42,55	-17,91	-1,82	-16,67	-31,11	54,84	-1,41	-16,67	36,41	-2585,29
X	-3,29	47,28	12,21	0,09	99,19	-11,62	21,05				
MED	-6,08	0,00	0,00	0,00	0,00	-4,55	14,51		X of all DG (%)	24,81	
S	28,20	177,32	51,39	29,88	378,29	30,43	70,28		Med of all DG (%)	0,00	
CV	-858,36	375,05	420,91	34747,67	381,38	-261,85	333,94				

Source: Author (2020)

Table 8 shows that from the end of the 4th week to the 6th week, the highest percentages of increase in new cases of COVID19 were recorded in Italy, with Thursday (X = 38.37%), Saturday (X = 26.93%) and Wednesday (17.83%) respectively the most critical days of the week.

Spain officially released a total of only 25 new cases until the 28th day (02/27/20) of the 4th week, since January 31, 2020, when the first case was confirmed. In the 5th week, 257 new cases were recorded (average of 36.7 new cases/day), a value 10 times higher than that recorded in the first 4 weeks. In the 6th week more 2864 new cases were registered (average of 409 cases/day), in the 7th week, there were 14931 new cases (average of 2133 per week) with values of 4 digits.

The highest number of new cases was 8271 recorded on the last day of the 8th week (03/26/20). And because the average growth rate in the last ten days (10.7%/day) is higher than the average growth rate for the same period recorded in Italy (- 3.03%), Spain is likely to exceed Italy among the April 3 and 5, 2020. Table 9 shows that from the end of the 4th week until the 7th week, the highest percentages of increase in new cases of COVID19 were registered in Spain, with Monday (X = 41.04%), Tuesday (X = 64.18%) and Thursday (X = 33.34%), respectively the most critical days of the week.

Table 9: Daily growth (DG%) of the number of cases of COVID19 in Spain (01/31 - 03/26/20)

WEEK - SPAIN	F(6a)	Sa	Sun(D)	M(2a)	T(3a)	W(4a)	Th(5a)	X - DG(%)	Med - DG(%)	S - DG(%)	CV - DG(%)
1	Start	-100,00	0,00	0,00	0,00	0,00	0,00	-16,67	0,00	40,82	-244,95
2	0,00	0,00	.	-100,00	0,00	0,00	.	-20,00	0,00	44,72	-223,61
3	-100,00	0,00	0,00	0,00	0,00	0,00	0,00	-14,29	0,00	37,80	-264,58
4	0,00	0,00	0,00	.	500,00	-33,33	175,00	106,94	0,00	206,45	193,05
5	-27,27	212,50	4,00	38,46	25,00	40,00	-14,29	39,77	25,00	80,37	202,07
6	120,37	4,20	20,16	273,83	-16,70	25,43	49,31	68,09	25,43	100,66	147,85
7	140,05	-44,44	37,79	22,35	-3,53	56,07	12,44	31,53	22,35	57,54	182,48
8	5,62	-13,42	37,92	52,64	8,70	7,73	10,92	15,73	8,70	22,15	140,81
X	19,82	7,35	14,27	41,04	64,18	11,99	33,34				
MED	0,00	0,00	4,00	22,35	0,00	3,86	10,92		X of all DG (%)	27,45	
S	83,79	90,16	17,62	113,97	176,49	27,81	65,52		Med of all DG (%)	0,00	
CV	422,68	1225,78	123,53	277,72	274,97	231,96	196,50				

Source: Author (2020)

4.3.3 Iran

Iran was the only country that surpassed more than 1000 new cases in a day before the end of the 3rd week (1234 cases on the 17th day and 1076 cases on the 18th day). Initially, it released a total of only 95 new cases on the 7th day (2/27/20) of the 1st week, since February 19, 2020, when the first case was confirmed. In the 2nd week, 2241 new cases were registered (average of 320 new cases/day), 23.6 times the value of the first week. In the 3rd week, more than 5706 new cases were registered (average of 815 cases/day), with daily growth twice exceeding the 3-digit number and returning to 3 digits. In the 4th week more 8127 new cases (average of 1161 cases/day) with values exceeding 3 digits. The peak of 3186 new cases registered on the last day of data collection (03/30/20), and in the last ten days the growth rate was 11.21%. Table 10 shows in the first two weeks the highest percentages of increase in new cases of COVID19 were recorded in Iran, with Friday (X = 34.91%), Tuesday (X = 48.07%), Thursday (X = 12.21%) and Sunday (X = 6.42%), respectively the most critical days of the week.

Table 10: Daily growth (DG%) of the number of COVID19 cases in Iran (02/19 - 03/24/20)

WEEK - IRAN	W(4a)	Th(5a)	F(6a)	Sa	Sun(D)	M(2a)	T(3a)	X - DG(%)	Med - DG(%)	S - DG(%)	CV - DG(%)
1	Start	50,00	333,33	-23,08	50,00	20,00	88,89	86,52	50,00	126,51	146,22
2	29,41	140,91	34,91	43,36	87,80	35,84	59,66	61,70	43,36	40,26	65,25
3	-29,82	0,85	108,80	-12,80	-30,95	-19,92	48,07	9,18	-12,80	51,59	562,22
4	8,74	12,21	19,91	5,90	-11,43	-12,90	11,87	4,90	8,74	12,43	253,65
5	1,19	-12,25	18,26	-21,91	6,42	37,26	29,84	8,40	6,42	21,57	256,71
X	2,38	38,35	103,04	-1,71	20,37	12,06	47,66				
MED	4,96	12,21	34,91	-12,80	6,42	20,00	48,07		X of all DG (%)	32,60	
S	24,56	61,85	133,99	27,73	48,13	26,97	29,34		Med of all DG (%)	19,08	
CV	1031,90	161,31	130,03	-1624,47	236,27	223,71	61,55				

Source: Author (2020)

4.3.4 Germany and United Kingdom

Germany registered the first case on January 27, 2020. Until the 5th week, it officially released a total of only 130 new cases, in the 6th week another 910 new cases were registered (average of 130 new cases/day), almost 9 times the value of the first 5 weeks.

In the 7th week more 4773 new cases registered (average of 682 cases/day), with daily growth exceeding 3 digits on the last day of this week (1214 cases on 03/15/20). By the end of the last day (03/29/20) which completed 9 weeks, the peak of 6933 new cases was registered on 27 March 2020. Germany's average growth rate in the last ten days is 4.54 %, which is the second-lowest rate in this group, second only to Italy. Table 11 shows between the 5th and 8th weeks, the highest percentages of increase in new cases of COVID19 were recorded in Germany, with Thursday (X = 86.11%), Sunday (X = 111.69%), Tuesday (X = 33.08%), Wednesday (X = 30.47%) and Friday (X = 15.31%), respectively the most critical days of the week.

Table 11: Daily growth (DG%) of the number of cases of COVID19 in Germany (01/27 - 03/29/20)

<u>WEEK - GERMANY</u>	<u>M(2a)</u>	<u>T(3a)</u>	<u>W(4a)</u>	<u>Th(5a)</u>	<u>F(6a)</u>	<u>Sa</u>	<u>Sun(D)</u>	<u>X - DG(%)</u>	<u>Med - DG(%)</u>	<u>S - DG(%)</u>	<u>CV - DG(%)</u>
1	Start	200,00	-100,00	.	100,00	-50,00	0,00	30,00	0,00	120,42	401,39
2	100,00	-100,00	0,00	.	0,00	-100,00	0,00	-16,67	0,00	75,28	-451,66
3	0,00	.	-50,00	-100,00	0,00	0,00	0,00	-25,00	0,00	41,83	-167,33
4	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
5	0,00	.	300,00	175,00	18,18	-80,77	920,00	222,07	96,59	368,24	165,82
6	-31,37	8,57	55,26	379,66	-55,83	4,00	84,62	63,56	8,57	147,35	231,83
7	-23,33	85,33	17,60	94,26	19,38	-0,65	31,39	32,00	19,38	43,23	135,12
8	20,18	43,59	41,29	1,11	51,29	-44,43	-0,28	16,11	20,18	33,67	209,04
9	66,72	-5,93	10,09	52,70	4,81	-1,57	-30,54	13,75	4,81	34,16	248,34
X	16,52	33,08	30,47	86,11	15,31	-30,38	111,69				
<u>MED</u>	0,00	8,57	10,09	52,70	4,81	-1,57	0,00		<u>X of all DG (%)</u>	<u>36,38</u>	
S	45,04	92,76	111,42	155,21	42,38	39,86	304,80		<u>Med of all DG (%)</u>	<u>0,00</u>	
CV	272,59	280,42	365,66	180,25	276,71	-131,20	272,90				

Source: Author (2020)

The United Kingdom registered the first two cases on January 31, 2020. Until the 5th week, it officially released a total of only 116 new cases, in the 6th week another 480 new cases were registered (average of 68.3 new cases/day), 4 times the value of the first 5 weeks.

In the 7th week more 2673 new cases registered (average of 382 cases/day). In the 8th week more 8389 new cases (1199 new cases/day), with a maximum value of 2129 new cases per day registered on 26 March 2020.

The average growth rate of new cases for Covid19 in the United Kingdom in the last ten days is 17.75%, one of the highest index among the countries, reason by which the daily growth may continue during the next month.

Table 12 shows that between the 5th and 8th weeks the highest percentages of increase in new cases of COVID19 were registered in the United Kingdom, with Tuesday (X = 57.15%), Wednesday (X = 42.24%), Sunday (X = 46.33%), respectively the most critical days of the week.

For reasons of space, Tables 13 to 20 containing the daily growth (DG%) of the other countries can be seen in the Appendix of this article.

Table 12: Daily growth (DG%) of the number of cases of COVID19 in the UK (01/31 03/26/20)

WEEK - UK	F(6a)	Sa	Sun(D)	M(2a)	T(3a)	W(4a)	Th(5a)	X - DG(%)	Med - DG(%)	S - DG(%)	CV - DG(%)
1	Start	-100,00	0,00	0,00	0,00	0,00	0,00	-16,67	0,00	40,82	-244,95
2	0,00	0,00	0,00	.	-100,00	.	-100,00	-40,00	0,00	54,77	-136,93
3	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
4	0,00	0,00	.	-100,00	0,00	0,00	.	-20,00	0,00	44,72	-223,61
5	33,33	-25,00	333,33	-76,92	300,00	200,00	-19,44	106,47	33,33	168,22	158,00
6	65,52	-6,25	53,33	-37,68	41,86	27,87	74,36	31,29	41,86	40,42	129,19
7	48,53	69,31	-26,61	-39,44	167,76	66,09	-4,88	40,11	48,53	71,53	178,34
8	11,04	44,96	-35,75	45,41	47,57	1,75	46,63	23,09	44,96	32,13	139,15
X	22,63	-2,12	46,33	-29,80	57,15	42,24	-0,48				
MED	11,04	0,00	0,00	-37,68	20,93	1,75	0,00		X of all DG (%)	19,74	
S	26,76	49,93	129,69	49,56	123,07	73,77	54,93		Med of all DG (%)	0,00	
CV	118,22	-2351,82	279,93	-166,28	215,36	174,63	-11506,03				

Source: Author (2020)

4.3.5 Brazil

Brazil registered the first case on February 25, 2020. Up to the 3rd week, a total of 234 new cases were officially released, in the 4th week another 1690 new cases were registered (average of 241 new cases/day), 7 times the value of the first 3 weeks. In the 5th week more 2706 new cases registered (average of 387 cases/day). During the 5 weeks, the highest value was 487 new cases, registered on March 28, 2020. The average growth rate in Brazil in the last ten days is 5.51%, considered lower than the USA, Iran, Spain, the UK and near to Germany.

Table 21 shows that between the 2nd and 4th weeks, the highest percentages of increase in new cases of COVID19 were recorded in Brazil, especially week 4. It is noteworthy that in the 5th week, the average daily growth decreased dramatically, falling from 70.49% to 1.77%, which is strange for a country with a continental dimension and with chronic problems in its health system.

In addition, Thursday (X = 87.99%) and Wednesday (X = 77.11%) are the days with the most significant increases in the percentage of new cases registered, followed by Tuesday respectively (X = 48.72%), Sunday (X = 38.54%) and Friday (X = 36.31%).

Table 21: Daily growth (DG%) of the number of cases of COVID19 in Brazil (02/25 - 03/30/20)

WEEK - BRAZIL	T(3a)	W(4a)	Th(5a)	F(6a)	Sa	Sun(D)	M(2a)	X - DG(%)	Med - DG(%)	S - DG(%)	CV - DG(%)
1	Start	-100,00	0,00	0,00	.	-100,00	0,00	-40,00	0,00	54,77	-136,93
2	0,00	.	400,00	0,00	20,00	0,00	-16,67	67,22	0,00	163,44	243,14
3	-20,00	350,00	38,89	-16,00	9,52	243,48	-56,96	78,42	9,52	155,05	197,72
4	229,41	63,39	-39,34	197,30	-36,97	76,92	2,72	70,49	63,39	107,73	152,83
5	-14,55	-4,95	40,39	0,23	12,73	-27,72	6,25	1,77	0,23	21,66	1224,84
X	48,72	77,11	87,99	36,31	1,32	38,54	-12,93				
MED	-7,28	29,22	38,89	0,00	11,13	0,00	0,00		X of all DG (%)	39,31	
S	120,76	193,87	177,47	90,27	25,90	130,90	26,14		Med of all DG (%)	0,00	
CV	247,89	251,42	201,70	248,63	1960,11	339,69	-202,11				

Source: Author

This information is useful to advance studies on which days are the ones that have the greatest growth of new cases, to identify the causes and to guide the population over time. For example, if you assume that:

- the average incubation time is 5.2 days and the average time from the beginning to the hospital visit is 12.5 days (LI, GUAN, WU et al, 2020);
- that in the two public hospitals in São Paulo (Brazil) that concentrate serious cases of patients with COVID19, it is taking an average of one week to obtain and confirm the test result (LEÃO and CARVALHO, 2020);
- it takes a day for hospitals to inform the authorities to update the new case with the Ministry of Health, so it can be speculated that it would take about 20.5 days to confirm a case of Covid19 in the Brazilian health system, in this hypothesis, looking at Table 21, would it be possible to consider that the days of greatest contagion were Wednesday, Thursday and Friday, while Sunday, Monday and Tuesday would be the periods with the least contagion?

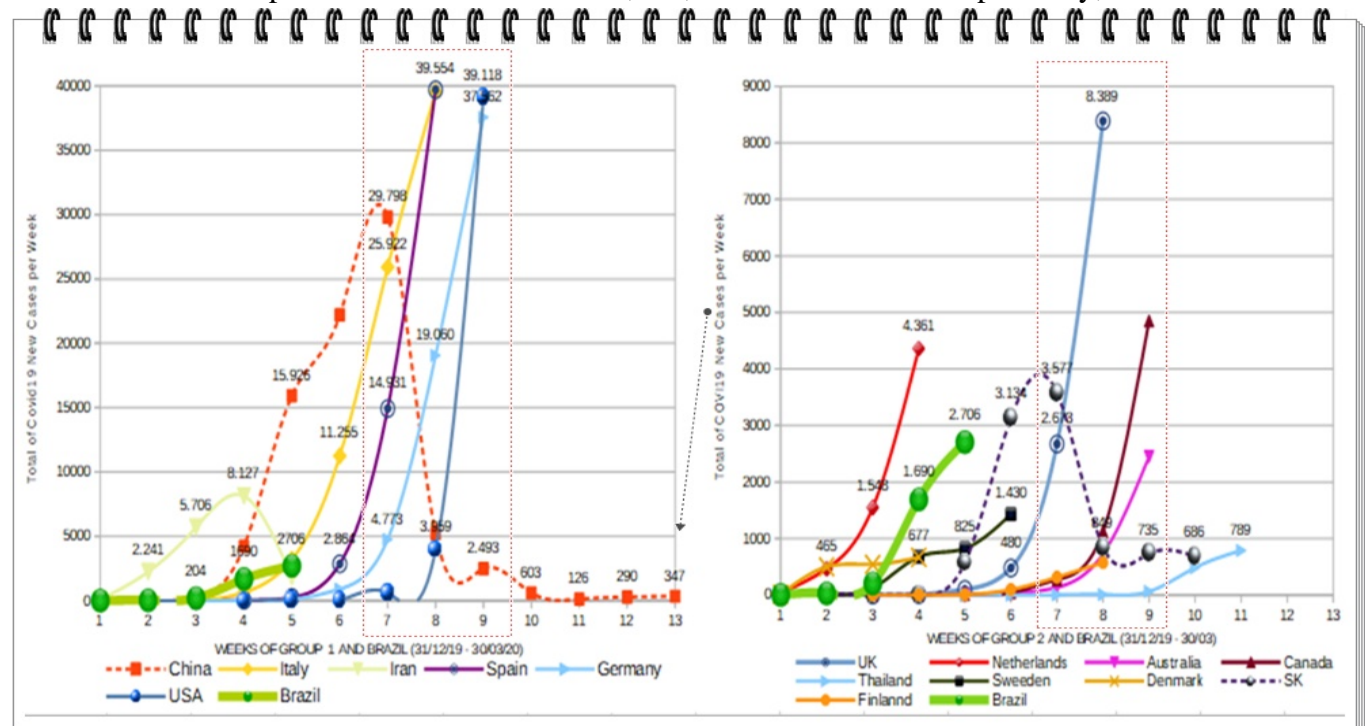
Because the weighting is based on initial Chinese statistics analyzed in early January/20, the answer is difficult, which is why further research is recommended to advance this topic.

4.3.6 Brazil and the 15 countries

Figures 11 and 12 summarize the total number of new cases per week between the two groups, inserting Brazil in each of them, just placing the total of new cases for the weeks that were completed between 12/31/19 and 03/30/20.

In short, the results from Figure 11 and 12 show that:

- Each country has a different dynamic of evolution in the number of new cases per week overtime, because while Iran and China had rapid evolution from the third week, Italy, Spain, Germany, and the United States had rapid evolution a from the 6th, 7th, 8th and 9th weeks respectively;



Figures 11 and 12: Total new cases per week in Group 1 countries (left), Group 2 and Brazil

Source: Author (2020)

b) among the countries of Group 2 (except USA; 2326 cases/day), the UK in 60 days reached a total of 22141 new cases, an average of 369 new cases/day, with fast growth from the 7th week. After that is Netherland, in 33 days already reached a total of 11750 new cases, 356 new cases/day. The South Korea in 71 days reached a total of 9661 new cases (average of 136 new cases/day), with its fast growth from the 5th week, peaking in the 7th week, reducing the values over the time. Next comes Canada, which in 64 days had a total of 7448 new cases, an average of 116 cases/day, with critical growth from the 8th week. The other countries had daily average values lower than 90, standing out Thailand, Australia and Finland for having more then 2 months of combact against coronavirus, they were able to maintain the lowest vales in relation to others;

c) When comparing the result of the first 5 weeks of Brazil with the same period of the 15 countries (Figures 11, 12), it is clear that, except China, Iran, and the Netherlands, the growth of its curve is greater than the other countries, with the potential to increase significantly between the 7th (April 7 to 13, 20) and 9th (April 21 to 27, 20) weeks, and maybe among the 5 most-affected countries before the end of May 2020.

For example, the two weeks (4 and 5), in absolute terms, Brazil had 4396 new cases (95% of the total), second only to China, Iran, and the Netherlands respectively (Table 22 - TNCW45) and surpassing Italy, Denmark, Sweden, South Korea, Spain, Germany, United Kingdom, USA, and other countries.

Tables 22 and 23: New Cases of Covid 19 in Brazil during weeks 4 and 5 compared to 15 countries

RANK	COUNTRIES	TNCW45	AVDG (%)	MEDDG (%)	SDG(%)	CVDG (%)	RANK	COUNTRIES	TNCW45	AVDG (%)	MEDDG (%)	SDG(%)	CVDG (%)
1TH	China	20150,0	34,6	16,8	43,4	125,4	1TH	SK	575,0	223,8	0,0	751,6	335,8
2TH	Iran	16839,0	7,6	7,6	17,0	224,7	2TH	Germany	114,0	102,5	0,0	264,2	257,7
3TH	Netherlands	11563,0	9,4	10,0	18,4	195,1	3TH	Spain	279,0	70,8	4,0	149,0	210,5
4TH →	Brazil	4396,0	36,1	4,5	82,7	229,0	4TH	UK	108,0	53,8	0,0	142,8	265,6
5TH	Italy	3855,0	52,8	20,3	90,2	170,8	5TH	Italy	3855,0	52,8	20,3	90,2	170,8
6TH	Denmark	2050,0	12,1	6,0	32,9	270,9	6TH →	Brazil	4396,0	36,1	4,5	82,7	229,0
7TH	Sweeden	1502,0	18,8	30,2	39,2	208,4	7TH	China	20150,0	34,6	16,8	43,4	125,4
8TH	SK	575,0	223,8	0,0	751,6	335,8	8TH	Canada	16,0	20,9	0,0	137,1	655,9
9TH	Spain	279,0	70,8	4,0	149,0	210,5	9TH	Sweeden	1502,0	18,8	30,2	39,2	208,4
10TH	Germany	114,0	102,5	0,0	264,2	257,7	10TH	Denmark	2050,0	12,1	6,0	32,9	270,9
11TH	UK	108,0	53,8	0,0	142,8	265,6	11TH	Netherlands	11563,0	9,4	10,0	18,4	195,1
12TH	USA	41,0	-9,1	0,0	30,2	-331,7	12TH	Iran	16839,0	7,6	7,6	17,0	224,7
13TH	Canada	16,0	20,9	0,0	137,1	655,9	13TH	USA	41,0	-9,1	0,0	30,2	-331,7
14TH	Thailand	16,0	-20,0	0,0	42,2	-210,8	14TH	Finlannd	10,0	-10,0	0,0	87,6	-875,6
15TH	Finlannd	10,0	-10,0	0,0	87,6	-875,6	15TH	Thailand	16,0	-20,0	0,0	42,2	-210,8
16TH	Australia	10,0	-22,7	0,0	41,0	-180,4	16TH	Australia	10,0	-22,7	0,0	41,0	-180,4

Note: TNCW25: Total of New Cases in Weeks 4 and 5; AVDG (%): Average of Daily Growth of New Cases in Weeks 4 and 5; MED: Median; S: Standard Deviation; CV: Coefficient of Variation

Source: Author (2020)

When analyzing indicators involving the average and median daily growth rate during this period, it is clear that it presented an average growth rate of 36.13% (Table 23 - AVDG%), ranking sixth, behind South Korea, Germany, Spain, the United Kingdom, and Italy.

Given the high variability of the % around the Average, when using the Median Daily Growth Rate of new cases (MDDG%), it is noticed that it represents 4.5%, that is, half the days varied up to 4.5%, while the other half was worth more than that. When ranking countries by this indicator, Brazil is ranked 7th, behind Sweden (30.2%), Italy (20.3%), China (16.8%), Netherlands (10%), Iran (7.6%) and Denmark (6.0%), while surpassing Spain (4%) and other countries.

In both cases, Brazil is worrying, because in absolute and relative terms it has grown more than some of the countries that are currently in the lead in new cases of COVID 19 on the planet, which justifies the

concern of scenarios in which it may be at the top of the countries most affected before the end of May 2020.

4.4 The Leap and the Board of Covid19

The Covid19 is a pandemic that if it happened in ancient times it would be considered a plague, because of that and to facilitate the analysis of the evolution of new cases, as well as the construction of scenarios, it was decided to develop a simple metaphorical approach that could be used in any country, the strategy was to use numbers and symbols widely known on the planet: Number 7, the Board, the Papyri and the Pyramid, as explained below.

The Leap of COVID is defined as the first value of the number of new coronavirus cases chosen when it first exceeds a certain level. As over the period from 12/31/19 to 3/30/20, most of the critical countries (except Iran) came to register more than 6000 new cases per day, so it was decided to use the number of 7 levels (number considered sacred, of cyclical completion, renewal: the menorah, seven plagues of Egypt, seven days of creation, etc.):

The Leap of COVID level 1 (LD1): when the first value is recorded above 50 cases/day; Leap of COVID level 2 (LD2): when the first value is recorded above 250 cases/day; Leap of COVID level 3 (LD3): when the first value above 500 cases/day is recorded; Leap of COVID level 4 (LD4): when the first value is recorded above 1000 cases/day; Leap of COVID level 5 (LD5): when the first value is recorded above 2000 cases/day; Leap of COVID level 6 (LD6): when the first value is registered above 4000 cases/day; Leap of COVID level 7 (LD7): when the first value is registered above 6000 cases/day.

The Board of COVID19 (Figure 13) aims to condense in a spreadsheet all the main data for the effectiveness of calculations to more clearly identify the performance of each country, group, to find success cases over time, as well as allowing an initial comparison of any country with those analyzed.

The initial variables used to record the data for each country in the main spreadsheet were (Figure 9): DAY (Number of the day), WEEK (Number of the week), Date (Date), WD (weekday), DV (Number value) of new cases registered on the day), DVAC (Number of new cases accumulated on the day), DG (Daily Growth in% compared to the previous day), DAC (Accumulated Daily Growth in% compared to the previous day), DVTA (how much the value of the number of new cases registered in the day represents the accumulated total: $DV * 100 / DAC$), DEATH (Number of fatal cases in the day), DEATHAC (Number of fatal cases accumulated in the day).

In addition to these variables, the variable ND (Total number of days until the end of data collection) and LD (Leap Day) was also created, which counts when the leap with the ND happened, that is, the nth day on which each of the seven leaps was identified: LD1, LD2.... up to LD7.

To make the comparison between countries, the sequence of values was recorded respecting the values of the same period of contagion from Day 1. To illustrate, Figure 9 shows that in the case of Brazil, the first leap of COVID19 ($LD1 \geq 50$) was on 03/20/20 (Date) of the third week, so:

LD1 = 19 means that COVID's first leap above 50 occurred on the 19th day;

Week = 3 means the third week;

WD = Sun occurred on Sunday;

DV = 79 days means that 79 new cases were registered;

DVAC = 200 means that from the 1st day to this date there have already been 200 new confirmed cases;
 DG = 243.48% is the percentage of growth about the previous day;
 DAC = 65.29 is the percentage of accumulated growth with the previous day;
 DVTA = 39.5% represents the percentage of the number of new cases concerning the total number of cases;
 DEATH = 0 means that there was no death on that day;

DEATHAC = 0 means that from the first day until the moment, the total number of deaths was zero.

After completing the registration, the COVID19 Board was created, condensing all the registered values, organized horizontally by:

Group 1 (China, Italy, Iran, Spain, Germany and the USA);

Group 2 (United Kingdom, Netherlands, Australia, Canada, Thailand, Sweden, Denmark, South Korea, and Finland);

Brazil with indicators to compare its performance with those of Group 1 and 2

The "CASE" below Brazil was a space created so that another country could be studied compared to those investigated.

In the vertical columns, for each COVID19 Leap (LD1 to LD7), was inserted the ND (Total number of days), LD (Leap Day), WD (Weekday), DV (Number of New cases), DVTA (percentage) number of new cases about the accumulated total). There is also the total number of new cases, the total number of fatal cases, as well as the percentage of fatal cases concerning the total recorded in the period.

Although it does not appear on the COVID19 Board, columns were also created to calculate the difference in days between each level created:

Example:

$\Delta L1 L0$ means the number of days it took to register Covid19's first leap;

$\Delta L2 L1$ it means the difference between LD2 and LD1, that is, how many days it took for the second leap from the first;

$\Delta L3 L1$ means the number of days it took to register the 3rd leap in relation to the second

The logic goes until the $\Delta L7 L1$ which means the number of days it took to register Covid19's seventh leap compared to the first.

In addition, the variable SCL7L1 was created to calculate the Speed of coronavirus contagion between levels 7 and 1:

$$(1) SCL7L1 = \Delta DV7DV1 / \Delta L7 L1$$

Where: $\Delta DV7DV1$ is the variation in the number of covid cases between levels 7 and 1

$\Delta L7 L1$ is the time variation between levels 7 and 1

The period between the seventh and first level was chosen as a priority because of the scenario analysis to focus on the critical countries that reached level 7. But the form can be adjusted to calculate other periods:

$$(2) SCLYLX = \Delta DVYDVX / \Delta LY LX$$

Finally, the mean, the median, the standard deviation, and the variation coefficient were used for the final construction of the COVID19 Board.

	31/12/19-30/03/20	LEAP DAY 1>=50 NC/DAY				LD2>=250 NC/DAY				LD3>=500 NC/DAY				LD4>=1K NC/DAY				LD5>=2K NC/DAY				LD6>=4K NC/DAY				LD7>=6K NC/DAY					
COUNTRY	ND	LD1	WD1	DV1	DV1TA%	LD2	WD2	DV2	DV2TA%	LD3	WD3	DV3	DV3TA%	LD4	WD4	DV4	DV4TA%	LD5	WK5	DV5	DV5TA%	LD6	WK6	DV6	DV6TA%	LD7	WK7	DV7	DV7TA%		
G1	China	91	19	Sa	58	47.93	24	Th	272	32.27	26	Sa	688	34.84	28	M	1771	39.22	32	F	2099	17.8	L>6K				44	W	14108	24.01	
	Italy	60	23	Sa	59	74.68	28	Th	250	38.46	31	Sun	566	33.41	37	Sa	1247	21.20	41	W	2313	18.56	48	W	4207	11.78	51	Sa	6557	12.24	
	Iran	41	9	Th	106	43.27	12	Sun	385	39.37	13	M	523	34.84	17	F	1234	26.00	36	W	2206	8.14									
	Spain	60	34	W	63	27.63	L>500				39	M	557	45.25	L>2K				43	F	2086	38.87	52	Sun	4172	14.5	53	M	6368	18.12	
	Germany	64	35	Sun	51	39.23	39	Th	283	51.93	46	Th	779	28.28	49	Sun	1214	20.88	51	T	2095	22.81	54	F	4528	22.81	60	Th	6615	15.06	
	USA	70	45	Th	63	28.51	50	T	290	29.18	53	F	550	24.48	57	T	1748	27.27	58	W	2848	30.76	59	Th	4530	32.85	62	Sun	9400	27.98	
	X	64	28	Sun, W	67	43.5	31		296	38.2	35		611	33.5	38		1443	26.9	44		2275	22.8	53	Sun	4359	20.5	54		8610	19.5	
	MEDIAN	62	29	Sun, W Th2x	61	41.3	28	Sun, T	283	38.5	35	SunM	562	34.1	37	Sun, M, T, F	1247	26.0	42	T	2153	20.7	53	W	4368	18.7	53	Sun, M, W	6615	18.1	
	S	16	13	and 2x	20	17.2	15	Th3x	52	8.8	14	F, Sa	101	7.1	16	Sa	289	7.4	10	W3x	294	10.8	5	Th	197	9.5	7	Th	3319	6.5	
	CVX (%)	25	47	2x	30	40	47		18	23	42		16	21	43		20	28	22	F2x	13	47	9	F	5	46	13		39	33	
G2	UK	60	38	Sun	69	24.8	44	Sa	342	30.0	48	W	676	25.7	51	Sa	1035	20.63	56.0	Th	2129	18.3	GOING TO BE AMONG 6 MOST AFFECTED COUNTRIES								
	Netherlands	33	10	Sa	60	31.9	19	M	278	19.7	23	F	534	17.8	29	Th	1019	13.71	33 DAYS & 6.71% OF DG IN THE LAST 10 DAYS & 11750 NEW CASES & 356 NC/DAY												
	Australia	66	51	Sun	52	17.3	L>500				58	Sun	537	33.4	BENCHMARK 3 - 66 DAYS & 17.52% OF DAILY GROWTH IN THE LAST 10 DAYS & 4460 NC & 68 NC/DAY																
	Canada	64	47	F	56	19.0	L>500				57	M	621	29.7	64	M	1128	15.15	64 DAYS & 39.5% OF DG IN THE LAST 10 DAYS & 7448 NEW CASES 116 & NC/DAY												
	Thailand	78	67	Th	60	22.1	BENCHMARK 1 - 78 DAYS & 17.8% OF DAILY GROWTH IN THE LAST 10 DAYS & 1524 NEW CASES & 20 NC/DAY																								
	Sweden	45	24	M	57	21.2	39	T	253	11.0	BENCHMARK 5 - 45 DAYS & 14.75% OF DAILY GROWTH IN THE LAST 10 DAYS & 4028 NEW CASES & 90 NC/DAY																				
	Denmark	33	12	M	55	61.1	14	W	252	49.0	BENCHMARK 4 - 33 DAYS & 9.89% OF DAILY GROWTH IN THE LAST 10 DAYS & 2577 NEW CASES & 78 NC/DAY																				
	SK	71	32	Th	53	47.8	38	W	284	22.5	39	Th	505	28.6	BENCHMARK 6 - 71 DAYS & GOOD CASE TO STUDY ON HOW TO REDUCE THE NEW CASES OF COVID19																
	Finland	62	42	T	54	50.0	BENCHMARK 2 - 62 DAYS & 5.29% OF DAILY GROWTH IN THE LAST 10 DAYS & 1313 NEW CASES & 21 NC/DAY																								
	X	57	36	Sun2x	57	33	31		282	26	45		575	27	48		1061	16													
CASE	MEDIAN	62	38	M2x, T, T	56	25	38	M, T, W2x, Sa	278	23	48	Sun, M, W, F	537	29	51	M, Th	1035	15													
	S	16	19	h2x, F, S	5	16	13	Sa	37	14	15		71	6	18	Sa	59	4													
	CVX (%)	28	52	a	9	49	43	F	13	54	32		12	22	37		6	22													
	Brazil	35	20	Sun	79	39.5	25	F	330	34.02	35 days & 4630 NC & is going to be among top 5 countries the end of May																				
	Brazil x G1	-29	-8	Germ	12	-4	-6	-	34	-4	Conclusion: Brazil has total days (ND) and LD1 lowers than most countries, and the results are much closer with group 1 than group 2																				
	Brazil x G2	-22	-16	UK/Aust	22	7	-6	-	48	8																					
	x G1																														
	x G2																														

Figure 13: COVID19 Board (12/31/19-30/03/20)

Source: Author

In summary, the Covid19 Board (Figure 13) revealed that:

- 1) the majority of Group 1 countries, except for Iran, reached the last level (LD7 red), with China registering at this level 14,108 new cases on the 44th day (Wednesday), the USA with 9400 new cases on the 62nd day (Sunday), Germany with 6615 new cases on the 60th day (Thursday), Italy with 6557 new cases on the 51st day (Saturday) and Spain with 6368 cases on the 53rd day (Monday). In general, the coefficient of variation (CV%) of the day of the COVID 19 leap has been decreasing since the first (47%) to the sixth (9%). All levels had similar average and median jumps: LD1 (X = 28; Med = 29; S = 13), LD3 (X = 35; Med = 35; S = 14), LD4 (X = 38; Med = 37; S = 16), LD5 (X = 44; Med = 42; S = 10), LD6 (X = 53; Med = 53; S = 5) and LD7 (X = 54; Med = 53; S = 7);
- 2) There were 37 jumps in Group 1, the most critical day of the week that registered the most jumps was Thursday (8 times; 21.2%), followed by Wednesday (6 times; 16.22%), Sunday (6 times; 16.22%), Friday and Saturday each repeating 5 times (13.5%). On the other hand, the two days on which fewer jumps occurred were Tuesday (3 times; 8.1%) and Monday (10.8%);
- 3) In Group 1, the means and medians of the speed of contagion between the level 7 and 1 of the countries were respectively XSCL7L1 = 388 new cases/day, MEDSCL7L1 = 332 new cases per day with S = 151 and CV = 41%. The speeds between countries were in ascending order: 1) China (SCL7L1 = 562 new cases per day); 2) the USA (SCL7L1 = 549 new cases per day); 3) Spain (SCL7L1 = 332 new cases per day); 4) Germany (SCL7L1 = 263 new cases per day) and 5) Italy (SCL7L1 = 232 new cases per day);
- 4) In Group 1, the rapid spread in China reached level 7 on the 44th day (Week 7) with 14108 new cases, a moment from which there was a slowdown with a drastic reduction until the end of the data collection when 48 new ones were registered cases on the 91st day (03/30/20). On the other hand, the second-fastest country, the USA, reached level 7 on the 62nd day (03/22/20) with 9400 new cases and by the end of the

data collection, it had a daily growth rate (DG%) 19.88%, reaching 20353 new cases on 03/30/20, which is why if it continues at this pace, it will continue to lead with an increase in cases in the coming weeks;

5) In Group 2, no country reached the last level, the United Kingdom was the only one to reach the fifth leap and if it continues at the current pace, it could be among the 6 most-affected on the planet in the coming weeks. The Netherlands and Canada reached the 4th level, South Korea reached the third level even with 71 days of fighting COVID19;

6) Thailand (Benchmark1) was the country with the best results, as in 78 days, it only registered a leap from COVID on the 67th day, Tuesday, 60 cases representing 22.1% of the total new accumulated cases. The other countries considered Benchmark were in this order: Finland (only one leap), Australia (3 leaps in 66 days); Denmark (2 leaps, but has little time, 33 days), Sweden (2 leaps) and South Korea (3 leaps in 71 days with a sharp reduction in new cases over time).

7) Brazil in 36 days (ND) advanced to the 2nd level with contagion speed (SCL2L1) of 50 new average cases per day when compared to the 1st level. When comparing the speed with the other countries, this speed is lower than the average (55) and median (45) of Group 1, but higher than the average (44) and median (39) of the Group 2 countries. Brazil was the country whose first leap started earlier (LD1 = 20), eight days before the average of Group 1 and 16 days before the average of Group 2. Overall, Brazil's results are closer to Group 1 than Group 2.

4.5 The COVID19's Inverted Pyramid

The board is useful to perform data accounting, however, it would not be recommended to present it to decision-makers, due to the difficulty of having a synthesized visualization of the events, so the next step was to develop an easy-to-understand conceptual model to synthesize Covid19's leaps over the levels, the main values (X, MED and S) of Group 1 and Group 2, as well as the difference of days in each level about its previous one: The board is useful to perform data accounting, however, it would not be recommended to present it to decision-makers, due to the difficulty of having a synthesized visualization of the events, so the next step was to develop an easy-to-understand conceptual model to synthesize Covid19's Leaps over the levels, the main values (X, MED and S) of Group 1 and Group 2, as well as the difference of days in each level with the first one: $\Delta L2 L1 \dots \Delta L7 L1$.

The model used the figure of the Pyramid because it represents one of the most accurate monuments of humanity, especially those built by the Egyptians, who used astronomy to accurately align the pyramids in the North-South direction (SPENCE, 2000).

Since the number of COVID19 new cases tends to grow rapidly over the first 3 months, it was opted to use the COVID19's Inverted Pyramid, which allows viewing coronavirus leaps both in a group of countries or individually.

Figure 14 shows COVID's Inverted Pyramid with the two groups, for which it is possible for a country that is in the initial stage of the pandemic (3 months) to identify the main indicators of Group 1/Group 2 in order to compare and predict with some certainty when the next leap will happen (LD) and the number of new cases (DV) at each level (L).

For example, between February 25th (first day with new cases registered) and March 30th (last day of data collection), Brazil made two leaps, Covid's last leap has the following information:

L2 (Second Level) ≥ 250 : Second Level with a value above or equal to 250

LD2 = 25: the second jump took place on the 25th day (03/20/20 Friday) since the start of the count

DV2 = 330: On the day of the second leap, 300 new cases of covid19 were registered in Brazil

As the indicators on the Covid19 Board pointed out that Brazil has results closer to Group1 (red) compared to Group 2, then one of two events may happen:

First) Brazil may leap to the Third Level ($L3 \geq 500$) in LD3 = 35 days, that is, on the 35th day after the beginning of the count, which would be on the date of 03/30/20 (last day of collection) with a tolerance of 14 days. The number of new cases to be registered can be on average 651 or 562 cases if we consider the median. Sunday, Monday (2x = more chance), Thursday or Saturday may be the most likely days. Taking into account that the second jump happened on the 25th day and that the tolerance would be 14 days, then this jump could occur until the 39th day (24 + 14), whose date would be 04/03/20;

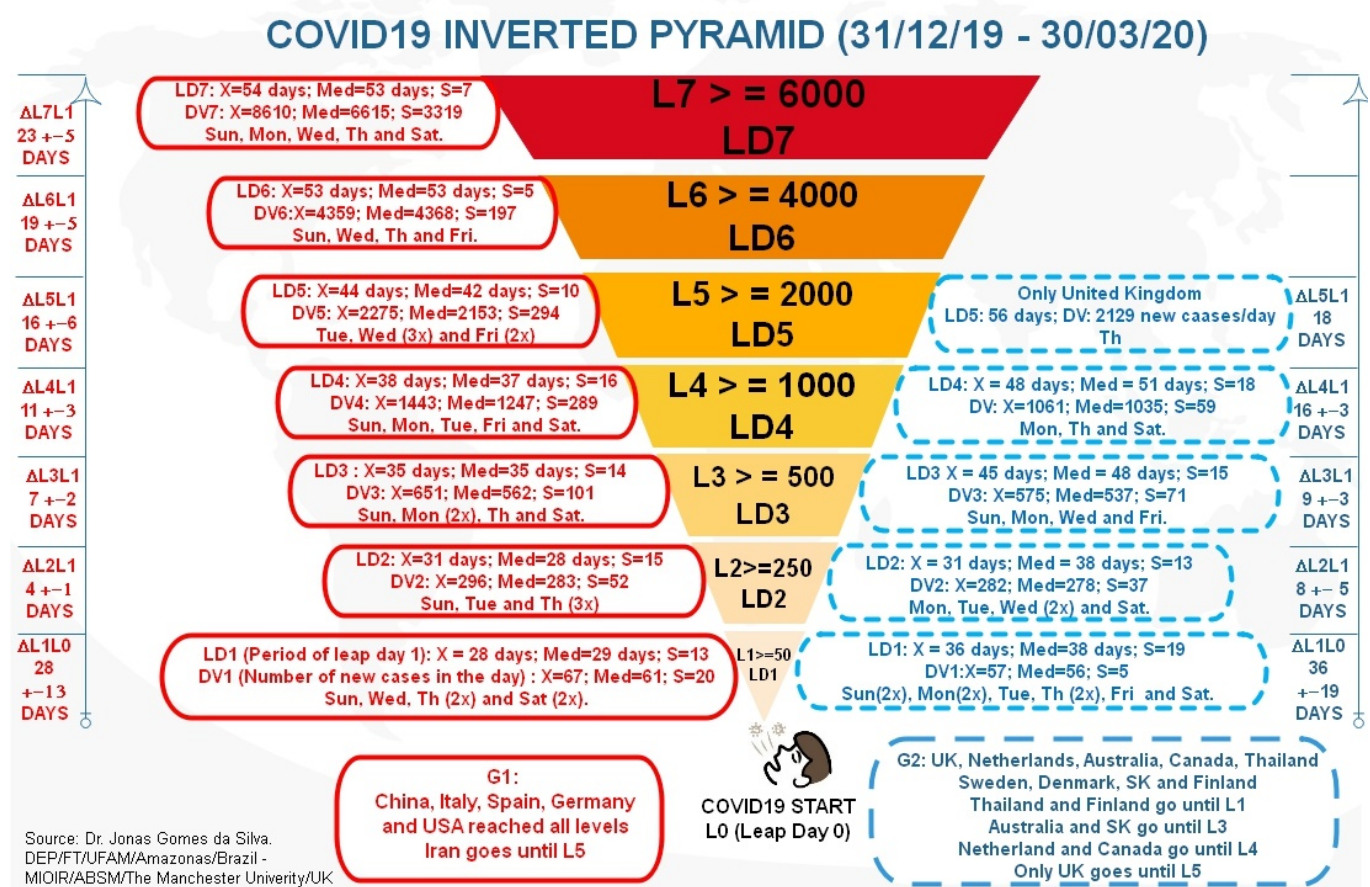


Figure 14: COVID's Inverted Pyramid involving 15 countries (except Brazil)

Source: Author (2020)

Second) With the difficulty in Brazil to carry out tests effectively to confirm the covid19, the leap may take time, but when it comes it will have a value well above 500, quickly surpassing Level 1 to Level 4 ($LD \geq 1000$), on the 38th day (04/04/20) with an average value of 1443 or median of 1247, with a range of ± 289 new cases.

After reach the next level, the logic remains the same for the following levels, it is important to record what has been learned to the results obtained.

Finally, on the extreme sides of the Pyramid there is a spear that indicates the variation of the average time that the Group took to leap from one level comparing with first level, in the case of Brazil, looking at $\Delta L3 L1 = 7 \pm 2$, this means that in the Group 1 took an average of 5 to 9 days to jump from Level 1 to Level 3, so that would be between March 20 (because the first jump was on the 25th day) and March 29, 20, the date on which 352 new cases were registered, a value well below the expected L3 ($> = 500$), so there is a strong possibility that Brazil will jump directly from level 1 to level 3 in a few days.

To use the Pyramid effectively, it is recommended to register the data using a spreadsheet with the model shown in Figure 9 together with the COVID19 Board.

Although the inverted Pyramid is useful to have a synthesized view of the evolution of COVID19 over time and help to estimate the next values, it is necessary to develop other board that allow decision-makers to analyze trends within a more detailed range of variation COVID19 values around the mean and median, which is why the COVID19 Papyri were created.

The Papyri is very symbolic due to the use of it by ancient peoples such as Egyptians and Greeks to describe and record facts involving medicinal wisdom and health at the time, and the papyrus well known are: Edwin Smith, Ebers, Kahun Gynecology, Hearst, Chester Beatty, Berlin, London Medical and Carlsberg (REGGIANI, 2019; EGYPT GUIDE, 2020; WRF, 2020).

So, in this research, they are also useful to develop the Inverted Pyramid of an individual country that wants to analyze scenarios.

4.6 The COVID19's Papyri

The COVID19's papyri is defined as a document containing statistics and/or facts involving COVID19, which can be a control chart of the mean and median of the main variables involved, or a combination of this chart with other decision-making variables such as the number of hospital beds in the country, costs, etc.

If the Papyri consists of a control chart, then it contains the mean, the median with the upper and lower limits of the three main variables used in the study of Coronavirus leaps at each of the seven levels adopted in the research. If combined with other variables, it is up to the researcher to arrange the information in the best way for the decision-maker to analyze.

The COVID19's papyri is built from the COVID19 Board, with the difference that there is a variation of three levels of values around the means: Standard Deviation (S) = $0 = X = \text{Med}$; $X \text{ or MED} \pm 0.25 S$; $X \text{ or MED} \pm 0.75S$; $X \text{ or M} \pm 1 S$.

The Papyri's number one (Figure 14) objective is to allow any country to compare its moment of the Covid19 leap (LD), the Covid19 Leap Value (DV), the percentage of the accumulated total (DVTA), the total number of new cases accumulated (DVAC), etc with a Group of Countries or other country individually. The second objective is to estimate future values at levels that the country has not yet reached, to create scenarios with priority actions over time, according to the example proposed in the following section. The third objective is to compare the control chart with other decision-making variables.

GROUPS	LEAP DAY 1>=50 NC/DAY				LD2 >= 250 NC/DAY				LD3 >= 500 NC/DAY				LD4 >= 1K NC/DAY				LD5 >= 2K NC/DAY				LD6 >= 4K NC/DAY				LD7 >= 6K NC/DAY				L
VARIABLES →	S	LD1	DV1	DV1TA%	LD2	DV2	DV2TA%	LD3	DV3	DV3TA%	LD4	DV4	DV4TA%	LD5	DV5	DV5TA%	LD6	DV6	DV6TA%	LD7	DV7	DV7TA%	1						
G1 – X	1	40	86	60,785	45	348	46,995	49	711	40,592	54	1732	34,355	53	2569	33,589	58	4556	29,970	61	11929	25,935	2						
	0,75	37	81	56,474	41	335	44,807	45	686	38,823	50	1660	32,495	51	2495	30,898	57	4507	27,599	59	11099	24,322	3						
	0,25	31	72	47,852	34	309	40,430	38	636	35,285	42	1515	28,774	46	2348	25,515	54	4408	22,856	56	9439	21,095	4						
	X	28	67	43,542	31	296	38,242	35	611	33,517	38	1443	26,914	44	2275	22,823	53	4359	20,485	54	8610	19,482	5						
	-0,25	24	62	39,231	27	283	36,054	31	585	31,748	34	1370	25,054	41	2201	20,132	52	4310	18,114	52	7780	17,869	6						
	-0,75	18	52	30,609	20	257	31,677	24	535	28,211	26	1226	21,333	36	2054	14,749	50	4212	13,371	49	6120	14,642	7						
	-1	15	47	26,298	16	244	29,489	20	510	26,442	22	1153	19,473	34	1981	12,058	49	4163	11,000	47	5290	13,029	8						
CHINA, ITALY, IRAN, SPAIN, GERMANY AND USA – COVID19 FROM 31/12/19 UNTIL 30/03/20																													
G1 – MED	1	41	81	58,493	43	335	47,213	49	662	41,200	53	1536	33,441	52	2447	31,451	58	4564	28,140	60	9934	24,573	9						
	0,75	38	76	54,182	39	322	45,025	46	637	39,431	49	1464	31,581	49	2373	28,759	56	4515	25,769	58	9105	22,960	10						
	0,25	32	66	45,561	32	296	40,648	39	587	35,894	41	1319	27,860	44	2226	23,376	54	4417	21,026	55	7445	19,733	11						
	MED	29	61	41,250	28	283	38,460	35	562	34,125	37	1247	26,000	42	2153	20,685	53	4368	18,655	53	6615	18,120	12						
	-0,25	25	56	36,939	24	270	36,272	31	536	32,356	33	1175	24,140	40	2079	17,994	52	4318	16,284	51	5785	16,507	13						
	-0,75	19	46	28,318	17	244	31,895	24	486	28,819	25	1030	20,419	35	1932	12,611	50	4220	11,541	48	4125	13,280	14						
	-1	16	41	24,007	13	231	29,707	21	461	27,050	21	958	18,559	32	1859	9,919	48	4171	9,170	46	3296	11,667	15						
COLUMN →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22							

Figure 14: COVID19's papyri with a control chart of the mean and median of countries of Group 1
Source: Author (2020)

GROUPS	LEAP DAY 1>=50 NC/DAY				LD2 > = 250 NC/DAY			LD3 > = 500 NC/DAY			LD4 > =1K NC/DAY			L
VARIABLES →	S	LD1	DV1	DV1TA%	LD2	DV2	DV2TA%	LD3	DV3	DV3TA%	LD4	DV4	DV4TA%	1
G2 – X	1	54	63	48,864	44	318	40,784	60	646	32,879	66	1120	20,148	2
	0,75	50	61	44,847	41	309	37,199	56	628	31,422	61	1105	19,235	3
	0,25	41	59	36,812	34	291	30,029	49	592	28,507	52	1075	17,409	4
	X	36	57	32,794	31	282	26,444	45	575	27,050	48	1061	16,497	5
	-0,25	31	56	28,777	27	273	22,859	41	557	25,593	44	1046	15,584	6
	-0,75	22	53	20,742	21	254	15,689	34	521	22,678	35	1017	13,758	7
	-1	17	52	16,725	17	245	12,104	30	503	21,221	30	1002	12,845	8
UK, Netherland, Australia, Canada, Thailand, Sweden, Den, SK & Fin – Covid19 -21/12/19 UNTIL 30/03/20														
G2 – MED	1	57	61	40,890	51	315	36,860	63	608	34	69	1094	18,801	9
	0,75	52	60	36,872	48	305	33,275	59	590	33	64	1079	17,888	10
	0,25	43	57	28,837	41	287	26,105	52	555	30	55	1050	16,063	11
	MED	38	56	24,820	38	278	22,520	48	537	29	51	1035	15,150	12
	-0,25	33	55	20,803	35	269	18,935	44	519	27	47	1020	14,237	13
	-0,75	24	52	12,768	28	251	11,765	37	484	24	38	991	12,412	14
	-1	19	51	8,750	25	241	8,180	33	466	23	33	976	11,499	15
C →	1	2	3	4	5	6	7	8	9	10	11	12	13	

Figure 15: COVID19's papyri with a control chart of the mean and median of countries of Group 2
Source: Author (2020)

On each papyri, there are the groups investigated, the possible variations of the three variables at each level, as well as numbers at the end of the right side to indicate the lines, and numbers at the base of the papyri to indicate the columns, to easily make the crossing and identification of results. Figure 14 shows the

variations of the mean and median at all levels of Group 1, while Figure 15 shows only the variations up to the Level 4 Leap of Group 2 since from level 5 only the United Kingdom passed for this step.

4.7 Short-term scenarios for Brazil: Papyri, Number of Beds in Brazil and Inverted Pyramid

To carry out the construction of short-term scenarios to the impact of the growth of new cases on public and private hospitals in Brazil, the following facts published by the Brazilian Association of Intensive Care Medicine (AMIB, 2020) will be taken into account:

First) About 20% of the total cases of covid19 will need hospitalization, of which 15% will need intensive care;

Second) In Brazil, there are approximately 47,000 ICU beds, of which 32,000 are intended for adult patients, the main victims of COVID19;

Third) Of the 32,000 beds, half are for patients in the Unified Health System (SUS) and the other half is for patients who have access to supplementary health;

Fourth) The average occupancy rate in public hospitals is over 95%;

Given this, it can be considered that there are about 5% of the public beds available to deal with severe cases of COVID.

The scenario analysis of the Brazilian case was based on the Papyri and Inverted Pyramids of the Average and Median of Group 1, as the country presented results closer to this group compared to Group 2.

In each Papyri, the information from Group 1 was placed at the top, while at the bottom the facts, the Scenarios, When, Number of estimated cases (DV), as well as the number of beds needed to attend the 15% of severe cases of Covid19 (15% DVA), this last value was calculated based on the number of new cases accumulated on the day of the Covid19's leap.

Two lines were placed at the base of the papyri, line 17 compares the number of estimated beds (15% DVA) with the total available beds (1600), generating a percentage of the system's capacity to absorb severe cases, with maximum and minimum values estimated.

Line 18 shows the number of new beds that will be needed in each leap of the COVID, considering the minimum, average and maximum estimated beds.

Finally, the scenario analysis was designed from the third leap of covid19 ($LD3 > = 500$) until the last leap ($LD7 > = 6000$ new cases), since the first and the second have already happened.

4.7.1 Papyri and Inverted Pyramid of Mean and Median

The Figure 16 shows that:

a) In the Realistic Scenario (X), the third leap could happen on the 35th day (Line L5 column C8), on March 30 (Wednesday - L13xC8) with an average value of 611 new cases (L13 - C9), in this day it is estimated that there would be 273 ICU beds (L13xC10) accumulated since the first day registered in Brazil. In the scenario (X + 1S), the maximum value (L16xC10) of beds is 289 accumulated beds (18% of 1600), and in the scenario (X - 1S) the minimum is 263 accumulated beds (16% of 1600), so the National Health System is managing to meet almost a fifth of the demand;

GROUPS	LEAP DAY 1 >= 50 NC/DAY				LD2 >= 250 NC/DAY				LD3 >= 500 NC/DAY				LD4 >= 1K NC/DAY				LD5 >= 2K NC/DAY				LD6 >= 4K NC/DAY				LD7 >= 6K NC/DAY				L
VARIABLES →	S	LD1	DV1	DV1TA%	LD2	DV2	DV2TA%	LD3	DV3	DV3TA%	LD4	DV4	DV4TA%	LD5	DV5	DV5TA%	LD6	DV6	DV6TA%	LD7	DV7	DV7TA%	1						
G1 - X	1	40	86	60,785	45	348	46,995	49	711	40,592	54	1732	34,355	53	2569	33,589	58	4556	29,970	61	11929	25,935	2						
	0,75	37	81	56,474	41	335	44,807	45	686	38,823	50	1660	32,495	51	2495	30,898	57	4507	27,599	59	11099	24,322	3						
	0,25	31	72	47,852	34	309	40,430	38	636	35,285	42	1515	28,774	46	2348	25,515	54	4408	22,856	56	9439	21,095	4						
	X	28	67	43,542	31	296	38,242	35	611	33,517	38	1443	26,914	44	2275	22,823	53	4359	20,485	54	8610	19,482	5						
	-0,25	24	62	39,231	27	283	36,054	31	585	31,748	34	1370	25,054	41	2201	20,132	52	4310	18,114	52	7780	17,869	6						
	-0,75	18	52	30,609	20	257	31,677	24	535	28,211	26	1226	21,333	36	2054	14,749	50	4212	13,371	49	6120	14,642	7						
	-1	15	47	26,298	16	244	29,489	20	510	26,442	22	1153	19,473	34	1981	12,058	49	4163	11,000	47	5290	13,029	8						
G1 = CHINA, ITALY, IRAN, SPAIN, GERMANY AND USA - COVID19 FROM 31/12/19 UNTIL 30/03/20																													
Brazil Public ICU beds = 32000 for adults (AMIB,20)	SHORT TERM SCENARIOS FOR BRAZIL				Scenarios		WHEN	DV3	15%DV3A	WHEN	DV4	15%DV4A	WHEN	DV5	15%DV5A	WHEN	DV6	15%DV6A	WHEN	DV7	15%DV7A	9							
	FACTS ASSUMPTIONS				Scenario + 1		Ap13th	711	263	Ap18th	1732	756	Ap17th	2569	1147	Ap22th	4556	2280	Ap25th	11929	6899	10							
	16K users of Sup. Health plan (25%)				Scenario + 0,75		Ap9th	686	265	Ap14th	1660	766	Ap15th	2495	1211	Ap21th	4507	2449	Ap23th	11099	6845	11							
	16K users without SH Plan (75%)				Scenario + 0,25		Ap2d	636	270	Ap6th	1515	790	Ap6th	2348	1380	Ap18th	4408	2893	Ap20th	9439	6712	12							
	Occupance rate 95%				Scenario Realistic		Mar30th	611	273	Ap2th	1443	804	Ap8th	2275	1495	Ap17th	4359	3192	Ap18th	8610	6629	13							
	ICU beds occupied 30400				Scenario - 0,25		Mar26th	585	277	Mar29th	1370	820	Ap5th	2201	1640	Ap16th	4310	3569	Ap16th	7780	6531	14							
	ICU beds available 1600				Scenario - 0,75		Mar19th	535	285	Mar21th	1226	862	Mar31th	2054	2089	Ap14th	4212	4725	Ap13th	6120	6270	15							
	% that will need ICU 15%				Scenario - 1		Mar15th	510	289	Mar17th	1153	888	Mar29th	1981	2464	Ap13th	4163	5676	Ap11th	5290	6091	16							
	Situation of 15% on Daily Value Acum. of new cases (15%DVA)→				16%-18% Capable		47%-55% - Half Capable		72%-154% - Start Collapse		142% - 355% - Collapsed		380% - 431% - Collapsed										17						
	Number of New ICU beds needed when the public system collapse →				0		0		40		489		864		680		1592		4076		4491		5029		18				
COLUMN →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22							

Figure 16: COVID19's Papyri (Average) with scenarios of leaps and beds estimated in Brazil

Source: Author (2020)

b) In the Realistic Scenario, the fourth leap could happen on the 38th day (Line L5 column C11), on April 02 (L13xC11) with an average value of 1443 new cases (L13xC12), on this day it is estimated that 804 beds would be needed accumulated ICU (L13xC13). In the scenario (X + 1S), the maximum value (L16xC13) of accumulated beds is 888 (55% of 1600), and in the scenario (X - 1S) the minimum is 756 beds (47% of 1600), so the National Health System is managing to meet almost half of the demand.

c) In the Realistic Scenario, the fifth leap could happen on the 44th day (L5xC14), on the 8th of April (L13xC14) with an average value of 2275 new cases (L13xC15), on this day it is estimated that 1485 accumulated ICU beds would be needed (L13xC16), in this case, the system is reaching its limit. In the scenario (X + 1S), the number of accumulated beds would be 1147 (L10xC16) which would occupy 72% of the available beds, this value seems strange, but it is worth mentioning that this will occur on April 17 when an average of 2569 is recorded new cases, that is, this event happened later, 9 days after the estimated period of the central average. In the scenario (X - 1S) the system collapses since the minimum number of accumulated beds would be 2464, so another 864 new beds would be needed to meet the demand in this scenario;

d) In the sixth and seventh leaps of COVID19, the system collapsed completely, requiring between 680 (L18xC17) and 5299 (L18xC22) new beds to meet the possible demands, depending on the scenario that occurred. That would be between April 11 and 25, 2020.

To facilitate visualization, Figure 17 shows Covid19's Inverted Pyramid in Brazil using the Papyri of average leaps as a base.

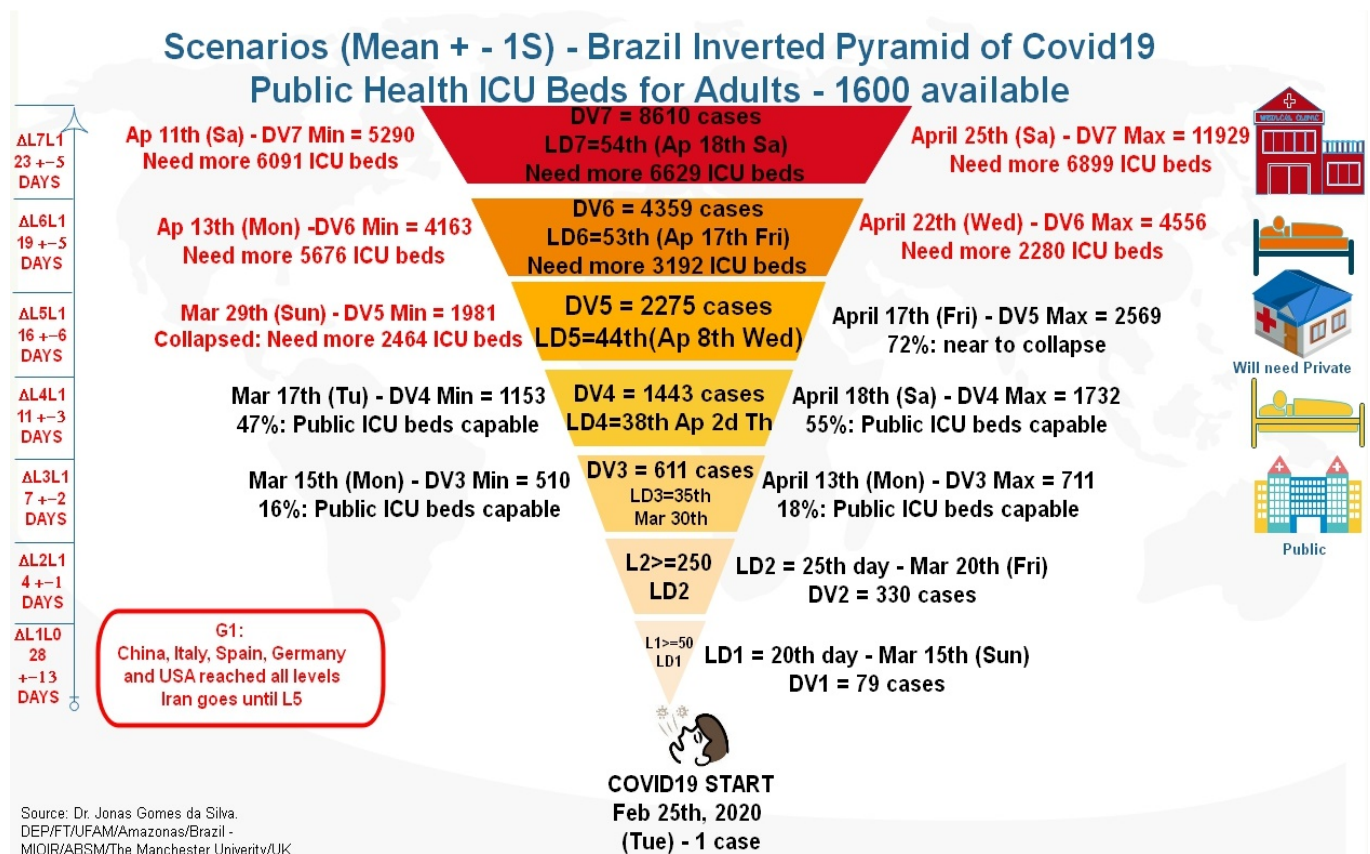


Figure 17: Covid19's Inverted Pyramid (Average) with scenarios for Brazil including ICU Beds

Source: Author (2020)

Figure 17 shows inside the base of the Pyramid the beginning of the count with date, day and number of cases registered in Brazil, in the center of it there are the levels with their respective jumps, number of new cases (DV) when it occurred and in the case of needing more beds, your quantity.

On the left side of the pyramid, there is the spear containing the average difference in days between the levels registered and Level 1 of Group 1, also beside the pyramid it has information on its maximum and minimum values, as well as the estimated number of beds needed after the collapse in the public health system. Finally, on the extreme right side of the pyramid were placed images that represent the public hospital (base) and when it would need support from private hospital beds.

The same approach can be followed for a second scenario analysis using the Median and Figures 18 and 19 show the papyrus and the inverted pyramid containing the possible scenarios overtime.

GROUP	LEAP DAY 1>=50 NC/DAY				LD2>=250 NC/DAY				LD3>=500 NC/DAY				LD4>=1K NC/DAY				LD5>=2K NC/DAY				LD6>=4K NC/DAY				LD7>=6K NC/DAY				L
VARIABLES →	S	LD1	DV1	DV1TA%	LD2	DV2	DV2TA%	LD3	DV3	DV3TA%	LD4	DV4	DV4TA%	LD5	DV5	DV5TA%	LD6	DV6	DV6TA%	LD7	DV7	DV7TA%	1						
G1 – MED	1	41	81	58,493	43	335	47,213	49	662	41,200	53	1536	33,441	52	2447	31,451	58	4564	28,140	60	9934	24,573	2						
	0,75	38	76	54,182	39	322	45,025	46	637	39,431	49	1464	31,581	49	2373	28,759	56	4515	25,769	58	9105	22,960	3						
	0,25	32	66	45,561	32	296	40,648	39	587	35,894	41	1319	27,860	44	2226	23,376	54	4417	21,026	55	7445	19,733	4						
	MED	29	61	41,250	28	283	38,460	35	562	34,125	37	1247	26,000	42	2153	20,685	53	4368	18,655	53	6615	18,120	5						
	-0,25	25	56	36,939	24	270	36,272	31	536	32,356	33	1175	24,140	40	2079	17,994	52	4318	16,284	51	5785	16,507	6						
	-0,75	19	46	28,318	17	244	31,895	24	486	28,819	25	1030	20,419	35	1932	12,611	50	4220	11,541	48	4125	13,280	7						
	-1	16	41	24,007	13	231	29,707	21	461	27,050	21	958	18,559	32	1859	9,919	48	4171	9,170	46	3296	11,667	8						
G1 = CHINA, ITALY, IRAN, SPAIN, GERMANY AND USA – COVID19 FROM 31/12/19 UNTIL 30/03/20																													
SHORT TERM SCENARIOS FOR BRAZIL				SCENARIOS		WHEN	DV3	15%DV3A	WHEN	DV4	15%DV4A	WHEN	DV5	15%DV5A	WHEN	DV6	15%DV6A	WHEN	DV7	15%DV7A	9								
Brazil Public ICU beds = 32000 for adults (AMIB,20)	FACTS ASSUMPTIONS				Scenario + 1		Apr13th	662	241	Apr17th	1536	689	Apr16th	2447	1167	Apr22th	4564	2433	Apr24th	9934	6064	10							
	16K users of Sup. Health plan (25%)				Scenario + 0,75		Apr10th	637	242	Apr13th	1464	695	Apr13th	2373	1238	Apr20th	4515	2628	Apr22th	9105	5948	11							
	16K users without SH Plan (75%)				Scenario + 0,25		Apr3rd	587	245	Apr5th	1319	710	Apr8th	2226	1428	Apr18th	4417	3151	Apr19th	7445	5659	12							
	Occupance rate 95%				Scenario Realistic		Mar30th	562	247	Apr1st	1247	719	Apr6th	2153	1561	Apr17th	4368	3512	Apr17th	6615	5476	13							
	ICU beds occupied 30400				Scenario -0,25		Mar26th	536	249	Mar28th	1175	730	Apr4th	2079	1733	Apr16th	4318	3978	Apr15th	5785	5257	14							
	ICU beds available 1600				Scenario -0,75		Mar19th	486	253	Mar20th	1030	757	Mar30th	1932	2298	Apr14th	4220	5485	Apr12th	4125	4660	15							
	% that will need ICU 15%				Scenario - 1		Mar16th	461	256	Mar16th	958	774	Mar27th	1859	2810	Apr12th	4171	6823	Apr10th	3296	4237	16							
	Situation of 15% on Daily Value Accum. of new cases (15%DVA)				15%-16% = Capable		43% - 48% = Almost Half Capable		73% - 176% = Start Collapse		152% - 426% = Collapsed		265% - 379% = Collapsed										17						
	Number of New ICU beds needed when the public system collapse →				0		0		133		698		1210		833		1912		5223		2637		3876		4464		18		
COLUMN →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22							

Figure 18: Papyri of COVID19 (Median) with scenarios of leaps and ICU beds estimated in Brazil

Source: Author (2020)

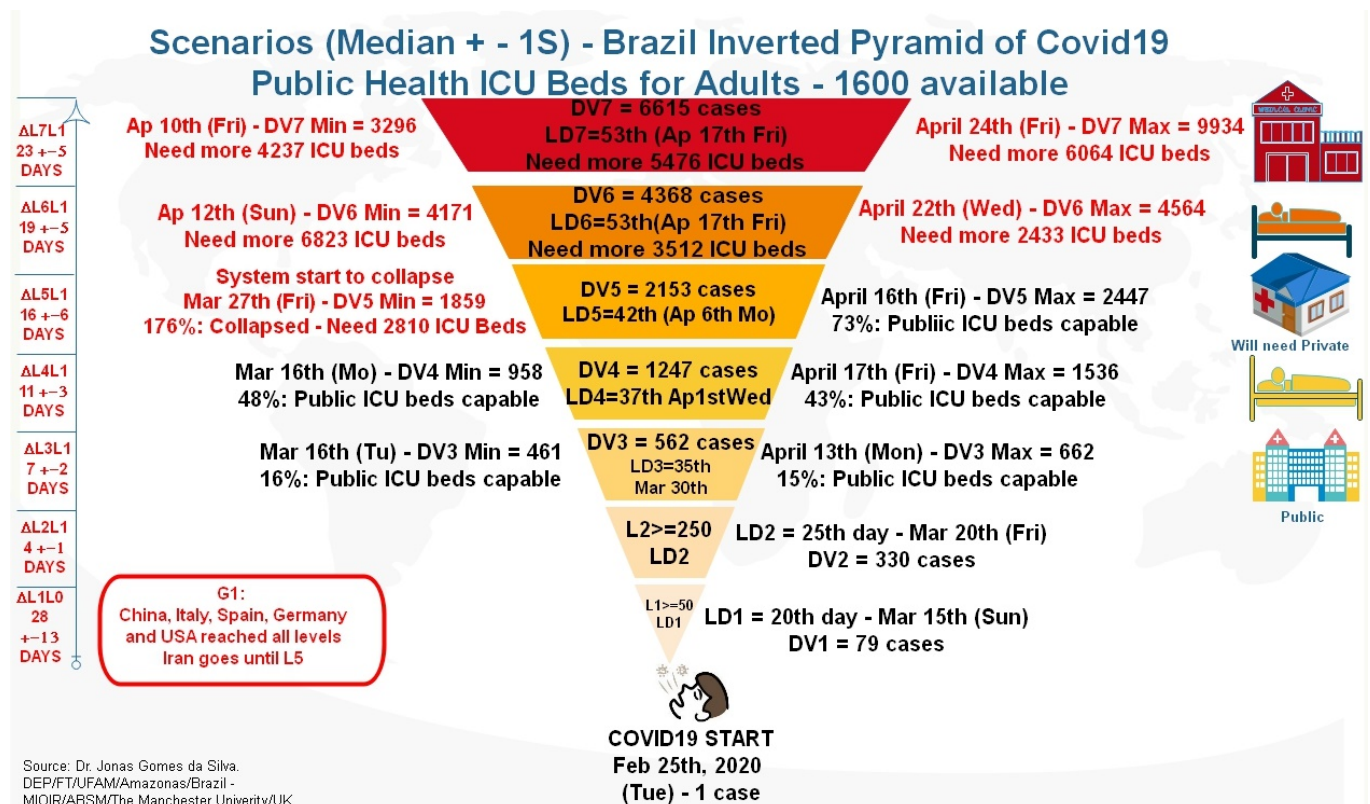


Figure 19: Covid 19 Inverted Pyramid (Median) with scenarios for Brazil (New cases and ICU Beds)

Source: Author (2020)

5. Conclusions and recommendations

The top ten conclusions and recommendations are:

First) Although no country is prepared to face epidemics and pandemics (NTI, JHU, and EIU, 2019), among the 16 countries investigated, Thailand, Finland, Australia, South Korea, Denmark, and Sweden are cases that Brazil could study so as not to repeat the scenarios of China, USA, Italy, and Spain. New research can be carried out to identify good government practices successfully adopted in partnership with the private sector, academia and organized civil society. However, certain care is recommended with Thailand, because even though it was considered the 6th with the best Health Security System (GHSI2019), the GPI2019 Report placed it in 101st place in terms of transparency;

Second) WHO needs to be more valued and known by the population, as it has a very rich collection of information, documents, and guidelines to help in the fight against global diseases. Also, since February 12, 2020, it has developed a model action plan with guidelines to be implemented in partnership with member countries, but in the name of the economy, the leaders of the most critical countries have taken a long time to recognize the pandemic and act in together with the managers of local WHO offices;

Third) Each country has a different dynamic of evolution in the number of new cases per week overtime, because while Iran and China had rapid evolution from the third week, Italy, Spain, Germany, and the United States had rapid evolution a from the 6th, 7th, 8th and 9th weeks respectively;

Fourth) 37 COVID19 leaps were recorded in Group 1, the most critical day of the week on which most leaps were recorded was Thursday (8 times; 21.2%), followed by Wednesday (6 times; 16.22 %), Sunday (6 times; 16.22%), Friday and Saturday each repeating 5 times (13.5%). On the other hand, the two days on which fewer leaps occurred were Tuesday (3 times; 8.1%) and Monday (10.8%). Further research may be carried out to try to identify the days of the greatest contagion throughout the week to orient the population. In this sense, the Appendix Tables can be useful in conjunction with the use of Information and Communication Technologies to develop innovative solutions that allow the citizen to know when a store, a supermarket or a pharmacy has less movement of people, as well as if there is the product you are looking for, optimizing time and reducing the risk of contagion;

Fifth) Among the 16 countries surveyed, 11 (69%) had at least 60 days of fighting the pandemic. Regarding the average number of new cases per day, the performance of the best to the worst followed this order: 1st) Thailand (20/day); 2nd) Finland (21 / day); 3rd) Australia (68/day); 4th) Canada (116/day); 5th) South Korea (136/day); 6th) United Kingdom (369/day); 7th) China (896/day); 8th) Germany (1045/day); 9th) Spain (1466/day); 10th) Italy (1696/day) and 11th) USA (2326/day). The top six are in group 2, of which the majority (83%) is among the 39 countries considered most transparent on the planet in 2019 (E.V., T. I., 2020), the only exception being Thailand. New research can be carried out to identify the performance of combating covid19 among the most transparent and least transparent countries;

Sixth) Shared transparency, publicity of data are needed to draw a more comprehensive and reproducible picture of global gaps related to preparedness (NTI, JHU, and EIU, 2019 p. 34). Given the above, each government must streamline the data collection process, ensuring easy access to the database with integrated, standardized and updated information about new cases, fatalities, location, the number of tests, technical documents, educational material, etc. (EV, TI, 2020b; NAKANO, 2020);

Seventh) Overall, Group 2 countries (except for the USA) performed better in tackling the pandemic. Then, the recommendations of the 2019 GHS Index report (NTI, JHU, and EIU, 2019) to strengthen the National Health System become more reinforced for each investigated nation;

Eighth) When comparing the results of the first 5 weeks in Brazil with the same period in the 15 countries, it is clear that, except China, Iran, and the Netherlands, the growth of its curve is greater than the others. The analysis of the scenarios showed that the number of new cases has the potential to increase significantly on the 8th (April 14th to 20th/20) and 9th weeks (April 21st to 27th/20), with April/20 ending with an accumulated total of new cases between 46,000 and 50,000, and the country being among the 5 most-affected before the end of May 2020. A good portion of public hospitals in Brazil will start showing signs of collapse at the beginning of the second week of April/20, so to help optimize the services of hospitals and their partners, it is urgently recommended: a) adopt an efficient bed management system; b) partner with private hospitals and laboratories to reduce the time taken to deliver test results; c) create field hospitals in strategic cities to serve patients with low or medium complexity, especially in cities with a certain hospital structure, but whose number of beds is insufficient to meet the strong demand; d) involve the Armed Forces to assist in security and also in the logistics of essential products for hospitals, supermarkets, etc; e) supermarkets create specific hours to serve health professionals, in the United Kingdom some of the supermarket chains use the hours from 8 am to 9 am to specifically serve these professionals; f) involve the private initiative and the universities to adapt their production lines and laboratories to produce equipment, gel, detergent, soap, alcohol and other useful materials for health professionals and other professionals involved in essential services for the population, etc; g) encourage start ups to develop innovative solutions to assist hospitals, supermarkets, pharmacies, in this sense, access to the Coronavirus Innovation Map <<https://bit.ly/2XMIcy5>> under the responsibility of StartUp Blink, etc; Ninth) Follow strategies recommended by the Ministry of Health, Health Departments and other organizations of Health professionals or researchers (AMIB, 2020; BEDFORD et al, 2020);

Tenth) It is possible to create and present scenario analysis without having to use complex mathematical models, which are difficult for most of the population to understand. The proposal to use descriptive statistics in conjunction with metaphorical figures (Board, Papyri and Inverted Pyramid) can make knowledge more accessible to the population, as well as simpler for managers and researchers working in related fields. Far from being perfect, it is expected that the approaches can be improved over time with the development of software that allows treating this information more reliably and quickly. Besides, the research was limited to studying only the number of new cases per day, so a similar study is recommended, but involving the variable number of fatal cases.

6. Appendices - Covid19 daily growth charts in other countries

Table 13: Daily growth (DG%) of the Number of COVID19 case in the Netherlands

WEEK - NETHERLAND	Th(5a)	F(6a)	Sa	Sun(D)	M(2a)	T(3a)	W(4a)	X - DG(%)	Med - DG(%)	S - DG(%)	CV - DG(%)
1	Start	0,00	300,00	-25,00	233,33	-50,00	180,00	106,39	90,00	149,70	140,71
2	214,29	4,55	30,43	26,67	-25,00	7,02	98,36	50,90	26,67	81,43	159,98
3	-8,26	71,17	-18,42	13,55	57,95	5,04	18,49	19,93	13,55	33,17	166,43
4	18,21	30,56	19,29	-10,05	-4,89	48,81	5,06	15,28	18,21	20,55	134,48
X	74,74	26,57	82,83	1,29	65,35	2,72	75,48				
MED	18,21	17,55	24,86	1,75	26,53	6,03	58,43		X of all DG (%)	45,97	
S	121,57	32,64	146,28	23,19	117,43	40,53	80,94		Med of all DG (%)	18,21	
CV	162,65	122,85	176,62	1795,24	179,69	1492,58	107,24				

Table 14: Daily growth (DG%) of the Number of COVID19 case in Australia

WEEK - AUSTRALIA	Sa	Sun(D)	M(2a)	T(3a)	W(4a)	Th(5a)	F(6a)	X - DG(%)	Med - DG(%)	S - DG(%)	CV - DG(%)
1	Start	-100,00	.	-100,00		0,00	-100,00	-75,00	-100,00	50,00	-66,67
2	.	100,00	-100,00	0,00	0,00	0,00	0,00	0,00	0,00	63,25	0,00
3	.	-100,00	0,00	0,00	0,00	0,00	0,00	-16,67	0,00	40,82	-244,95
4	0,00	0,00	0,00	0,00	0,00	.	0,00	0,00	0,00	0,00	0,00
5	0,00	-50,00	-100,00	0,00	.	-100,00	.	-50,00	-50,00	50,00	-100,00
6	-100,00	.	0,00	50,00	133,33	-50,00	-57,14	-3,97	-25,00	84,79	-2136,76
7	266,67	-18,18	11,11	130,00	-47,83	133,33	53,57	75,52	53,57	109,14	144,51
8	13,95	6,12	94,23	-46,53	161,11	13,48	7,50	35,69	13,48	68,98	193,27
9	-16,28	272,92	-48,23	54,68	-16,51	4,18	-12,30	34,06	-12,30	109,84	322,44
X	27,39	13,86	-17,86	9,79	32,87	0,12	-13,55				
MED	0,00	0,00	0,00	0,00	0,00	0,00	0,00		X of all DG (%)	6,36	
S	124,15	122,95	64,12	64,90	80,34	65,98	46,10		Med of all DG (%)	0,00	
CV	453,27	887,26	-358,98	662,64	244,41	53493,74	-340,29				

Table 15: Daily growth (DG%) of the Number of COVID19 case in Canada

WEEK - CANADA	M(2a)	T(3a)	W(4a)	Th(5a)	F(6a)	Sa	Sun(D)	X - DG(%)	Med - DG(%)	S - DG(%)	CV - DG(%)
1	Start	-100,00	0,00	0,00	0,00	0,00	0,00	-16,67	0,00	40,82	-244,95
2	0,00	.	-66,67	-100,00	.	-100,00	0,00	-53,33	-66,67	50,55	-94,79
3	0,00	0,00	0,00	0,00	0,00	.	-100,00	-16,67	0,00	40,82	-244,95
4	0,00	0,00	0,00	0,00	.	-100,00	.	-20,00	0,00	44,72	-223,61
5	0,00	-100,00	.	100,00	-50,00	400,00	-20,00	55,00	-10,00	181,52	330,04
6	-25,00	0,00	33,33	225,00	-46,15	-14,29	0,00	24,70	0,00	91,67	371,16
7	83,33	63,64	-16,67	113,33	75,00	-3,57	64,81	54,27	64,81	47,15	86,89
8	12,36	57,00	-17,83	13,18	46,58	12,62	-41,08	11,83	12,62	33,98	287,25
9	337,32	12,88	-11,98	2,76	12,62	25,77	-25,95	50,49	12,62	127,64	252,82
X	51,00	-8,31	-9,98	39,36	5,43	27,57	-15,28				
MED	0,00	0,00	-5,99	2,76	0,00	-1,79	-10,00		X of all DG (%)	13,43	
S	119,94	62,00	28,03	93,34	45,42	158,10	46,44		Med of all DG (%)	0,00	
CV	235,17	-746,13	-280,91	237,14	835,78	573,51	-303,98				

Table 16: Daily growth (DG%) of the Number of COVID19 case in the Thailand

WEEK - THAILAND	M(2a)	T(3a)	W(4a)	Th(5a)	F(6a)	Sa	Sun(D)	X - DG(%)	Med - DG(%)	S - DG(%)	CV - DG(%)
1	Start	-100,00	0,00	0,00	.	-100,00	0,00	-40,00	0,00	54,77	-136,93
2	0,00	0,00	.	-50,00	0,00	100,00	-100,00	-8,33	0,00	66,46	-797,50
3	.	-100,00	0,00	0,00	.	-100,00	0,00	-40,00	0,00	54,77	-136,93
4	0,00	0,00	.	0,00	0,00	0,00	.	0,00	0,00	0,00	0,00
5	-100,00	.	0,00	0,00	.	0,00	-100,00	-40,00	0,00	54,77	-136,93
6	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
7	0,00	0,00	.	50,00	-100,00	0,00	0,00	-8,33	0,00	49,16	-589,92
8	.	0,00	0,00	0,00	.	-75,00	100,00	5,00	0,00	62,25	1244,99
9	-100,00	.	100,00	83,33	-54,55	40,00	357,14	70,99	61,67	160,52	226,12
10	3,13	-9,09	16,67	71,43	-16,67	78,00	111,24	36,39	16,67	49,90	137,14
11	-35,11	-13,11	0,94	3,74	-18,02	19,78	31,19	-1,51	0,94	22,70	-1501,36
X	-29,00	-24,69	14,70	14,41	-27,03	-3,38	39,96				
MED	0,00	0,00	0,00	0,00	-16,67	0,00	0,00				
S	45,54	42,97	34,95	38,44	37,55	66,01	131,20				
CV	-157,04	-174,02	237,72	266,78	-138,92	-1950,90	328,36				
								X of all DG (%)		-15,34	
								Med of all DG (%)		0,00	

Table 17: Daily growth (DG%) of the Number of COVID19 case in Sweden

WEEK - SWEEDEN	Sa	Sun(D)	M(2a)	T(3a)	W(4a)	Th(5a)	F(6a)	X - DG(%)	Med - DG(%)	S - DG(%)	CV - DG(%)
1	Start	-100,00	0,00	0,00	0,00	0,00	0,00	-16,67	0,00	40,82	-244,95
2	0,00	0,00	0,00	0,00	.	400,00	-20,00	63,33	0,00	165,13	260,73
3	-50,00	-50,00	0,00	1400,00	46,67	90,91	2,38	205,71	2,38	529,03	257,18
4	-44,19	75,00	35,71	66,67	52,63	28,97	-32,09	26,10	35,71	46,85	179,48
5	15,75	-46,26	2,53	-7,41	40,00	31,43	44,93	11,57	15,75	31,93	276,08
6	-34,50	25,19	-31,71	125,89	-10,28	38,33	-27,07	12,27	-10,28	57,64	469,94
X	-22,59	-16,01	1,09	264,19	25,80	98,27	-5,31				
MED	-34,50	-23,13	0,00	33,33	40,00	34,88	-10,00				
S	28,89	62,23	21,35	558,85	28,83	150,74	28,35				
CV	-127,92	-388,65	1959,58	211,53	111,72	153,39	-534,03				
								X of all DG (%)		51,74	
								Med of all DG (%)		0,00	

Table 18: Daily growth (DG%) of the Number of COVID19 case in Denmark

WEEK - DENMARK	Th(5a)	F(6a)	Sa	Sun(D)	M(2a)	T(3a)	W(4a)	X - DG(%)	Med - DG(%)	S - DG(%)	CV - DG(%)
1	Start	0,00	0,00	0,00	-100,00	.	-33,33	-26,67	0,00	43,46	-162,98
2	25,00	-60,00	200,00	33,33	587,50	212,73	46,51	149,30	46,51	216,75	145,18
3	-36,51	-18,75	-75,38	-12,50	78,57	26,00	26,98	-1,66	-12,50	50,14	-3028,86
4	17,50	10,64	-31,73	-2,82	-5,80	101,54	1,53	12,98	1,53	42,03	323,84
X	2,00	-17,03	23,22	4,50	140,07	113,42	10,42				
MED	17,50	-9,38	-15,87	-1,41	36,39	101,54	14,26				
S	33,56	31,12	121,84	19,95	307,08	93,93	34,50				
CV	1680,06	-182,75	524,68	442,96	219,23	82,81	331,01				
								X of all DG (%)		38,12	
								Med of all DG (%)		0,76	

Table 19: Daily growth (DG%) of the Number of COVID19 case in South Korea

WEEK - SK	M(2a)	T(3a)	W(4a)	Th(5a)	F(6a)	Sa	Sun(D)	X - DG(%)	Med - DG(%)	S - DG(%)	CV - DG(%)
1	Start	-100,00	0,00	0,00	.	-100,00	.	-50,00	-50,00	57,74	-115,47
2	0,00	-100,00	0,00	.	150,00	-80,00	200,00	28,33	0,00	121,72	429,61
3	-100,00	.	200,00	33,33	-75,00	-100,00	.	-8,33	-75,00	128,83	-1545,96
4	-100,00	.	-100,00	0,00	0,00	0,00	.	-40,00	0,00	54,77	-136,93
5	0,00	0,00	2600,00	96,30	84,91	131,63	-26,87	412,28	84,91	966,50	234,43
6	39,16	-37,66	97,22	77,82	13,07	42,38	-27,92	29,15	39,16	50,43	172,98
7	2,22	42,07	-48,88	52,41	-53,39	44,98	-39,29	0,02	2,22	47,13	267993,38
8	-39,34	-78,79	591,43	-52,89	-3,51	-2,73	-28,97	55,03	-28,97	238,05	432,59
9	-2,63	13,51	10,71	63,44	-42,76	68,97	-33,33	11,13	10,71	43,12	387,48
10	-24,49	-10,81	51,52	4,00	-12,50	60,44	-28,08	5,72	-10,81	35,95	628,01
X	-25,01	-33,96	340,20	30,49	6,76	6,57	2,22				
MED	-2,63	-24,24	31,11	33,33	-3,51	21,19	-28,08				
S	47,52	54,08	817,66	46,98	70,66	78,55	87,32				
CV	-190,00	-159,24	240,35	154,09	1045,78	1196,04	3935,08				
								X of all DG (%)		53,58	
								Med of all DG (%)		0,00	

Table 20: Daily growth (DG%) of the Number of COVID19 case in Finland

WEEK - FINLAND	W(4a)	Th(5a)	F(6a)	Sa	Sun(D)	M(2a)	T(3a)	X - DG(%)	Med - DG(%)	S - DG(%)	CV - DG(%)
1	Start	-100,00	0,00	0,00	0,00	0,00	0,00	-16,67	0,00	40,82	-244,95
2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
3	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
4	0,00	0,00	0,00	0,00	0,00	0,00	.	0,00	0,00	0,00	0,00
5	-100,00	.	200,00	-100,00	.	-100,00	.	-25,00	-100,00	150,00	-600,00
6	25,00	-80,00	400,00	40,00	28,57	77,78	237,50	104,12	40,00	161,25	154,87
7	35,19	-21,92	-50,88	-7,14	80,77	-4,26	-11,11	2,95	-7,14	42,74	1448,93
8	112,50	0,00	-11,76	4,00	-2,56	7,89	15,85	17,99	4,00	42,56	236,57
X	10,38	-28,85	67,17	-7,89	15,25	-2,32	40,37				
MED	0,00	0,00	0,00	0,00	0,00	0,00	0,00		X of all DG (%)	13,24	
S	62,93	42,93	154,29	39,94	30,87	47,94	96,95		Med of all DG (%)	0,00	
CV	606,10	-148,81	229,70	-506,08	202,38	-2063,78	240,14				

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